Comparison of Manikin Carry Performance by Lifeguards and Lifesavers When Using Barefoot, Flexible and Fiber Fins

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ABSTRACT

The use of fins is fundamental in aquatic sport and saving rescue activities, large variety of models existing in the market. The main purpose of this study was to compare two groups (lifeguards and lifesavers) performing a manikin carry effort using barefoot, flexible and fiber fins. Ten licensed lifeguards and ten lifesavers performed 3 x 25 m with barefoot, flexible and fiber fins in manikin carry connected to a cable speedometer that measured instantaneous velocity (v). For lifesavers, fiber fins allowed higher v values compared with flexible fins. No differences between fins models were observed regarding v of lifeguards. Additionally, the use of flexible or fiber fins do not show differences in fatigue index for both groups.

Key words: *Biomechanics, lifesaving, rescue, fatigue.*

INTRODUCTION

The use of fins is fundamental in some professional and sport aquatic activities (e.g. diving, underwater fishing, sea rescuing, fin swimming, underwater hockey and sportive diving). Aquatic rescue considers both professional and sportive events, in which lifeguards and lifesavers are being involved, respectively. The purpose of each group is different: lifeguards are required to rescue a person for saving his/her life and don't compete; lifesavers are asked to achieve a best performance against the stopwatch and don't save real persons. Fins are a fundamental element for both lifesavers and lifeguars, besides lifesavers don't use fin in every events. Besides the difference in purposes, to choose the best fin model is a common concern of lifesavers and lifeguards.

Fins can be classified in two major types: mono and single fins. Each type presents a large variety of models, being distinguished by their stiffness, surface (width and length), flexibility and composition. Although monofins allow higher velocities when compared to single fins (Zamparo et al., 2006), they could not be used for lifesaving purposes, since they do not allow walking in a real rescue situation.

There are a limited number of studies on single fins efficacy. Nevertheless, some physiological parameters were studied by Daniel and Klauck (1992). Authors found that lactate accumulation and heart rate trends in life-saving are comparable to those produced by competitive swimmers. Economy and efficiency were assessed by Zamparo et al. (2006), that found that large and heavy fins were characterized by approximately the same economy and efficiency of fins with smaller surface but better buoyancy. Carrying by chest or head techniques were characterized by Juntunen et al. (2006), and the velocity in aquatic rescues was assessed by Abraldes et al. (2007). Last ones showed that velocity was higher when fins were used, independently of the fin type.

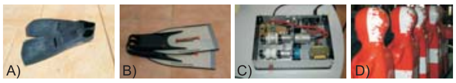
Considering the large variety of fin models available, it is important to understand which is the best fin model fitting the needs of both lifesavers and lifeguards. Some studies were conducted in this topic, but in different populations, analysing swimming or mannequin-carry events using different effort distances (Abraldes et al., 2007), but lifeguards and lifesavers were never compared. Specialized literature leads to think that the best fin model is not necessarily the same for different populations but studies results are not homogeneous. In carry efforts related studies, results were different from those above. In fact, although differences were not found between different fin models in 25 m mannequin carry effort (Abraldes, 2004), in another study with a similar sample, Abraldes (2005) found best carry performances when stiff fins were used, comparatively with flexible, short and fiber fins. Additionally, for 50 m carry performed by university students, Abraldes (2006) found that the use of stiff fins allows higher performances comparatively with flexible fins, but only in the first 25 m of the effort. Contradictory findings could probably be related with differences in subjects number and characteristics. Lastly, Abraldes et al. (2007) analyzed carry velocity with barefoot, flexible and fiber fins obtained by lifeguards. Authors observed that fiber fins can provide a steadier velocity during a short sprint, comparatively with flexible fins.

Since it was never tried to compare lifesavers and lifeguards concerning fin models, the main purpose of this study was to compare these two groups performing a manikin carry effort using barefoot, flexible and fiber fins. Complementarily, it was aimed to study fatigue in carry, since literature is scarce about this subject.

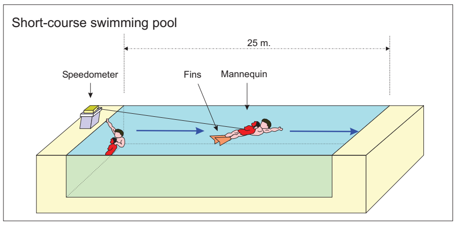
METHODS

Subjects	Age (years)	Weight (kg)	High (cm)	BMI ($kg.m^{-2}$)
Lifesavers (n=10)	17.08±2.24	72.90±11.71	176.43±3.96	23.37±3.33
Lifeguards (n=10)	27.44±10.79	76.22±11.92	179.33±7.45	23.56±2.14

Mean ± SD values of the subjects main physical characteristics.



