P460

Serum leptin and adiponectin in overweight and obese postmenopausal women after the six-month weight loss program and their relationship with BMD

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Introduction

The connection between osteoporosis and obesity is becoming a topic of increasing research. The associated cells to these conditions, osteoblasts and adipocytes, originate from bone marrow stromal cells. The adipocyte-secreted hormones, leptin and adiponectin, may be the mediators between adipose tissue and bone. Clinical studies indicate that increased body weight was highly associated with increased BMD and BMC in postmenopausal women. Conversely, a significant decrease in BMD/BMC was found in this population during and after weight loss.

Objective

The aim was to examine the changes in leptin and adiponectin with the weight and body composition change during the six months weight loss program. Additionally, the relationship between two adipokines and BMD of various skeletal sites was also examined.

Method

Participants were 100 overweight and obese Caucasian postmenopausal women, randomly assigned to three groups after baseline screening. Each group had a hypocaloric diet combined with assigned treatment: placebo, calcium+vitamin D supplements, or low-fat dairy products. Anthropometries, BMD (by iDXA), were measured and serum leptin, adiponectin, and bone markers (osteocalcin, serum NTx and urine CTx) were analyzed with immunoassay kits, at baseline and 6 months. Dietary and activity records were collected, as well. The data were analyzed by SPSS 20.0 (IBM Corporation, Somers, NY), calculating Pearson's and partial correlation coefficients, adjusted for confounders (age or YSM, BMI, physical activity and Ca and vitamin D intake). The changes across time were examined using repeated measure analysis of variance.

Results

Table 1 Principle characteristics and adipokines' levels at baseline and six month (N=100)

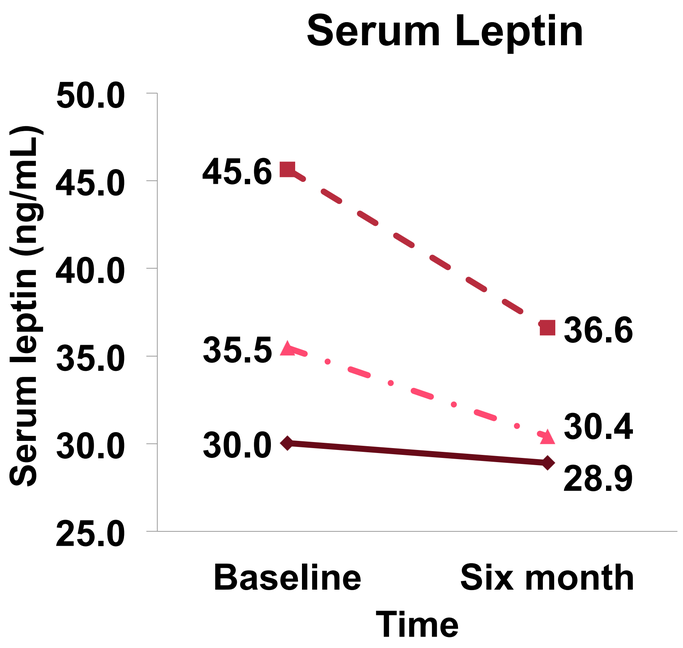
	Baseline	Six-month
	Mean ± SD	Mean ± SD
Age (year)	55.76 ± 3.69	56.32 ± 3.70
Weight (kg)	82.55 ± 14.85	79.33 ± 15.05
BMI (kg/m^2)	30.86 ± 5.26	29.62 ± 5.31
Fat mass (%)	45.33 ± 4.74	43.80 ± 5.76
Years since menopause	36.46 ± 20.69	49.97 ± 4.04
Leptin (ng/mL)	11.83 ± 5.70	31.70 ± 21.40
Adiponectin (µg/mL)	55.76 ± 3.69	16.42 ± 8.06

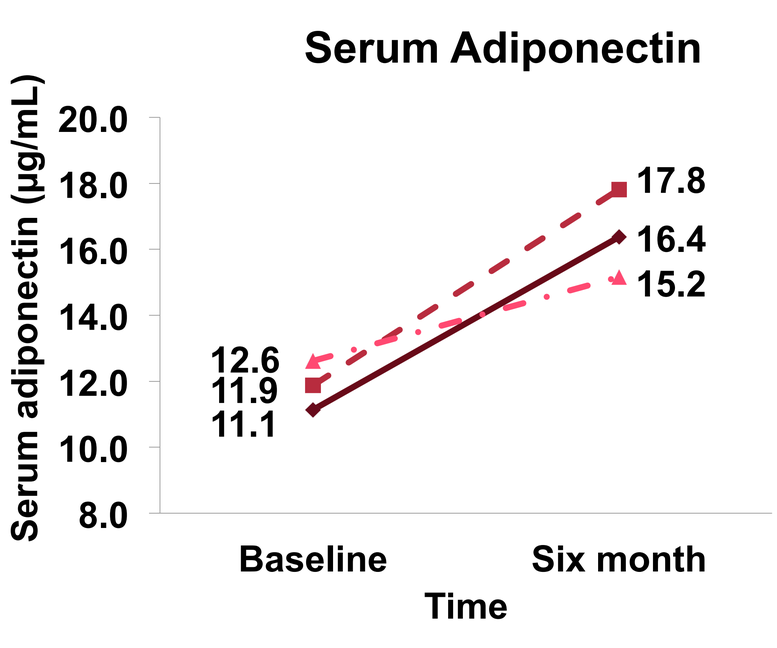
Results are expressed as mean ± SD. BMI, body mass index.

