FACTA UNIVERSITATIS
Series: **Physical Education and Sport** Vol. 8, No 2, 2010, pp. 115 - 124

Original empirical article

MANNEQUIN CARRY EFFORT BY LIFESAVERS USING DIFFERENT TYPES OF FINS

UDC 797.214.9

Arturo Abraldes[1], Antônio B. Lima[2], Susana Soares[3], Ricardo J. Fernandes[3], João Paulo Vilas-Boas[3]

[1]University of Murcia, Faculty of Sports Sciences, Murcia, Spain
[2]Federal University of Ceará, Institute of Physical Education and Sports, Fortaleza, Brazil
[3]University of Porto, Faculty of Sport, Porto, Portugal

Abstract. *Our aim was to determine the best fin type for a 25m mannequin-carry effort. For that purpose, barefoot swimming instantaneous velocity and using four fin types was compared. The fatigue effect over 25m, considering the beginning, the middle part, and the end of the event, was also assessed. Ten national level lifesavers performed 5x25m mannequin carry efforts at maximum velocity while barefoot and while wearing flexible, short, stiff and fiber fins. A cable speedometer was used for assessing velocity. Mean velocity during 2sec periods was computed in the beginning, middle section, and at the end of the event. Descriptive statistics and repeated ANOVA measures were conducted. The results showed that different fin types imply different propulsion effectiveness, with fiber fins being the best ones to use in short carry efforts performed by sportive lifesavers. Flexible fins tend to be less effective, but allow higher velocity than when swimming barefoot.*

Key words: *biomechanics, swimming, lifesaving, fatigue.*

INTRODUCTION

Fins are auxiliary equipment that allows higher propulsion in an aquatic environment. Used in aquatic activities like underwater fishing, aquatic rescues, diving and snorkeling, as well in sports activities (e.g. fin swimming and underwater hockey), fins are also used in sportive lifesaving, specifically in open water and swimming pool competitions. Lifesaving as a sport is growing worldwide, most notably in Australia and New Zealand. The Interna-

Received March 26, 2010 / Accepted August 15, 2010
Corresponding author: Ricardo Fernandes
University of Porto, Faculty of Sport, Cifi2d, Rua Dr. Plácido Costa, 91, 4200 Porto, Portugal
Tel: +351225074763 • Fax: +3512255000687 • E-mail: ricfer@fade.up.pt

tional Life Saving Federation regulates sportive lifesaving, establishing specific events in which the use of fins is allowed. As rules basically limit the fins maximal length and width (25 and 12 in., respectively), it is possible to find a great variety of models in lifesaving competitions, most frequently the "stiff and wide", and, especially, the "fiber" fins.

Fin swimming has already been the subject of study, and it is possible to find comparative studies in literature, mostly based on fin morphology, namely monofins and single fins. Studies related to the use of monofins were conducted for different aims, such as velocity production (Colman, Persyn, & Ungerechts, 1999; Rejman, 2006), the dynamic model (Rejman, Colman, & Soons, 2003), the technical model (Rejman, Pietraszewski, & Jaroszczuk, 2004; Rejman & Borowska, 2008), the functional model (Rejman & Ochmann, 2007), the biomechanical momentum produced (Shuping, 1989), the economy and efficiency of exercise (Zamparo, Pendergast, Termin, & Minetti, 2006), and the mechanical properties (Shuping & Sanders, 2002). Nonetheless, even though the fact that the use of monofins in sports events is not allowed, due to their non-homogeneous size, they could be used in rescue situations, which justifies the growing scientific interest.