Materials used: A) Flexible fins, B) Fibre fins, C) Speedometer and D) Mannequin carry



Graphic representation of the test used with the materials cited

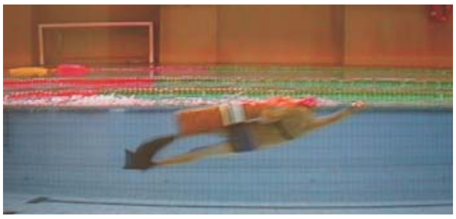
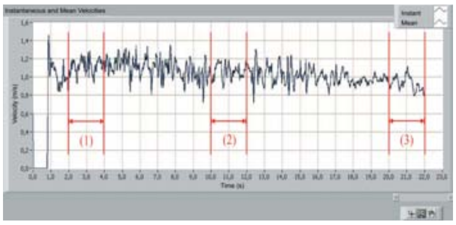


Photo of a lifeguard during the performance test

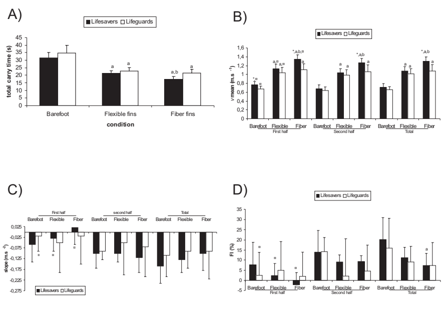


Instantaneous velocity curve obtained using the velocimetric system and time intervals (segments) used to calculate mean initial (1), middle (2) and final (3) velocities.

RESULTS

	Initial		Middle		Final	
	Lifesavers	Lifeguards	Lifesavers	Lifeguards	Lifesavers	Lifeguards
Barefoot	0.77±0.08*	0.67±0.06	0.71±0.09	0.66±0.07	0.61±0.11¤	0.57±0.10¤
Flexible	1.12±0.12a	1.03±0.10a	1.09±0.11a	0.98±0.20a	0.99±0.10a	0.93±0.12a
Fiber	1.31±0.11 *ab	1.09±0.12 a	1.33±0.09*ab	1.07±0.19a	1.21±0.11*ab	1.01±0.12a

Mean ± SD values of the velocity ($m.s^{-1}$) corresponding to initial, middle and final segments of the total carry effort performed with barefoot, flexible and fibre fins by lifesavers and lifeguards. Differences (p<0.05) between groups: *different from lifeguards; Differences (p<0.05) between conditions: [a]different from barefoot; [b]different from flexible fins; Differences (p<0.05) within conditions: ¤different from initial velocity of the same group.



Mean ± SD values of lifesavers and lifeguards when carry with barefoot, flexible, and fiber fins. A panel: total duration of the mannequin carry effort (t); B panel: velocities (v_{mean}, $m.s^{-1}$) of the first and second halves of the effort, and for the total effort; C panel: slopes of v(t) decline ($m.s^{-2}$); D panel: fatigue indexes (FI, %). Differences (p<0.05) between groups: *different from lifeguards; Differences (p<0.05) between conditions: [a]different from barefoot; [b]different from flexible fins; Differences (p<0.05) between half parts: ¤different from second middle part.

DISCUSSION

Due to the high variability of fin models, a careful selection is required in order to increase performance or to facilitate rescue situations. As no study compared the performance obtained by lifesavers and lifeguards when using different fin models, the purpose of the study was to compare lifeguards and lifesavers when using flexible and fiber fins, which were compared also with the barefoot condition.

The observed higher v at the end of the 25m effort (final v) attained by lifesavers when using fiber fins could be due to the fact that they are commonly used in training and competition situations. Contrarily, fiber fins do not seem to be so often used in rescue situations, requiring of lifeguards a more specific adaptation. This statement is only based on observation of the lifeguards' behaviour in rescue scenes. The initial, mean and final segments vmean of lifesavers and lifeguards in the 25 m mannequin carry test were similar when flexible fins were used. The inexistence of differences in v attained by lifeguards using four different fin models was already pointed out by Abraldes et al. (2007). It is possible that the eventual lower training level of lifeguards compared to lifesavers did not allow for a specialized use of any of the tested fin models. Other possible explanation is that lifesavers usually carry dummies in standard events, and lifeguards carry real persons in real and unexpected circumstances.

Additionally, we can speculate that lifesavers revealed a higher level of technical carrying competence at the beginning of the effort with barefoot, once they got higher initial vmean. This difference in vmean between lifesavers and lifeguards observed in barefoot condition was not evident in the middle and final moments of the test. Regarding fatigue related parameters, v decay and FI seem to be similar between lifesavers and lifeguards in the three conditions tested. This absence of differences could be a consequence of the short effort duration of the particular test used. Moreover, it can be explained by the inexact location of the point of exponential rise of fatigue. In the present study, the effort was divided in two parts, without the exact point of evident fatigue occurrence being determined. Future studies should focus on a more precise assessment of the point of fatigue appearance. Soares et al. (2006) have study fatigue analysing velocity in 30 s maximal efforts. Authors could determine one or two fatigue thresholds over the 30 s v(t) curves, none of which being coincident with the middle of the effort. Fatigue thresholds were above the 15 s.

Lastly, a noticeable result was the increase of vmean during the first middle carries performed by the lifesavers with the fiber fins, which favour its use by this population. Another highlight is the significant variability of FI data. The abnormally higher SD values could explain, in part, the absence of significant differences observed for FI, which suggests the need of further research.

CONCLUSIONS

Fiber fins allow a higher v of lifesavers when compared with flexible fins, but for lifeguards it is indifferent the type of fins used. The effect of the use of flexible or fiber fins is not evident in fatigue index both for lifesavers and lifeguards.

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