Gender variations of body composition, muscle strength and power output in morbid obesity

C.L. Lafortuna, N.A. Maffiuletti, F. Agosti, A. Sartorio

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Background: motor capabilities are reduced in obese (OB) individuals, and this impairment may result also from quantitative variation of muscle mass due to alterations in body composition.

Objective: this study aims to evaluate the differences in body mass (BM) and composition, as well as in muscle strength (ST) and power output (Ŵ) between OB and NW males and females, and to test the hypothesis that variations in body composition affect muscle performance in OB subjects.

Design and methods: body composition (determined by BIA with a two-compartment model), upper and lower limb maximum ST (evaluated with isotonic machines) and lower limb maximum anaerobic Ŵ (measured with a jumping test) were studied in a group 95 extremely OB subjects (OB: 28 males, 67 females; mean age±s.d.: 29.3±7.0y; BMI 41.2±4.4 kg/m^2) and in a control group of 18 NW voluntary subjects (NW: eight males, 10 females; age 30.3±5.3 y; BMI 22.6±2.1 kg/m^2).

Results: OB male and female subjects differed significantly with increases in BM being attained by a similar contribution of fat mass (FM) and fat-free mass (FFM) in male subjects, but mainly contributed by FM in female subjects. Compared with NW, both OB men and women had a greater amount of FFM (P<0.001) and, since a general linear correlation was found between ST and FFM (ST (N) = 64.4 FFM (kg) - 190.0, R^2=0.612, P<0.001), they developed higher values of ST (P<0.05) than they respective NW counterparts. For the same reason, both OB and NW male subjects had higher ST (P<0.001) than their female counterparts. Correction for FFM eliminated all gender- and obesity-related ST differences. On the contrary, in spite of their higher absolute muscle strength, both OB men and women could develop absolute Ŵ similar to that of NW subjects, and were notably less powerful per unit BM than NW subjects (P<0.001), women being most affected among the OB.

Conclusions: obesity-related variation in body composition differs considerably by gender, and is responsible for differences in muscle performance: the higher muscle strength observed in OB subjects (both men and women) and in male subjects (both OB and NW) is accounted for by a greater amount of FFM. Nonetheless, biomechanical limitations appear to impair muscle power development during jumping in OB individuals.