Association between body composition parameters and hip fracture risk in an elderly female population

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Background

- Hip fracture is a global public health problem because it is associated with increased mortality and long-term disability among survivors.
- People with higher body weight have lower hip fracture risk. However, it is not known which component of weight, lean mass or fat mass, is predictive of hip fracture.

Aims

We conducted this study to test the hypothesis that higher fat mass is associated with lower risk of hip fracture.

Design and Methods

- **Design**: Population-based, prospective, 20-yrs follow-up.
- **Participants**: 2662 women aged 60 years and older as of 1990.
- **Outcome**: atraumatic hip fracture ascertained by X-ray report.
- **Measurements**: bone mineral density (BMD) at the femoral neck and whole-body composition were measured by dual-energy X-ray absorptiometry (GE-Lunar Prodigy) at baseline.
- **Body composition analysis**: percent body fat, lean mass and fat mass (kg) were adjusted for height as follows:

$$\text{fat mass index (FMI)} = \frac{\text{fat mass (kg)}}{\text{height (in m)}^2}$$

- **Analysis:** the Cox's proportional hazard model was used to estimate the magnitude of association between fracture and body composition parameters. The model was further adjusted for age and BMD which are known to be associated with body composition and fracture.

Results

During the follow-up period (median 16.5 years, range: 0.5 to 31 years), 225 women had sustained a hip fracture, giving an incidence rate of 0.60 (95% CI, 0.53 – 0.69) per 100 person-years.

Table 1. Baseline characteristics of 2662 women by fracture status

Characteristics	Without hip fracture (n=2437)	With hip fracture (n=225)
Age (years)	69.0 ± 8.74	74.4 ± 7.96
BMI (kg/m^2)	26.9 ± 5.25	24.3 ± 4.29
Total fat mass (kg)	26.9 ± 8.41	22.9 ± 7.16
Central fat mass (kg)	1.79 ± 0.67	1.51 ± 0.63
Percentage body fat mass (%)	39.0 ± 7.36	35.9 ± 6.42
Femoral neck BMD (g/cm^2)	0.83 ± 0.14	0.71 ± 0.13
Fall: n (%)		
0 (n=1598)	1483 (61%)	115 (49%)
1 (n=664)	578 (24%)	68 (29%)
2+ (n=382)	294 (12%)	34 (14%)
Prior fracture: n (%)		
0 (n=2257)	2071 (85%)	186 (79%)
1 (n=371)	287 (12%)	30 (13%)
2+ (n=88)	79 (3%)	9 (4%)

- Compared to those without a fracture, women with a hip fracture were older (74 vs 60 yrs) and had lower baseline fat mass (23 vs 27 kg).

DOES — *Symptomatic fracture incidence in elderly men and women: The Dubbo osteoporosis epidemiology study (DOES)*

- Both fat mass and lean mass were positively correlated, and age was negatively correlated with BMD (Figure 1).

Figure 1. Association between body composition parameters and bone mineral density at the femoral neck

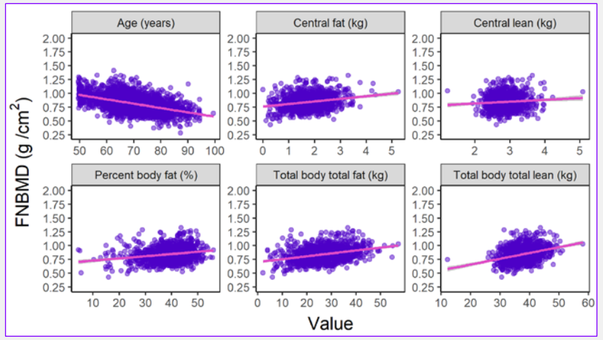
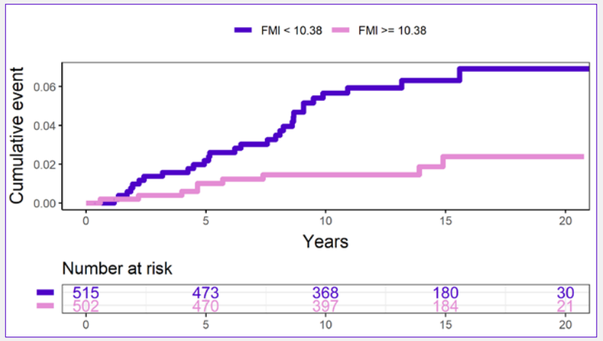


Figure 2. Cumulative incidence of hip fractures stratified by fat mass index



- Greater risk of hip fracture was associated with lower FMI and percent body fat (Figure 2: P = 0.002; Figure 3: P <0.001).
- In univariate analysis, greater fat mass or percent body fat or central fat mass was associated with lower risk of hip fracture (Figure 4).
- However, after adjusting for age or age and covariates the association was no longer statistically significant.

Figure 3. Cumulative incidence of hip fractures stratified by percentage body fat

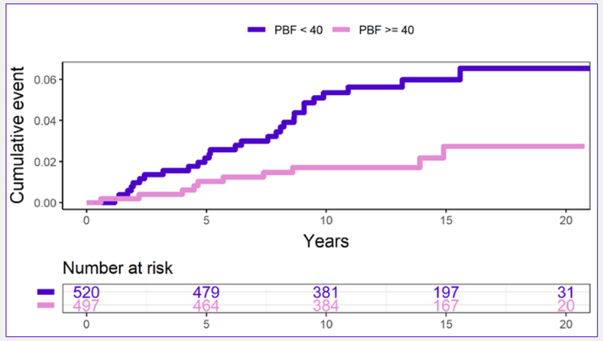
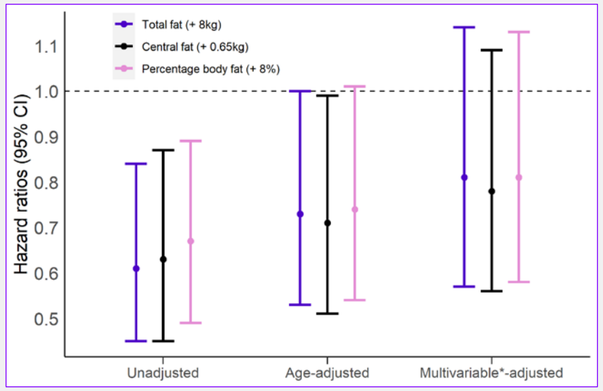


Figure 4. Association between fat mass, and hip fracture: unadjusted analysis, adjusted for age and covariates



*adjusted for age, femoral neck density, history of falls and prior fracture.

Conclusion

Greater fat mass is associated with lower risk of hip fracture, but the association is likely mediated by bone mineral density.

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