## Seasonal Anthropometric changes using 3-Dimensional Whole Body Scanner in collegiate female swimmers

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# **INTRODUCTION**

Competitive seasons of swimming are generally divided into almost 2 stages in a year. For instance, the first half period is to the first main meets on April since last October, and then the second half period is to the main meets on September since May. Over the past years, several studies have been made on body composition by anthropometric measurements [1]. But there has been no study that tried to measured this three-dimensional anthropometry method in athletes. This investigation was to monitor the body shape longitudinally by using three-dimensional anthropometry method (BLS: Body line scanner, Hamamatsu Photonics KK) in female collegiate swimmers, as the subjects in first half period (during the 5 months: since May). June is basic fraise; endurance training (B) and August is taper fraise; conditionings (T). Furthermore, these separate body composition parameter of August compared with June.

#### **METHODS**

We calculated the segmental volumes (SV) of six parts of bodies by integrating the cross-section area of a human body which was obtained every 2.5mm interval in horizontal plane with respect to each segment length. The subjects were 11 female collegiate swimmers (B fraise; Age : 20.8±0.6 years, body height: 162.0±4.0cm, body mass: 57.5±4.4kg; T fraise; Age: 20.9±0.6 years, body height: 162.3±4.1cm, body mass: 56.6±4.2kg) participated in the study. The subjects wore close-fitting clothing and head cap during the measurements. We measured body weight, height, body segmental circumferences, and length. Relative value of Cross Section Area (%CSA), each segment volume to whole body volume (%SV) and value of each body surface area whole body surface area (%BSA) was also calculated. %SV and %BSA and %CSA were compared with these calculated from two fraise.

#### **RESULTS AND DISCUSSION**

The frontal and sagittal dimensions of a swimmer measured by BLS (a) and feed-back paper (b) are shown in Figures 1. The differences of the measurements (%diff.) of circumference and CSA between B fraise and T fraise (Taper fraise - Basic fraise / Basic fraise, %) were as follows; Circumference of chest: 0.9±3.1%, waist: 1.7±3.8%, hip:  $1.3\pm2.4\%$ , left upper arm:  $-3.0\pm4.4\%$ , right upper arm:  $-0.4\pm2.7\%$ , left forearms:  $-1.1\pm2.7\%$ , right forearms: -1.9±1.6%, left thighs: -3.1±2.3%, right thighs: -2.6±1.9%, left legs: -0.5±1.1%, right legs: -0.6±1.1%; CSA of chest: 0.7±4.7%, waist: -3.8±6.1%, hip: -0.3±3.8%. In the same way, the results were shown in differences of %SV and %BSA were; head: -1.5±1.5%, -1.8±2.3%, trunk: -0.8±2.3%, 1.2±7.3%, left superior limb: -2.8±3.5%, -0.1±3.7%, right superior limb: -2.5±4.5%, -1.5±3.0%, left inferior limb: -1.6±4.4%, -0.6±2.8%, right inferior limb:  $-1.7\pm4.4\%$ ,  $-0.8\pm3.0\%$ , total:  $-1.2\pm0.9\%$ ,  $-0.2\pm3.0\%$ , respectively.



Figure 1: Front and side dimensions of a swimmer measured by 3-dimensional whole body scanning anthropometry (a) and feed-back paper (b).

In comparisons between B fraise and T fraise for total body volume, %SV, %BSA, %CSA and segmental circumference in 11 female collegiate swimmers, these parameter was not significantly difference (Table 1). Although there was changed in not only circumference of chest, waist and hip (%diff.) but also %CSA. This is training effect during 2 months from this phenomenon. It may be necessary to monitor longitudinally both training and change of body composition (physiological) peaking of those swimmers. The further research will be required for a detailed posture mechanism (configuration).

Table 1: The ratio of each segmental volumes and body surface area in whole body volumes.

	segmental volumes / whole body volumes (%SV)					
	head	trunk	left superior limb	right superior limb	left inferior limb	right inferior limb
basic fraise (B)	8.1±0.5	54.4±1.5	3.9±0.3	4.0±0.3	14.6±0.7	14.9±0.6
taper fraise (T)	8.1±0.5	54.7±2.1	3.8±0.3	4.0±0.3	14.5±0.9	14.9±0.7
body surface area / whole body volumes (%BSA)						
basic fraise (B)	9.3±0.4	36.7±1.6	8.6±0.4	8.8±0.4	18.2±0.6	18.4±0.5
taper fraise (T)	9.2±0.4	37.2±1.6	8.6±0.4	8.7±0.5	18.1±0.7	18.3±0.6

# REFERENCES

1. J. Wang, D. Gallagher, J. C. Thornton, W. Yu, M. Horlick, and F. X. Pi-Sunyer, Am. J. Clin. Nutrition 83, 809-816, 2006.