In specialized literature, we can also find studies conducted with single fins, namely with the purpose of evaluating some physiological and biomechanical parameters (Daniel & Klauck, 1992), the economy and effectiveness of exercise (Lewis & Lorch, 1979; Pendergast, Tedesco, Nawrocki, & Fisher, 1996; Zamparo, Pendergast, Termin, & Minetti., 2002; Zamparo, *et al*., 2006), movement analysis and propulsion (Colman, Persyn, Zhu, & Ungerechts., 1996), carrying techniques (Hay, McIntyre, & Wilson, 1975; Juntunen, Leskinen, Louhevaara, & Keskinen, 2006), and velocity in aquatic rescues (Abraldes, Soares, Lima, Fernandes, & Vilas-Boas, 2007). Single fins should be used in sports lifesaving according to the measures defined by the International Life Saving Federation. However, rules do not clearly specify the material, stiffness and properties characteristics of each fin model. In this sense, coaches and lifesavers are always trying to find the best fin model which would have an increase in propulsion. However, the best fin type for lifesaving competition purposes, namely in mannequin carry efforts, was not yet determined. Nonetheless, some trials have already been conducted: (i) Abraldes (2006) observed higher velocities when using stiff fins comparing to flexible fins in a 50 m mannequin carry efforts and (ii) Abraldes et al. (2007), when studding instantaneous velocity in a 25 m mannequin carry effort performed by lifeguards with flexible and fiber fins, observed the inexistence of differences between two fin types in 2 sec time periods in the beginning, middle and end part of the trial.

The purpose of this study was to determine the best fin type (from flexible, short, stiff and fiber fins) for a 25 m mannequin-carry effort. Instantaneous velocity (v) of each carry effort was determined. In addition, fatigue effect over a distance of 25 m maximum mannequin carry effort, based on v records, considering the beginning, the middle part, and the end of the event was also assessed. Mean v, slope of the v(t) decline (v decay) and fatigue index (FI) in the first and second half parts of the time spent in each 25 m, and in the total test, were used as fatigue criteria.

METHOD

Participants

Ten licensed male competitive lifesaving rescue athletes (at the national level) participated in this study. Their main physical characteristics were: 17.08 ± 2.24 yr. old, 72.90 ± 11.71 kg in weight, 176.43 ± 3.96 cm in height, and 23.37 ± 3.33 $kg.m^{-2}$ in terms of the body mass index. All of the participants signed a written informed consent form in which the experimental protocol was described.

Instruments and procedure

All the tests were performed on a short-course indoor swimming pool with a mean depth of 2 m. The water temperature was set at 27.5º C. The Ethics Committee of the hosting university approved the experimental protocol. The experimental protocol consisted of 5 x 25 m maximum swim trials carrying a manikin (Swedish model), with a minimum recovery time of 30 min. The mannequin (Fig. 1) was constructed with a closed Pitet plastic type and had a total height of 1 m. This mannequin was completely filled with water in order to have a total land weight of 80 kg.

Fig. 1 Mannequin used in the experimental protocol (Swedish model).

Of the 5 total trials, one was performed barefoot and the four others with different fin types: (i) the flexible fins (Gabbiano Francis) were 18 in. in length and 8 in. in width, with a closed shoe part and a small opening for the toe extremities (Fig. 2); (ii) the short fins (Deeply) measured 16.5 in. in length and 10 in. in width, being provided with two nerves that give rigidity and obliquity to the dorsal part of the fin (Fig. 3); (iii) the stiff fins (Cressi-sub) were 23 in. in length and 8 in. in width (Fig. 4) and (iv) the fiber fins (Special Films, model Sebak Saber 140 Hard M) were rectangular in their tail end (25 in. long and 8.5 in. wide), their rigidity due to the two nerves that fix the shoe part to the tail of the fin and to one lateral nerve that reinforces the edge of the fin (Fig. 5). The fins used in the study were chosen based on whether they adhere to the lifesaving competition criteria, and are the ones that athletes seem to prefer. The trials order was randomized for each lifesaver.

Fig. 2 Flexible fins

Fig. 3 Short fins

Fig. 4 Stiff fins

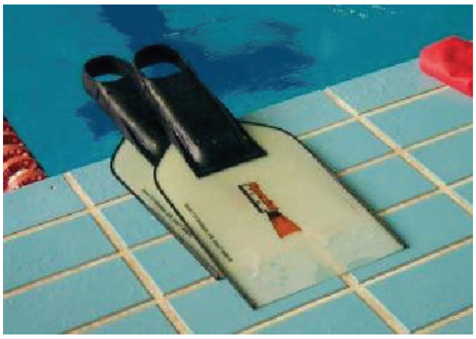

Fig. 5 Fiber fins

Each 25 m repetition began with an in-water start, irrespective of whether the lifesaver was in contact with the wall or the starting platform, and holding the mannequin in a carrying position (Fig. 6). Lifesavers kept their faces out of the water and used their arms to help during the start. The carry position was lateral-dorsal with no arm help. Propulsion movements were produced by the legs only.

