The purpose of this study was to determine if gender differences exist in resting metabolic rate (RMR) among children and adults independent of body mass (BM) and composition (%BF). Measures of BM, %BF, and RMR were made on four groups of subjects: 38 male children (MC), 39 female children (FC), 40 male adults (MA), and 41 female adults (FA). Children and adults ranged in age from 6 to 12 yrs and 19 to 50 yrs, respectively. Dimensional analysis based on the theory of biological similitude predicts the relationship between RMR and body mass should be $V O_2 = aM^b$, where the coefficient "a" represents the mass independent metabolic rate (MIM). Best-fit power functions were calculated for each group to determine if the best-fit results were consistent with the similitude model. The theoretical exponent ($b=0.67$) fell with the 95% confidence interval (CI) of the best-fit power function for MC, MA, and FA and just outside FC (95% CI = 0.36 to 0.59). The similitude model was consequently used to correct for differences in BM and %BF among the groups. The individual and group means of MIM were calculated and ANOVA with Tuckey's post hoc tests ($P<0.05$) revealed significant differences in MIM among all the groups: MC = 0.204, FC = 0.0184, MA = 0.0149, and FA = 0.0122 L O2/kg^0.67. The MIM values calculated as a function of lean body mass were similarly analyzed revealing significant differences no longer existed between male and female children (0.0226 and 0.0213 L O2/kg^0.67, respectively), but did exist between male and female adults (0.0175 and 0.152 L O2/kg^0.67, respectively); and between adults and both groups of children. The results suggest that males have higher RMR than females when corrected for BM. These gender differences persist between adults, but not between children when corrections are made for differences in %BF. Also, the results indicate that children have higher metabolic rates than adults which are independent of
differences in BM and %BF.