

## Anthropometric Profile of Male Amateur vs Professional Formula Windsurfs Competing at the 2007 European Championship

by

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*This study aimed to describe the current anthropometric profile of Formula Windsurf competitors during the 2007 European Championships and establish a set of reference values useful for future investigations on player selection, talent identification, and training programme development. Forty-five male participants (mean age 30±9.77 years; body height 182.04±6.3 cm; body mass 81.67±7.35 kg) were selected for the anthropometric profile, including 15 which the International Windsurf Association had defined as professionals. The anthropometric profiles included measurements of skinfolds, segment lengths, breadths, and girths. Somatotype measurements were also calculated into the equation. The male professional windsurfers had larger length, breadth, and girth measurements than their amateur counterparts. The three somatotype components showed that both groups were predominantly mesomorphic, but the professionals were more ectomorphic than endomorphic, whereas the amateurs were slightly more endomorphic than ectomorphic. The descriptive analysis of the anthropometric data provide relevant information concerning the morphological indicators of competitive success in this sporting discipline.*

**Key words:** anthropometry, somatotype, windsurfers, males, championships

### Introduction

Windsurfing has its origins in two sports: surfing and sailing. It consists of moving over the water on a board fitted with a sail and propelled by the wind. Depending on the degree of skill and the type of equipment used, the different categories of windsurfing include freestyle, jumps and speed. Although there are different theories as to how windsurfing began, most people believe that Windsurfing first appeared in 1935, when Tom Blake, a famous Californian surfer, attached a sail to his 14-foot hollow board (Winner, 1995).

Seventy-four years separate us from this origin, which represented the birth of a new speciality. Today, windsurfing is well-established as in interna-

tional sport, having been an Olympic sport since 1984, when it was included in the Los Angeles Olympic Games. That inclusion, with numerous participating countries, was a resounding success, with the sport seen as attractive with direct links to sustainable development.

The International Windsurfing Association (IWA) is now the umbrella organisation for the different national federations that promote windsurfing. The association was founded in the United Kingdom in January 2001 and its mission includes organising the different European Championships (Formula Windsurfing).

The optimal somatotype for sportsmen varies according to the sport and the period of the year (Gualdi-Russo & Zaccagni, 2001). Although morphology is not the only characteristic that determines success in sport,

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it is a predominant factor and can often be the determinant for success when other factors, such as skill, are comparable between competitors. Thus, knowledge of optimal morphology for a sport is a valuable asset for selection and development.

Formula Windsurfing, as a class, requires a light breeze to sail, allows sails up to 12.5 m<sup>2</sup> and competitors need to have a good understanding of regatta sailing techniques, as well as being able to fully control boards and sails used to glide over the sea. The large sail dimensions and varying conditions during competition differentiate this sport in terms of intensity and morphology.

However, for windsurfing, particularly Formula Windsurfing, morphologic values (as identified by anthropometry) have rarely been reported and certainly not recently. This study was undertaken, therefore, to establish the current anthropometrics parameters and somatypes of professional racers in Formula Windsurf, and compare them to those found in amateur level participants.

## Methods

The qualifying regatta in the Men's Division of the 2007 Formula Windsurfing World Championships took place during the European Formula Windsurfing championship (celebrated in Santa Pola, Spain). Organized by Club Windsurf Santa Pola and the Royal Spanish Sailing Association (RFEV), the event was run according to the Racing Rules of Sailing (RRS) of the International Sailing Federation (ISAF).

### Participants

Eighty-nine caucasian males representing 18 countries took part in the event. From these, 45 male windsurfers participating in the European Formula Windsurfing Championships 2007 took part in this study. Their characteristics were: age 30±9.77 (mean±SD), height 182.6±6.0 cm, weight 81.67±7.35 kg, body mass index 24.7±2.1 kg. The subjects were informed about the study procedures before testing and completed a written informed consent. The Ethics and Research Committee of the Alicante University approved the study.

