Body mass index, muscle mass and NT –proBNP levels in healthy adults

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BACKGROUND

Recent attempts were made to adjust B-type natriuretic peptide (BNP) levels in patients with dyspnea, to further increase its diagnostic accuracy. In this context, a higher body mass index (BMI) has been associated with lower BNP levels. While obesity and metabolic abnormalities have been implicated in this inverse relationship, the exact mechanisms remain largely unknown.

OBJECTIVE

To investigate which body compartments are directly related to N-terminal (NT) - proBNP levels in a population based sample of young and healthy individuals.

METHODS

The Genetic and Phenotypic Determinants of Blood Pressure and Other Cardiovascular Risk Factors (GAPP) study is a population based cohort study of healthy adults aged 25-40 years in the Principality of Liechtenstein. Individuals with diabetes, BMI > 35 kg/m² and prevalent cardiovascular disease were excluded. BMI was calculated using body weight in kg divided by height in meters squared. NT-proBNP was assayed using the Elecsys electrochemoluminscence immunoassay analyser (Roche). Body composition was determined by bioelectrical impedance analysis using a validated device (BIA, ego fit, Germany).

We constructed univariable Pearson correlations and multivariable linear regression models adjusting for sex, age, BMI, smoking status, lipid profile, fasting glucose, hypertension, body fat, body water and muscle mass. A significance level of 0.05 was prespecified.

RESULTS

857 individuals were included in this analysis. Baseline characteristics are shown in table 1.

Using correlation analyses, we found significant negative relationships of BMI (r= -0.28, p <.0001), muscle mass (r= -0.34, p <.0001), and body water (r= -0.20, p <.0001) with NT-proBNP levels. Body fat was positively related to NT-proBNP (r= 0.29, p <.0001) (table 2). In multivariable linear regression analysis using log-transformed NT-proBNP as the outcome variable, muscle mass (β= -0.05, (95% confidence interval -0.07, -0.02), p=<.0001) and body water (β= 0.03, (95% CI 0.007, 0.05), p=0.0088) were independent predictors of NT-proBNP levels after multivariate adjustment. Body fat was not significantly associated with NT-proBNP (β= -0.01, (95% CI -0.04, 0.004), p=0.158 (table 3).

Table 1 Baseline characteristics

	N = 857
Sex female (%)	446 (52)
Age (y)	39 (33 – 41)
Blood pressure sys (mmHg)	120 ± 13.8
Blood pressure dia (mmHg)	78 ± 9.4
BMI (kg/m²)	24.6 ± 3.8
Body fat (%)	24.8 ± 6.5
Body water (%)	54.6 ± 5.4
Muscle mass (%)	35.1 ± 4.0
Nt-proBNP (ng/l)	34 (17 – 58)

Data are means ± SD, medians (interquartile range) or number (percentage)

Table 2 Relationship of NT-proBNP and body composition variables (Pearson correlation)

	r	p
BMI (kg/m²)	-0.28	< .0001
Body Fat (%)	0.29	< .0001
Body Water (%)	-0.20	< .0001
Muscle Mass (%)	-0.34	< .0001

NT-proBNP is log-transformed. r = correlation coefficient

Table 3 Relationship of NT-proBNP and body composition variables (multivariable linear regression analysis)

	β	95% CI	p
BMI (kg/m²)	0.02	-0.005, 0.04	0.135
Body fat (%)	-0.01	-0.04, 0.004	0.158
Body water (%)	0.03	0.007, 0.05	0.0088
Muscle mass (%)	-0.05	-0.07 , -0.02	< .0001

Adjusted for sex, age, BMI, smoking status, lipid profile, fasting glucose, hypertension, body fat, body water and muscle mass. NT-proBNP is log-transformed. β = regression coefficient; CI = Confidence Interval

CONCLUSION

In this large population based study of young and healthy individuals, the inverse relationship between BMI and NT-proBNP levels was predominantly explained by muscle mass, not fat. The biological underpinnings of these relationships need to be determined in future analyses.

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