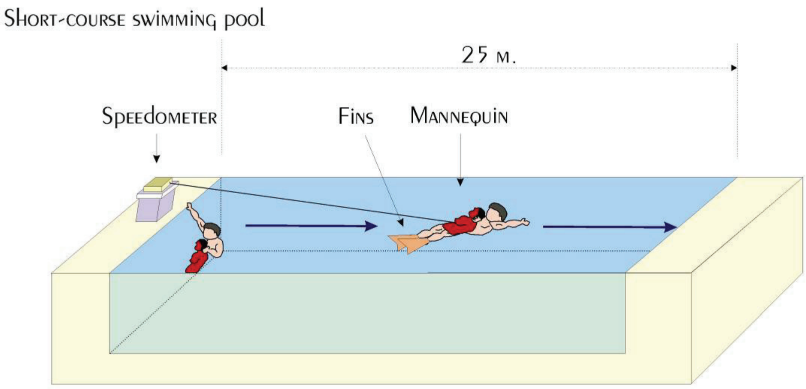

Fig. 6 Description of the experimental protocol.

A cable speedometer (Fig. 7), named the *Swim Sensor* (Lima, Semblano, Fernandes, Gonçalves, Morouço, Sousa, *et al.* 2006), was connected to the mannequin in order to measure *v* during the total event duration. The Swim Sensor uses an incremental sensor with 500 point resolution per revolution. A brake engine allows the full system inertia to be insignificant, keeping the line always stretched.

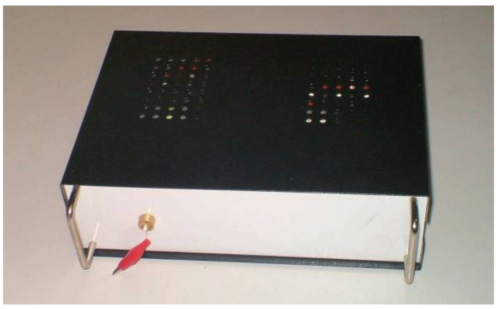

Fig. 7 Cable speedometer

Analysis

During the data analysis, the first 2 sec of the instantaneous *v* curves of each swimmer were removed, which allowed the minimization of the effect of the initial impulse resulting from the start, and focused the analysis on the leg kicking actions only. The 2 sec interval was chosen after a visual inspection of the *v* traces of each lifesaver. Three *v* points were determined over 2 sec periods (Fig. 8) on the total curve: (i) Initialv was the mean *v* corresponding to the initial 2–4 sec of the total effort time, (ii) Halfv was the mean *v* corresponding to the 2 sec of the middle of the total effort time and (iii) Finalv was the mean *v* corresponding to the last 2 sec of total effort time. Total effort time was defined as the length of time between the first and the last *v* peak of the *v*(t) curve, after the initial impulse was removed.

