MEASUREMENT OF BODY SURFACE AREA USING 3D LASER SCANS

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3D laser scanning technology and sophisticated graphics editing software were applied to determine human body surface area (BSA). Whole-body scans of 641 adults (395 males and 246 females) were obtained from the anthropometric data base of the Civilian American and European Surface Anthropometry Resource project. BSA was calculated after detailed surface editing of the scans that involved patching and smoothing to produce closed surfaces. 12 males and 12 females (G24) were chosen from the entire population for detailed measurements of the surface area of the hand (SA_{hand}) and of the ratios of the surface area to volume (SA/VOL) of various body segments. Regression formulae involving wrist circumference and arm length were subsequently used to predict SA_{hand} for the remaining population. Overall mean ± SD of BSA were 2.03 ± 0.19 and 1.73 ± 0.19 m^2 for men and women, respectively. Various published prediction formulae were then compared and although most predicted close to the BSA measured herein, residual analysis revealed in most cases an overprediction with increasing body size. Non-linear regressions were performed for each gender separately and these yielded the following best-fit formulae (with root mean square errors of ~1.3%): $BSA(cm^2) = 128.1 \bullet WT^{0.44} \bullet HT^{0.60}$ for men and $147.4 \bullet WT^{0.47} \bullet HT^{0.55}$ for women, where WT is in kg and HT is in cm. The SA/VOL ratio of various body segments were higher for the females compared to the males of G24, significantly for the head plus neck (by 7%), torso (19%), upper arms (15%), forearms (20%), hands (18%), and feet (11%). The SA/VOL ratios for both genders ranged from ~12 m^{-1} for the pelvic region to 104 - 123 m^{-1} for the hands.

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