

# Which start is faster in finswimming?

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**Abstract.** Finswimming is a sport of speed practiced on the surface or underwater. The purpose of this study was to investigate the difference between two finswimming starts: the grab start (Gs) and the research start with hands on metatarsals (HMs). Fourteen well training young male finswimmers participated in our study and assessment the flight, the angle of entry, the angle of knee and the performance at the first 15-m. The results show differences between the two starts in the flight [Gs: 130.3±9.1 vs. HMs 136.2±7.9;  $t_{(13)}=-6.08$ ,  $p=0.000$ ], in the angle of knee [Gs: 107.1±8.9 vs. HMs 115.7±9.9;  $t_{(13)}=-2.57$ ,  $p=0.024$ ], in the angle of entry [Gs: 55.4±7.4 vs. HMs 52.6±5.2;  $t_{(13)}=2.71$ ,  $p=0.018$ ] and at the first 15-m performance [Gs: 5.7±0.5 vs. HMs 5.4±0.3;  $t_{(13)}=4.17$ ,  $p=0.001$ ]. This study demonstrates that the HMs is able to improve the parameters during entry which related with faster swimming.

**Keywords.** Finswimming, start, young athletes.

## Introduction

Finswimming is a sport of speed practiced on the surface or underwater, in which performance is based on whole-body oscillations (Gautier et al., 2004). The start in finswimming it is same like as a swimming grab start because of the use monofin. The start divided into five temporal phases: ready, pulling, detachment,

flight and entry (Costill et al., 1992). The success of startup depends on rapid succession of a movement-phase to another.

The purpose of this study was to investigate the difference between two finswimming start (Grab start: Gs, Figure 1; Research start with hands on metatarsals: HMs, Figure 2) in flight, entry, angle of the knee at the stage of ready and the performance on the first 15-m. We hypothesized that the different start could affect the finswimming performance.

## Methods

### Participants

Fourteen well training young male finswimmers, from the local finswimming club, participated in our study (Table 1). Inclusion criteria were not to have injuries in lower limbs and training age in finswimming > 3 yrs. The study was conducted according to the Helsinki declaration for use in Human subjects (N° of Ethical Committee; 2-5/2.2.2011). All the participants' parents written consent.



Figure 1. Grab start (Gs).



Figure 2. Start with his hands on metatarsal (HMs).

**Table 1**

Athlete's characteristics.

Variables	Mean $\pm$ SD
Age (yrs)	16.5 $\pm$ 0.9
Height (cm)	167.2 $\pm$ 4.0
Height with his hands in an elevation (cm)	212.2 $\pm$ 4.0
Training age (yrs)	4.5 $\pm$ 1.2
Body Mass Index (kg/m <sup>2</sup> )	21.3 $\pm$ 3.0
Body Surface Area (m <sup>2</sup> )	1.3 $\pm$ 0.1
Body mass (cm)	59.5 $\pm$ 7.2
Body fat (%)	12.2 $\pm$ 4.8
Sit and reach test (cm)	28.0 $\pm$ 3.0
Leg length (cm)	90.2 $\pm$ 0.4
Isokinetic knee extensor torque (N•m)	159.6 $\pm$ 9.8
Squat jump (SJ) (cm)	29.8 $\pm$ 1.3

## Procedures

Prior to the test procedures were measured the anthropometric characteristics, the percentage of body fat (7 skinfold points measurement, Harpenden, UK) (Norton et al., 1996) and the flexibility by sit and reach test (Cochrane & Stannard, 2005). The height of leg was measured from the greater trochanter to the lateral malleolus (Norton et al., 1996). For the isokinetic assessment of flexor and extensor muscles of the knee was used isokinetic dynamometer (Cybex Norm). The Jumping ability was measured by the squat jump (SJ) in force platform (Bertec Corp., Worthington, OH) (Bosco et al., 1983).