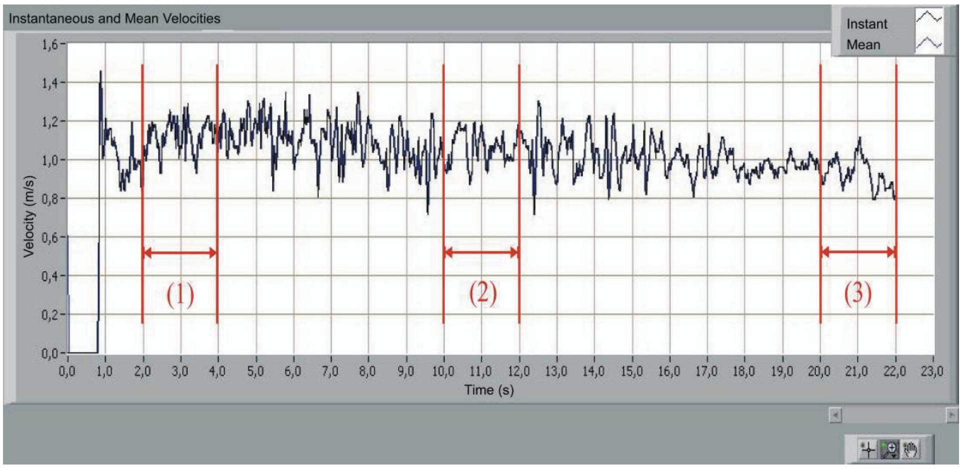

Fig. 8 Example of an instantaneous velocity curve obtained using the velocimetric system and time intervals used to calculate mean initial (1), half (2) and final (3) velocities.

The three *v* points that were determined allowed for the subsequent calculation of the mean *v* attained by the lifesavers in the total effort (*v* meanT) and in the first (*v* mean 1) and second (*v* mean2) effort parts. The *v* decay, i.e., the mean slope corresponding to the individual regression lines plotted between Initialv and Halfv, between Halfv and Finalv and between Initialv and Finalv were also assessed. The mean FI corresponding to the same first and second half, and to the total effort time, was also determined according to the following formula:

$$FI = (\overline{X}f\vec{v} - \overline{X}i\vec{v}).\overline{X}f\vec{v}^{-1} \quad (1)$$

where, $\overline{X}f\vec{v}$ is the mean *v* of the second point and $\overline{X}i\vec{v}$ is the mean *v* of the first point of the two considered points (initial and half mean *v*, half and final mean *v* or initial and final mean *v*) used for the calculation.

The mean *v* attained by lifesavers in the total effort and in each half part, *v* decay and FI were used to study the fatigue induced in the five situations tested, i.e., performing barefoot and with the four fin types.

Statistical analysis consisted of the comparison of the mean values using an ANOVA test for repeated measures. The normality (Shapiro-Wilk test) and homoscedasticity (the Levene test) of all distributions were verified. A significance level of 5% was accepted.

RESULTS

The mean v values measured during the 2 sec period in the initial, half and final stages of the 25 m carry effort, for the five tested conditions, are shown in Table 1. It is possible to observe that the mannequin carry effort v was lower for barefoot kicking as compared to fins kicking, irrespective of fin type, and irrespective of the moment of the effort considered (initial, middle or final parts). The comparison between fin types showed that flexible fins showed the weakest results in velocity production during each of the three moments considered, with only a small exception. No differences were observed in Finalv attained with flexible and short fins. Additionally, the fiber fins were faster than short fins during the half and final effort periods and, when compared with stiff fins, were fastest in the middle part of the effort.

Table 1 Mean ± SD velocity values corresponding to initial, half and final 2 s periods of the total carry effort under barefoot and under flexible, short, stiff and fiber fins conditions.

Period	Barefoot	Flexible fins	Short fins	Stiff fins	Fiber fins
Initial ($m.s^{-1}$)	0.77±0.08[a]	1.12±0.12[1,2,3,4,a]	1.23±0.10[1,a]	1.26±0.14[1,a]	1.31±0.11[1,a]
Half ($m.s^{-1}$)	0.71±0.09[a]	1.09±0.11[1,2,3,4,a]	1.23±0.12[1,4,a]	1.26±0.10[1,4,a]	1.33±0.09[1,a]
Final ($m.s^{-1}$)	0.61±0.11	0.99±0.10[1,3,4]	1.08±0.11[1,4]	1.16±0.09[1,]	1.21±0.11[1]

Statistical differences: [a]final velocity; [1]barefoot; [2]short fins; [3]stiff fins; [4]fiber fins (all for a $p \leq 0.05$).