### Procedures

A field laboratory was located in the regatta area in order to allow measurements to be taken as close to competition time as possible. The 45 male partici-

pants were categorised as Professionals (n=15) or Amateurs (n=30). All anthropometric measurements were taken in the same tent, at ambient temperature (22 ± 1°C) and by the same investigator, who was an International Society for the Advancement of Kinanthropometry (ISAK) Level 2 anthropometrist. Measurements followed the protocols of Marfell-Jones et al. (2006) and Marfell-Jones (1991). Measurements were taken three times for each subject. The equipment used included a Holtain skinfold calliper (Holtain Ltd. U.K), a Holtain bone breadth calliper (Holtain Ltd., U.K), scales, stadiometer and anthropometric tape (SECA LTD., Germany). The physical characteristics were measured in the following order: age, weight, stature, arm span. The following measurements were also taken: sitting height, acromiale height, radiale height, dactylion height, tibiale height, biacromial breadth, biiliocrystal breadth, humerus and femur width; pectoral, subscapular, biceps, triceps, supriliac, supraspinale, front thigh, medial calf and abdominal skinfolds.

Muscle mass was calculated using the Lee equation (Lee et al., 2009). Fat mass was calculated using for the Withers equation (Withers et al., 1987). Bone mass was calculated using the Döbeln equation, modified by Rocha (as cited in Carter & Yuhasz, 1984). Somatype was calculated using the Heath-Carter equations (Carter, 2002).

### Data analysis

A test of normality and variable homogeneity was done initially using the Statistical Programme Package for Social Sciences (SPSS) v.14.0. Following this, descriptive statistics were generated and finally the student's *t*-test for independent samples was applied. Significance levels were set at  $p \leq 0.05$ .

## Results

Table 1 shows the average values and standard deviations of anthropometric data (professionals and amateur). Professionals were taller and younger (21.3% and 2.1%, respectively;  $p < 0.05$ ) than amateurs. They also showed significant differences in muscle mass (1.1% more;  $p < 0.05$ ), bone mass (0.9% more;  $p < 0.05$ ) and height (5.3%;  $p < 0.05$ ), compared to amateurs. Significant differences were also identified in femur width (larger in the professionals) and biceps, supraspinale and abdominal skinfolds (smaller in the professionals).

Table 1

Descriptive data and somatotype characteristics for windsurfers by category (mean±SD)

Dimension	Amateur (n=30)		Professional (n=15)	
	Mean±SD	Range	Mean±SD	Range
Age (year)	32.3±11	16-55	25.4±3.9*	20-33
Body mass Index (kg)	24.9±2.5	20.2-30.2	24.4±0.9	22.6-26.5
Height (cm)	180.8±5.9	168.5-195.5	184.6±6.4*	172-194
Weight (kg)	81±8.2	61-100.5	83.1±5.3	73.3-92.6
Humerus width (cm)	7.6±0.79	6.7-10.4	7.63±0.32	7-8.4
Femur width (cm)	9.81±0.91	6.3-10.6	10.32±0.43*	9.3-10.9
Upper arm girth (cm) <sup>a</sup>	32.31±2.31	25.7-35.7	32.93±1.16	30.2-35.4
Biceps girth (cm) <sup>b</sup>	34.49±2.32	28.2-38.5	35.17±1.29	32.5-37.3
Thigh girth (cm)	56.3±3.27	49.5-64.1	56.81±3.09	52.1-63
Calf girth (cm)	38.17±1.90	34.1-42.8	38.41±2.04	35.4-42
Pectoral skinfold (mm)	7.07±3.03	3.6-17.4	5.72±1.02	4-8
Triceps skinfold (mm)	9.05±2.61	3.4-13.6	7.67±2.06	5.8-13.4
Subscapular skinfold (mm)	11.46±3.82	5-21.5	9.69±1.22	8-12.8
Biceps skinfold (mm)	4.89±1.56	2.4-9.4	4.04±0.72*	3-5.8
Iliac Crest skinfold (mm)	14.55±3.99	6.6-21.4	12.47±2.53	9-16.8
Supraspinale skinfold (mm)	10.11±3.11	4.4-16.4	8.31±2.04*	5.4-13
Abdominal skinfold (mm)	15.22±4.81	5.4-24.8	11.47±2.42*	7.6-16.6
Front Thigh skinfold (mm)	11.22±2.69	4.8-17.4	11.28±2.73	7.2-17.2
Medial Calf skinfold (mm)	8.12±2.57	4-13.2	7.6±1.67	5.6-11.4
Muscle mass (kg)	33.6±2.9	24.8-39.4	35.5±1.8*	32.4-38.9
Fat mass (kg)	10.3±3.1	4-15.9	8.9±1.8	6.4-12.6
Bone mass (kg)	12.9±1.3	9.6-15	14.1±1.5*	11.2-17.3
Arm span (m)	1.8±0.1	1.7-2	1.9±0.1*	1.7-2.1
Endomorphy	2.91±0.93	0.92-4.74	2.34±0.45*	1.7-3.27
Mesomorphy	4.94±1.17	2.89-7.13	5.01±0.87	3.63-6.82
Ectomorphy	2.03±1.15	-0.13-4.01	2.4±0.63	0.95-3.61