The trials were performed with a difference of 48 h between them. The trials were performed at a maximal intensity. The athletes performed the garb start (Gs) by three consecutive attempts. Among the efforts was 5 min rest. The start of each effort was made accordance CMAS rules (CMAS, 2013). All participants were used the personal monofin (weight 3 $\pm$ 0.5kg) and all trials was made without snorkel (Figure 1 and 2). All the sessions were performed in a 50-m indoor swimming pool with water temperature at 26  $\pm$  1 °C and environmental temperature at 24  $\pm$  1 °C. The evaluation was made between 17:30 and 18:30 p.m. The tests were performed in random sequence (Gs and HMs) and athletes did not warm-up before the tests.

All trials were record by two GoPro Hero5 Black camera. The first camera was mounted on a fixed point to allow coverage of all efforts and the second was record the angle of knee. The angle of knee was

calculated by placed marks on the greater trochanter, lateral condyle of femour and the lateral malleolus. The angle of entry was calculating accordance to constant reference on the surface and the entry of upper limbs. The upper limbs were calculated by placed marks on carpus area, major olekrano and on the area of head of humerus.

The evaluation and analysis of kinematic characteristics and efforts of trials were used by program V1sports Home 2.0 (USA) and software Templo 3.2.166 (Contemplas, Germany). The time performance (time/s) was recorded with a digital handheld chronometer (Cei-Ultrak 499, Cardena, CA, USA).

## Statistical analysis

The Kolmogorov-Smirnov test was used for the normality of the distribution. Paired t-test was used to determine statistically significant differences between variables of two trials. The level of significance was set to  $p < 0.05$  and the data are presented as mean value and standard deviation (Mean  $\pm$  SD). The SPSS 15 statistical package (SPSS inc., Chicago, IL, USA) was used for the statistical analyses.

## Results

The results of two trials showed in Table 2.

**Table 2**Results between trials (Mean  $\pm$ SD).

	Gs	HMs	<i>p</i> value
Flight (cm)	130.3 $\pm$ 9.1	136.2 $\pm$ 7.9	0.000
Entry (°)	55.4 $\pm$ 7.4	52.6 $\pm$ 5.2	0.018
Knee (°)	107.1 $\pm$ 8.9	115.7 $\pm$ 9.9	0.024
Time 0-15m (sec)	5.7 $\pm$ 0.5	5.4 $\pm$ 0.3	0.001

## Discussion

This study increases the knowledge of fin swimming start which is quite weak in the scientific literature. Was investigated the Gs versus HMs to determine differences between of them accordance to swimming assessment methodology which can be applied in fin swimming (Stavrou et al., 2007).

The finswimmers during the entry meets the same resistances like the swimmers (Vorontsov & Rumyantsev, 2000) and moreover due to equipment.

The equipment could be a limitation into performance and an item that affects the evaluation variables. The entry during HMs was measured higher compare to G<sub>s</sub>. The entry in accordance to Maglischo (2003) is around 3 to 4-m in elite swimmers. The HMs is closer to swimmers values although we used heavy monofin. These monofins could have negatively affected the outcome of the motion (Pendergast et al., 2003) and probable following different kinematics pattern modifies muscular activity (Mariona et al., 2010). According to Kong and Haselen [12] the maximum isometric strength of the quadriceps extensor muscles associated with the angle of the knee expressed in 110-120°. The angle of knee in HMs was measured closer to average values Kong & Haselen (2010) compared to G<sub>s</sub> (Table 1). The angle of entry, accordance to Maglischo (2003), is 30-40°. Our results reveals lower angle of entry with HMs (52.6±5.2°) compared to G<sub>s</sub> (55.4±7.4°). The parameters of the length of entry and the angle of entry are closer of average values of swimmers. These results relate to the hands position during start thus increasing the angle of the knee which produces more power (Murray et al., 1980) and swimming faster the first 15-m (Table 2).

## Conclusions

This study demonstrates that the HMs is able to improve the parameters during entry which related with faster swimming. The finswimming as a newly sport with weak in the scientific literature, enough research is needed to substantiate new methods.

## Conflict of interest

The authors declare they have no conflict of interest

## Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

## Informed consent

Informed consent was obtained from all individual participants included in the study.

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