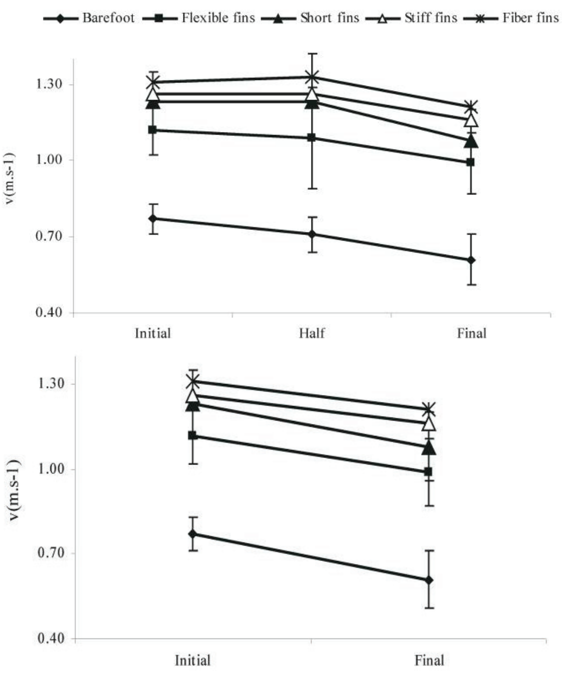

Fig. 9 Mean slopes of velocity drop observed for the total carry effort, and for the first and second half of the 25 m, performed by lifesavers in barefoot conditions and with flexible short, stiff and fiber fins (A and B panels, respectively).

The graphic presentation of the Initialv, Halfv and Finalv can be observed in Fig. 9, besides also being presented in Table 1. It is possible to observe differences for the total 25 m effort, when comparing the initial and final attained velocities (A panel) and the half and final velocities (B panel). However, no differences between Initialv and Halfv were found (B panel).

Additionally, Table 2 presents the total effort time (t) and *v* mean, *v* decay and FI per half part (1 and 2) and for the total effort (T), obtained during the barefoot mannequin carry effort, and with the four studied types of fins. Total carry effort time was higher for under barefoot kicking condition and lower when fiber fins were used. Additionally, flexible fins were proved to increase carry time when compared to short and stiff fins as well. Accordingly to these results, and as it was expected, mean total *v* for the 25 m mannequin carry effort was significantly lower for barefoot kicking. The same mean total *v* was significantly higher for fiber fins in all tested situations, except for the carry effort with stiff fins. Short and stiff fins produced higher *v* when compared to flexible ones. The same results could be observed for the mean *v* corresponding to the first and second half effort parts. *V* mean1 was higher than *v* meanT, but *v* mean2 did not differ from the *v* meanT.

Table 2 Mean ± SD values of total effort time (t) and mean velocities (*v* mean), *v* decay and fatigue indexes (FI) per half part (1 and 2) and for the total effort (T), obtained during the mannequin carry effort under barefoot conditions, and with flexible fins, short fins, stiff fins and fiber fins.

	Barefoot	Flexible fins	Short fins	Stiff fins	Fiber fins
t (s)	31.36±3.60	21.18±2.06[1]	19.42±1.62[1,2]	18.51±1.55[1,2]	17.54±1.77[1,2,3,4]
v mean1 ($m.s^{-1}$)	0.76±0.08[a]	1.12±0.11[a,1]	1.25±0.10[a,1,2]	1.26±0.13[a,1,2]	1.34±0.10[a,1,2,3]
v mean2 ($m.s^{-1}$)	0.67±0.09	1.04±0.09[1]	1.16±0.11[1,2]	1.20±0.09[1,2]	1.26±0.10[1,2,3]
v meanT ($m.s^{-1}$)	0.71±0.08	1.08±0.10[1]	1.20±0.12[1,2]	1.23±0.11[1,2]	1.30±0.10[1,2,3]
v decay1 ($m.s^{-1}$)	-0.06±0.08[a]	-0.03±0.06[a]	0.00±0.06[a,b]	0.00±0.08[a]	0.02±0.08[a,b]
v decay 2 ($m.s^{-1}$)	-0.10±0.07	-0.10±0.04	-0.15±0.05	-0.10±0.05	-0.12±0.07
v decayT ($m.s^{-1}$)	-0.16±0.08	-0.13±0.06	-0.14±0.07	-0.10±0.07	-0.10±0.08
FI1 (%)	7.81±11.03[a]	2.33±5.99[a]	-0.14±4.86[a,b]	-0.58±7.28[a]	-2.15±6.13[a,b]
FI2 (%)	13.88±10.59	9.08±3.54	11.80±3.54	8.03±3.69	9.27±5.53
FIT (%)	20.21±10.80	11.27±5.06	11.68±5.42	7.61±5.96	7.46±5.90

