Size Stream Body Fat Formulas

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Abstract

Size Stream has developed new formulas for estimating human body fat content via the Size Stream SS20 3D body scanner using machine learning. In addition, a new formula using manual measurements has also been developed.

A significant new finding during this process was that the optimal body measures to predict body fat are different for the lean versus obese ends of the body fat spectrum of subjects. A combined formula has been developed utilizing this knowledge.

These formulas were developed and cross-validated using a diverse set of over 1790 human 3D body scans (of 179 individuals) whose body composition was also measured using a state-of-the-art four-component body composition model. The four-component model (4C) takes into account the human body's four main molecular components: water, fat, bone mineral, and protein/residual. In order to obtain these compartments, estimates of body volume, water content, bone mineral, and total body mass are needed. These variables were provided via air displacement plethysmography (Cosmed BOD POD® Gold Standard), bioimpedance spectroscopy (ImpediMed® SFB7), dual-energy x-ray absorptiometry (GE Lunar Prodigy), and a calibrated body mass scale, respectively. The variables were then inserted into a validated equation (Wang et al. 2002, American Journal of Clinical Nutrition) in order to estimate 4C body fat. A 4C model is considered a true criterion method of body composition assessment. While many body composition assessment methods validate their products using well-respected single-assessment devices (such as DXA), validation using the 4C represents a notable strength of the new Size Stream formulas. Machine learning techniques were utilized to correlate the 3D body scan data to the 4C body composition measurements. The resulting formulas were then cross-validated using two additional test groups of subjects at separate labs.