



# A follow-up investigation on bone mineral density and nutritionally dependent hormones in patients with early onset anorexia nervosa

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## Objective:

In addition to other negative long term „side effects“, persistent bone mineral deficiencies are followed by an high risk of osteoporosis in anorexic patients.

Concerning this patient group, associations between bone mineral density and nutritionally dependent hormones are described. However, little is known about these correlations with an emphasis on eating disorders' onset during childhood and adolescence. There is a lack of prospective and personally reinvestigation studies.

Therefore, we carried out a follow-up investigation about eating disorder outcome and its hormonally influenced effects on bone mineral density.

## Methods:

Reinvestigating 39 former patients, eating disorder outcome was assessed by body examination and a standardized instrument (Composite International Diagnostic Inventory, World Health Organization, 1990), bone mineral parameters and actual body composition were measured (dual-energy x-ray absorptiometry: DXA, LUNAR DPX-L, Lunar Corporation, Madison, USA). At follow-up, we were also able to determine serum concentrations of leptin, insulin-like growth factor-I and II (IGF-I; IGF-II) and their binding proteins IGFBP-1, IGFBP-2 and IGFBP-3 (In-house radio-immuno-assays; see Blum, 1996).

Statistical analysis was done using SPSS™. Spearman's correlation coefficients were calculated between serum leptin levels, IGF-I, IGF-II, IGF-binding proteins and BMD or BMC changes. The z-scores were calculated using a polynomial fit function based on the means and standard deviations of the normal BMC values from Zanchetta et al. (Zanchetta et al., 1995).

## Results:

The duration of the catamnestic period was 5.3 years (?1.7; range 3-9 years) after discharge. For a description of sample data see table 1. Serum leptin levels varied from 1.48 µg/l to 43.1 µg/l.

Table 1. sample (first examination compared to follow-up)

age (years):	15.5 (r. 10-19)	20.7 (r. 13-26)
BMI (kg/m <sup>2</sup> ):	14.9 (?1.9; r. 10.8-18.7)	19.9 (?2.5; r. 14.3-26.3)
percent body fat:	12.5%	24.6%

According to the criteria of Morgan and Russell, eating disorder outcome was good in about 50% of our former patients (table 2).

Table 2. general outcome (n=39)

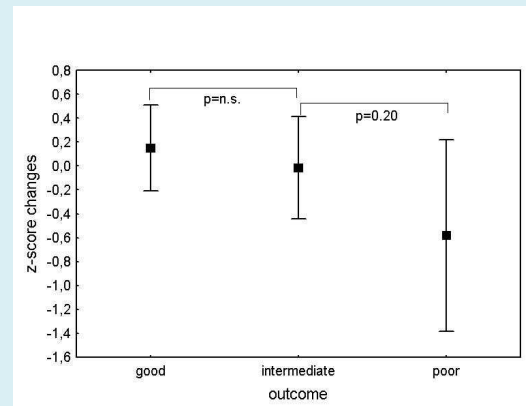
outcome	n (%)	symptoms
good	20 (51.3%)	BMI > 17.5; regular menstrual cycle
intermediate	15 (38.5%)	BMI < 17.5; or irregular menstrual cycle/ fluctuations of weight, amenorrhea
poor	4 (10.3%)	BMI < 17.5; amenorrhea; bulimic symptoms

Table 3. bone parameters (first examination compared to follow-up)

BMC (kg)	2.01 (±0.4)	(1.0-2.8)	2.32 (±0.3)*	(1.5-3.0)
BMD (g/cm <sup>2</sup> )	1.03 (±0.08)	(0.8-1.2)	1.08 (±0.07)*	(0.9-1.2)

The BMD as an areal density parameter implying bone growth in length and width was increased (table 3). Although there was a slight increase in the good outcome group (0.15; ±0.89), the z-score changes of the BMC values were not significantly different between the three outcome groups (fig. 1). Correlations were found between serum leptin concentrations and actual body composition (leptin/BMI: 0.62\*\*; leptin/FBM: 0.85\*\*) but also with one bone parameter (leptin/BMC: 0.35\*). There were negative correlations between age and IGF 1 (-0.42\*\*) resp. BMI and IGFBP-2 (-0.40\*). BMD correlated both with BMI (0.36) and BMC (0.73\*).

Figure 1: BMC-z-score changes differentiating between three groups (good vs. intermediate vs. poor outcome; means ± standard error)



## Discussion:

The main focus in our study lies on a clear correlation between eating disorder outcome and an improvement of bone mineral density. In particular, we didn't find a loss of BMC and BMD in the groups with good and intermediate outcome. The great variation of serum leptin levels reflects the heterogeneity of our sample. The hormones' influence on the modelling activity of the growing skeleton seems to be higher than on remodelling changes concerning the mature bone mass (and more indirectly). According to the literature, serum IGF-I concentrations in our patients group were low and showed no correlation with eating disorder outcome. However, there was one between leptin and serum glucose (0.48\*\*). An preliminary interpretation of our data leads to the presumption that leptin seems to reflect a relatively immediate response to the actual nutritional status, whereas IGF related changes should be more closely related to the long-term effects of undernutrition on central pathways.

## Conclusion:

Taken all this into consideration, further studies on bone mineral mass as well as bone strength and the GH-IGF-I axis especially in younger anorexic patients are needed.

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