Statistically different ($p \leq 0.05$): [a]vmean T or slope T or FI T, [b]vmean 2 or slopes 2 or FI 2, [1]barefoot, [2]flexiblet fins, [3]short fins and [4]stiff fins.

No differences were observed in *v* decay and FI corresponding to the first and second half, and total effort time between all five testing situations. A comparison of *v* decay and FI during the first and second half effort parts showed differences only when short and fiber fins were used. *V* decay and FI during the first half part were lower when compared to the total *v* decay. No differences were found between *v* decay and FI during the second half effort part and of the total effort.

DISCUSSION

The use of fins in swimming underwent a great increase in the last thirty years. Following Baly, Gouvernet, & Barla (2008), this fact is due to the development of industries that created a new market on fins and to the appearance of the first competitions that accelerated the optimization of products. Those fins, however, have not been sufficiently tested in order to define the best model. In this sense, a comparison of barefoot and different types of fins in mannequin carry effort conditions was proposed. The performance of the lifesavers was assessed by their instantaneous *v*, as well as through the *v* corresponding to initial, half and final stages of the 25 m carry effort. Mean *v*, the *v* decay and the FI in the first and second half parts of the time spent in each 25 m, and in the total test, were also assessed.

As already observed in the literature (Abraldes, 2006; Zamparo et al., 2006; Abraldes, 2007; Abraldes *et al*., 2007), mannequin carry *v* was lower in the case of barefoot kicking when compared to fin kicking irrespective of fin type. Inclusively, the differences found in the present study were observed in the initial, half and final parts of a total 25 m effort. This higher *v* obtained by the use of fins seems to be easily explained by the higher propulsive area of these materials, improving the propelling efficiency of aquatic locomotion (Zamparo *et al.*, 2002).

The comparison of the *v* obtained during the initial, middle and final moments of the total effort using different types of fins showed that fiber fins, due to their characteristics (larger and more rigid), tend to be the best for the purpose of achieving higher carrying *v*, which is in accordance with two studies carried out in scuba diving (Lewis & Lorch, 1979; Pendergast *et al*., 1996). If lifesavers do not have recourse to fiber fins, stiff fins are advised. According to the data obtained, the flexible fins are the model which produced lower *v* during mannequin carry. According to Pendergast *et al.* (1996), flexible fins could be used in medium-long duration swimming due to their higher comfort and lower energy cost, requiring lower leg strength. However, for lifesaving proposes, they seem to be less interesting.

Differences in *v* between initial and final effort moments were expected due to the fatigue effect (Soares, Machado, Lima, Santos, Fernandes, Correia *et al*., 2006). The inexistence of differences between Initialv and Halfv are probably due to the short total effort duration (mean values between 17 and 31 sec). Additionally, the precise instant for fatigue appearance could not be exactly coincident with the middle of the total effort. A recent study in swimming *v* assessment (Soares *et al*., 2006) showed the existence of one or two "fatigue thresholds" in a 30 sec supramaximum effort. Depending on the occurrence of the fatigue thresholds, differences between the two studied half parts could be determined.

The higher total carry effort time for barefoot kicking, and the lower carry effort time when fiber fins were used, have already been observed in swimming by Zamparo et al. (2006) and in carry efforts by Abraldes et al. (2007). Abraldes (2007) also observed the best performance of fiber fins. The increased carry time when using flexible fins compared to short and stiff fins has been already noted in some other works from the same group (Abraldes, 2006; Abraldes, 2007). The results point out that the best fin type could probably be dependent of a good relationship between fin stiffness and total fin surface. In this sense, fiber fins are more energetically demanding (Zamparo *et al*., 2002), they seem to be a better choice for lifesavers' 25 m carry efforts.