<sup>a</sup>Midway between acromion and olecranon, arm relaxed; <sup>b</sup>Maximum girth of the tensed upper arm (maximum flexed). \* Significant differences  $p \leq 0.05$ .

Body composition differences between the two groups are shown in Figure 1.

The mean results for the three somatotype components showed that both groups were predominantly mesomorphic (professionals  $5 \pm 0.8$  and amateurs  $4.9 \pm 1.1$ ), but that the professionals were more

ectomorphic ( $2.4 \pm 0.6$ ) than endomorphic ( $2.3 \pm 0.4$ ), whereas the amateurs were slightly more endomorphic ( $2.9 \pm 0.9$ ) than ectomorphic ( $2 \pm 1.1$ ). Although there were differences between the three somatotype components, only in endomorphy component was this significant ( $p \leq 0.05$ ).

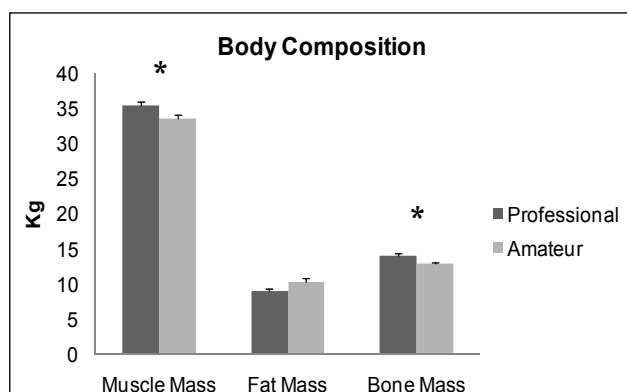


Figure 1

Body composition differences.  
\*Significant differences  $p \leq 0.05$

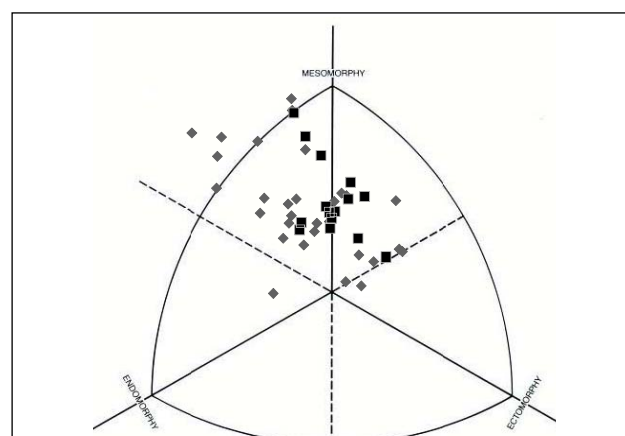
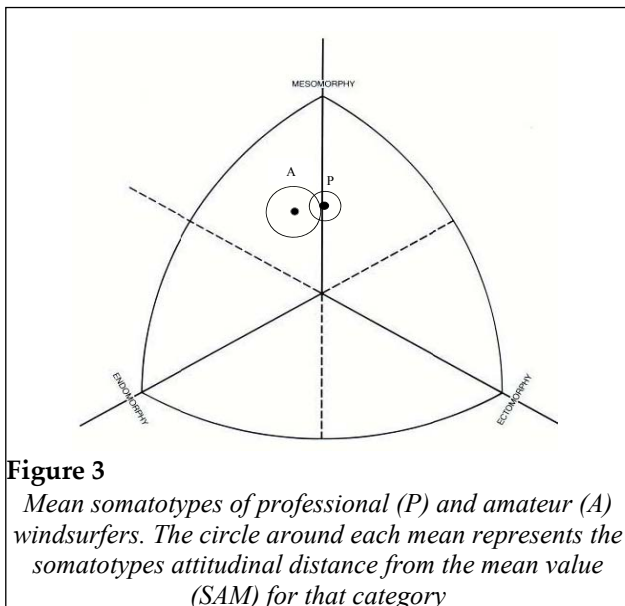


Figure 2

Distribution of somatotypes of windsurfers.  
■ Professional. ♦ Amateur.



