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**Letter to Editor**

## **OPTIMIZATION OF SWIMMING PERFORMANCE IN TRIATHLON**

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### **Dear Editor-in-chief**

Swimming performance improvement is significant in the context of Olympic triathlon at elite level, as it may result in a triathlete exiting the water closer to a group of athletes prior to the cycling stage. Moreover studies demonstrate that drafting in swimming, results in an improvement in pedaling technique and efficiency during cycling (Delextrat et al., 2003).

Despite the variation in swimming performance of elite triathletes is generally small, longitudinal observations of swimming performance in the top 20 elite triathletes in the world compared to that of the remaining field indicate that swimming performance is crucial at Olympic distance triathlon at elite level (Bentley et al., 2008). Therefore, researches that addresses optimization of swim performance in triathlon is of paramount importance in order to improve results.

Swimming performance in elite triathlon competitions is influenced by several factors, such as stroke pattern or drafting technique (Cejuela et al., 2007). In order to improve the swimming performance of elite triathletes, two levels may be considered. The first or macro level includes the overall competition strategy in the swim leg which includes taking into account several factors such as place to start, current directions, pace, buoy turning and others. At a micro-level, factors that need to be studied are the front crawl

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stroke technique and drafting-related factors. All these factors can affect overall swim performance individually, but there can be a synergetic interaction between them.

In triathlon there are few studies using video analysis of the swim leg and statistical researches that include the macro level factors. For instance the work of [Vleck et al. \(2008\)](#) is relevant at the macro level and gives a guide on the use of statistics and modern equipment to improve triathlon performance. However, physical laws, video analysis and statistical analysis are tools that need to be more explored to improve swimming performance in triathlon competition.

The literature in regard to the front crawl stroke has a long and ample history; nevertheless, the contribution of several factors related to it such as lift and drag forces, optimum stroke, propulsion, vortex, and others are not completely clear yet. For instance, phrases from the well known author [Maglischo \(2003\)](#), such as “I think I’ve been wrong, and I’ve provided you with a lot of misinformation over the years” or phrase related to propulsion “I was disenchanted with the Bernoulli theorem... I went back to Newton’s third law”, indicate that a lot of work is still necessary in regard to optimization of swimming technique. Moreover, there are four theories for explaining propulsion (drag, lift, vortex and sculling) ([Colwin, 1999](#)), and they probably should be applied in a distinct way to swimming in triathlon. For instance, [Colwin \(1999\)](#) said “we need to move on and learn more about the way the water reacts when we swim.” This fact is important since it implies that the thrust forces are different when the water is quiet or when it is moving significantly and even when the water is moving in the opposite or in the same direction of the displacement of the body such in triathlon environments.

Additionally, some physics factors that should be studied in order to improve swimming performance in triathlon include steady or unsteady flows, turbulent or laminar boundary layer, flow velocities and others. Some of these factors have been studied in several works ([Rouboa et al., 2006](#)), but the studies have not focused on the triathlon environment.

In addition, most of the studies related to swimming technique are performed in swimming pools or channels with a constant flow. This gives rise to the following question, are the results of swimming studies completely applicable to swimming in triathlon competitions? A provisional answer can be obtained from the well known fact that the swimming performance of a triathlete in a triathlon competition can be consistently either better or worse than his performance in a pool. This observation gives rise to other technical questions, which proportion of this swimming performance difference is explained only by macro level factors? These questions may give an indication toward new paths of research in order to improve swimming specific technique for triathlon.

In regard to the drafting factor there are important studies that have adressed its advantages ([Bentley et al., 2007](#)). However most of these are oriented toward drafting consequences than stroke technique optimization for drafting. There are few studies addressing which technique or stroke pattern is the ideal in order to optimize swimming performance in triathlon events. For instance in ([Chatard and Wilson, 2003](#)) a excellent work where the optimum distance and position for drafting have been studied.

It is important to remark that for our best knowledge statistics about factors such buoy turning or place to start are unknown in the related literature. Furthermore, researches related to stroke analysis under triathlon environment are few. However, these researches are not straightforward, need statistical analysis of data and experiments in the fluid dynamics area. Finally, it is important to point out that the aim of this opinion is to give more paths to improve the performance of elite triathletes.

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