Even though each fin type had its own special characteristics, the differences were not observed in *v* decay and FI between the first and the second half parts of the total effort time for all the five tested situations. It is observable that differences between the half parts and the total effort for *v* decay and FI are similar for both short and fiber fins.

CONCLUSION

We conclude that different types of fins seem to lead to different propulsion effects, fiber fins being the best ones in short carrying efforts, performed by sportive lifesavers. Flexible fins tend to show less interesting results considering the same exercise effort than fiber fins, but allow higher *v* than swimming barefoot.

REFERENCES

Abraldes, J. A. (2006). Evaluation of swim fins according to the time taken in swim tests and manikin tow tests. *Cultura, Ciencia & Deporte*, 5(2), 67-72.

Abraldes, J. A. (2007). The fins like fundamental element in the rescue and the sport. In *Book of Abstract of the International Lifesaving Congress*. La Coruña. pp. 41-42.

Abraldes, J. A., Soares, S., Lima, A. B., Fernandes, R. J., & Vilas-Boas, J. P. (2007). The Effect of Fin Use on the Speed of Lifesaving Rescues. *International Journal Aquatic Research and Education*, 1, 329-340.

Baly, L., Gouvernet, G., & Barla, C. (2008). Fin swimming Research - Past, Present and Future. In T. Nomura, B. E. Ungerechts (Eds.), *1st International Scientific Conference of Aquatic Space Activities*. University of Tsukuba, Japan. pp. 2-12.

Colman, V., Persyn, U., Zhu, J. P., & Ungerechts, B. (1996). Movement analysis and computer animation in swimming and life saving, In *Symposiums-Bericht*. Kolner Schwimmsporttage, Cologne. Pp. 68-73.

Colman, V., Persyn, U., & Ungerechts, B. (1999). A mass of water added to the swimmer's mass to estimate the velocity in dolphin-like swimming below the water surface. In K. L. Keskinen, P. V. Komi, A. P. Hollander (Eds.), *Biomechanics and Medicine in Swimming VIII*. Jyvaskyla: Gummerus Printing. pp. 89-94.

Daniel, K., & Klauck, J. (1992). Physiological and biomechanical load parameters in life-saving. In: D. MacLaren, T. Reilly, A. Lees (Eds.), *Biomechanics and Medicine in* Swimming. Swimming Science VI. Liverpool: E & FN Spon. pp. 321-325.

Hay, J. G., McIntyre, D. R., & Wilson, N. V. (1975). An evaluation of selected carrying methods used in lifesaving. In L. Lewillie, J. P. Clarys (Eds.), *Swimming II. Proceedings of the Second International Symposium on Biomechanics in Swimming*. Brussels: University Park Press. pp. 247-253.

Juntunen, P., Leskinen, T., Louhevaara, V., & Keskinen, K. (2006). Biomechanics of towing in skilled and less-skilled lifesavers. *Portuguese Journal of Sport Science*, 6 (Suppl. 2), 48-50.

Lewis, E.R., Lorch, D. (1979). Swim fin design utilizing principles of marine animal locomotion, in: Terauds, J., Bedingfield, W. (Eds), Swimming III. University Park Press, Baltimore, pp. 289-297.

Lima, A.B., Semblano, P., Fernandes, D., Gonçalves, P., Morouço, P., Sousa, F., Fernandes, R.J., & Vilas-Boas, J.P. (2006). A kinematical, imagiological and acoustical biofeedback system for the technical training in breaststroke swimming. *Portuguese Journal of Sport Science*, 6 (Suppl.1), 22.

Pendergast, D.R., Tedesco, M., Nawrocki, D.M., & Fisher, N.M. (1996). Energetics of underwater swimming with SCUBA. *Medicine & Science in Sports & Exercise*, 28, 573-580.

