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### Original Research

## Ultrasound Techniques Applied to Body Fat Measurement in Male and Female Athletes

Jean-Claude Pineau, PhD<sup>1</sup>, Jean Robert Filliard, PhD<sup>2</sup>, and Michel Bocquet, PhD<sup>3</sup>

<sup>1</sup>Centre National de Recherche Scientifique, Paris, France

<sup>2</sup>Institut National des Sports et de l'Education Physique (INSEP), Paris, France

<sup>3</sup>Ecole Nationale Supérieure d'Arts et Metiers, Paris, France

### Abstract

**Context:** For athletes in disciplines with weight categories, it is important to assess body composition and weight fluctuations.

**Objective:** To evaluate the accuracy of measuring body fat percentage with a portable ultrasound device possessing high accuracy and reliability versus fan-beam, dual-energy X-ray absorptiometry (DEXA).

**Design:** Cross-validation study.

**Setting:** Research laboratory.

**Patients or Other Participants:** A total of 93 athletes (24 women, 69 men), aged  $23.5 \pm 3.7$  years, with body mass index =  $24.0 \pm 4.2$  and body fat percentage via DEXA =  $9.41 \pm 8.1$  participated. All participants were elite athletes selected from the Institut National des Sports et de l'Education Physique. These participants practiced a variety of weight-category sports.

**Main Outcome Measure(s):** We measured body fat and body fat percentage using an ultrasound technique associated with anthropometric values and the DEXA reference technique. Cross-validation between the ultrasound technique and DEXA was then performed.

**Results:** Ultrasound estimates of body fat percentage were correlated closely with those of DEXA in both females ( $r = 0.97$ , standard error of the estimate = 1.79) and males ( $r = 0.98$ , standard error of the estimate = 0.96). The ultrasound technique in both sexes had a low total error (0.93). The 95% limit of agreement was  $-0.06 \pm 1.2$  for all athletes and did not show an overprediction or underprediction bias. We developed a new model to produce body fat estimates with ultrasound and anthropometric dimensions.

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**Conclusions:** The limits of agreement with the ultrasound technique compared with DEXA measurements were very good. Consequently, the use of a portable ultrasound device produced accurate body fat and body fat percentage estimates in relation to the fan-beam DEXA technique.

**Keywords:** [body composition](#), [DEXA](#), [anthropometry](#)

Jean-Claude Pineau, PhD; Jean Robert Filliard, PhD; and Michel Bocquet, PhD, contributed to conception and design; acquisition and analysis and interpretation of the data; and drafting, critical revision, and final approval of the article.

Address correspondence to Jean-Claude Pineau, PhD, Centre National de Recherche Scientifique, Dynamique de l'évolution humaine, UPR 2147 CNRS, 44 rue de l'Amiral Mouchez, Paris, France, e-mail: [jean-claude.pineau@evolhum.cnrs.fr](mailto:jean-claude.pineau@evolhum.cnrs.fr)

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