The distance between the mean somatopoints of both groups (Somatotype attitudinal distance, SAD) was only 0.68, which was not significant (Figure 2). Although the two groups were not significantly different, the group of professionals was more homogeneous than the amateur group, as indicated by the SAM (Somatotype Attitudinal Mean) values of 0.96 and 1.64, respectively. Somatotype distributions are shown in Figure 3.

Somatotype attitudinal means of formula windsurfing in relation to elite athletes in others sports are shown in Table 2.

## Discussion

Literature describing different somatotype according to different sport modalities exist (Gualdi-Russo & Zaccagni, 2001), even within the same sport, based on changes in technology and regulations experienced over time. Very little research is available, however, for windsurfing. Porcella et al. (1992) evaluated 79 windsurfers in the world championships and pre-Olympic races celebrated in 1983 and 1986 in Italy, and established the mean somatotype components of the subjects who performed better were 2.57 – 2.68 – 2.97, showing slight domination of ectomorphy. In our study, however, both the professionals and amateurs showed a clear mesomorphy dominance over the other two components. The professionals in our study were also taller, heavier and had bigger arm and calf girths than those in the 1992 study.

It is not immediately obvious why these significant changes have occurred. Since 2006, there have

**Table 2**

*Somatotype attitudinal mean (SAM) of Formula Windsurfing in relation to elite athletes in other sports (modified from Ackland et al. (2003))*

SAM	Sports
1.5	Track & field / Water polo (goal keepers) / Water polo (c.fwd) <sup>5</sup> / Volleyball
1.3	Water polo (c. back)
1.2	Diving (10m) / Rowing / Marathon running
1.1	Spring Kayak & Canoe / Swimming / Rowing / Diving (1m) / Diving (3m) / Distance running
1.0	Gymnastics / Middle distance running / Soccer (field position)
0.9	Windsurf (Formula) / Soccer (goal keeper) / Boxing / Triathlon

been significant changes in the characteristics of board, with the development of a larger, more rigid table needing greater muscularity to sail it successfully (The Mistral One Design used until the 2004 Athens Olympic games was superceded by the Neilpryde RS:X for the Beijing Olympics). However, these changes alone cannot explain the differences in height and muscularity observed since 1992, as they are far too recent. Professional windsurfers (and indeed all elite athletes) take far longer than a year to significantly change their group morphological profile.

More likely, these changes seen in professional windsurfers parallel increases in height and muscularity in many strength sports over the past 15 years, and it is clear that strength is a significant factor in windsurfing success.

Buchanan et al. (1996) and Dyson et al. (1996) discovered significant differences ( $P < 0.001$ ) between upper muscular group and lower muscular group use when they carried out research over levels of muscular activity in Trapezius, Carpi flexors, Biceps brachii, gluteals and tibials, finding greater muscular participation of the upper muscular group, particularly isometrically. Campillo et al. (2007) observed that much of the pain and injury seen in this sport was concentrated in the forearms and that this pain could be related to arm span--subjects with greater arm span being less likely to suffer pain. In our study we found the professional group had a larger mean arm span than the amateur group (5.3%;  $p < 0.05$ ), yet no comparison of pain experienced by the two groups was conducted, thus we were unable to address this topic.

Recent research emphasizes the health benefits of moderate increases in daily activities and the development of active lifestyles (Pahkala et al., 2007; Sjolie and Thuen, 2002). Health-risk behaviors such as being physically.

### **Conclusion**

It is of considerable value to know the current anthropometric profile of elite windsurfers, as this

knowledge enables sport scientists and coaches to better match the morphology with the performance required for success. This will assist not only in initial selection for the sport, but also in the design of training programmes which further develop that morphology, where possible, in the pursuit of improved performance.

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