Rejman, M. (2006). Influence of timing delay on monofin intracycle swimming velocity. *Portuguese Journal of Sport Science*, 6 (Suppl. 2), 85-88.

Rejman, M., Colman, V., & Soons, B. (2003). A preliminary study of the kinematics and dynamics of single fin movements. In J. C. Chatard (Ed.), *Proceedings of IX International Symposium on Biomechanics and Medicine in Swimming*. Saint-Etienne: University of Saint-Etienne. pp. 511-515.

Rejman, M., Pietraszewski, B., & Jaroszczuk, S. (2004). Dynamic statistical analysis as a method of monofin technique assessment (A preliminary study). *Acta of Bioengineering and Biomechanics*, 6 (supl. 1), 288-292.

Rejman, M., & Borowska, G. (2008). Searching for criteria in evaluating the monofin swimming turn from the perspective of coaching and improving technique. *Journal of Sports Science and Medicine*, 7, 67-77.

Rejman, M., & Ochmann, B. (2007). Functional model of monofin swimming technique based on the construction of neural networks. *Journal of Sports Science and Medicine,* 6, 193-203.

Shuping, L. (1989). Biomechanical study of fin-swimming and fins. In *Proceedings of VII International Symposium of the Society of Biomechanics in Sport*. Footscrey. pp. 217-218.

Shuping, L., & Sanders, R. (2002). Mechanical properties of the fin. In K. Gianikellis (Ed.), *Scientific Proceedings of XX International Symposium on Biomechanics in Sports*. Cáceres. pp. 479-481.

Soares, S., Machado, L., Lima, A., Santos, I., Fernandes, R., Correia, M., Maia, J., & Vilas-Boas, J.P. (2006). Velocimetric characterization of a 30 sec maximal test in swimming: consequences for bioenergetical evaluation. *Portuguese Journal of Sport Science*, 6 (2), 265-268.

Zamparo, P., Pendergast, D. R., Termin, B., & Minetti, A. E. (2002). How fins affect the economy and efficiency of human swimming. *Journal of Experimental Biology*, 205, 2665-2676.

Zamparo, P., Pendergast, D. R., Termin, B., & Minetti, A. E. (2006). Economy and efficiency of swimming at the surface with fins of different size and stiffness. *European Journal of Applied Physiology*, 96, 459-470.

NOŠENJE LUTKE TOKOM POKUŠAJA SPAŠAVANJA U VODI UZ UPOTREBU RAZLIČITIH VRSTA PERAJA

Arturo Abraldes, Antônio B. Lima, Susana Soares, Ricardo J. Fernandes, João Paulo Vilas-Boas

Naš cilj bio je da odredimo najbolju vrstu peraja koja bi se mogla koristiti pri pokušaju spašavanja lutke u vodi na razdaljini od 25 metara. U tu svrhu, poredili smo brzinu plivanja bez peraja i plivanja sa četiri različite vrste peraja. Uticaj na osećanje umora kod spasioca, u početku, na sredini i na samom kraju pokušaja spašavanja takođe je procenjivan. Deset spasioca, kvalifikovanih na nacionalnom nivou, učestvovalo je u 5 pokušaja spašavanja na 25 metara uz nošenje lutke i uz upotrebu maksimalne brzine, bosi ili sa fleksibilnim, kratkim, krutim i perajima od vlakana. Za određivanje brzine koristili smo brzinomer. Srednja vrednost brzine merena na 2 sekunde je izračunata za početak, sredinu i kraj pokušaja spašavanja. Koriščeni su parametri deskriptivne statistike i ponovljena ANOVA. Rezultati su pokazali da upotreba različitih vrsta peraja ima i različite posledice po efektivnost, a pri tom su se peraja od vlakana pokazala kao najbolje sredstvo tokom pokušaja spašavanja na ovoj kratkoj razdaljini. Fleksibilna peraja nisu bila podjednako efikasna, ali su ipak omogućila veću brzinu od one koju su spasioci postigli kada su plivali bosi.

Ključne reči: *biomehanika, plivanje, spašavanje u vodi, umor.*