Table 2 Percentage of changes in adipokines, bone, and body composition parameters after six months

		Time effect	
	% change	F	p
Leptin (ng/mL)	-12.6%	4.83*	0.03
Adiponectin (µg/mL)	39.1%	36.12**	<0.001
Total body BMD (g/cm^2)	-0.67%	8.12*	0.005
Total femur BMD (g/cm^2)	-0.37%	1.74	0.19
Body composition			
Fat free mass (kg)	-1.53%	27.05**	<0.001
Fat mass (kg)	-6.7%	48.59**	<0.001
Total % body fat	-3.4%	23.76**	<0.001
Body weight (kg)	-3.9%	60.30**	<0.001

*p < 0.05, **p < 0.001





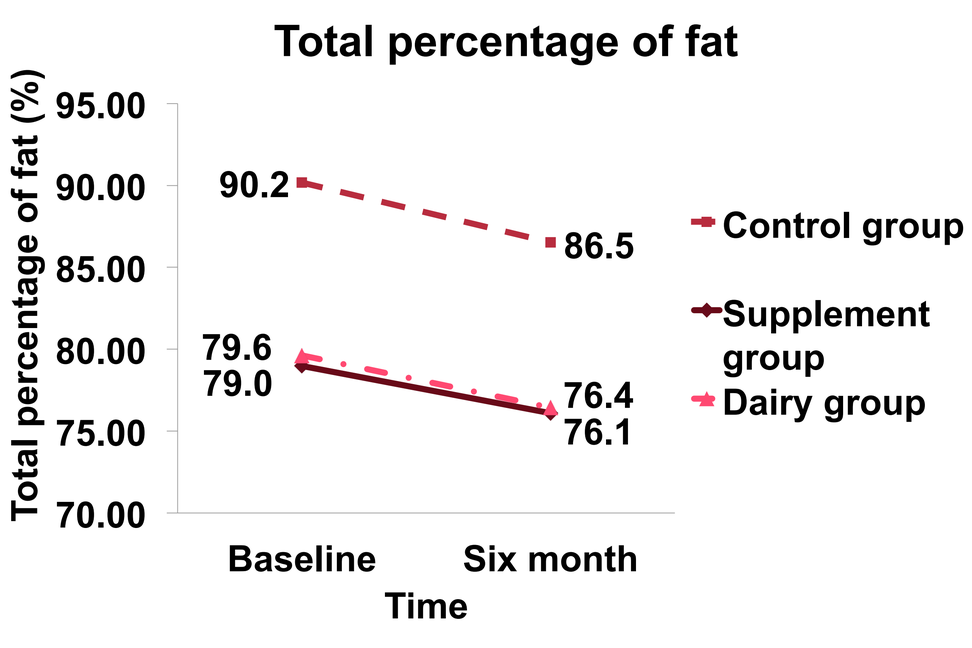


Table 3 Association between adipokines and bone parameters at baseline using Pearson's and partial correlation

	Leptin (ng/mL)			Adiponectin (µg/mL)		
Variables	r	r^a	r^b	r	r^a	r^b
BMD (g/cm^2)						
Total body	0.14	0.14	-0.10	-0.02	-0.02	-0.01
Total femur	**0.16***	0.15	-0.06	-0.10	-0.10	-0.09
Both forearms	**0.20***	**0.19***	0.02	-0.05	-0.05	-0.03
Bone markers						
Serum osteocalcin (ng/mL)	-0.13	-0.12	-0.02	**0.15***	0.16	0.15
Serum NTX (nmolBCE/l)	-0.09	-0.11	-0.08	0.02	0.03	0.03
Urine CTX (µg/mmol·Cr)	-0.04	-0.03	-0.01	0.03	0.04	0.03

*P<0.05. n = 184. BCE, bone collagen equivalent. r: Unadjusted
r^a Adjusted for age, physical activity, baseline YSM, dietary calcium and vitamin D intake.
r^b Adjusted for age, physical activity, baseline YSM, dietary calcium and vitamin D intake, and BMI.

Table 4 Association between adipokines and bone parameters at 6 month using Pearson's and partial correlation

	Leptin (ng/mL)			Adiponectin (µg/mL)		
Variables	r	r^a	r^b	r	r^a	r^b
BMD (g/cm^2)						
Total body	**0.23***	0.19	0.09	-0.02	-0.04	-0.05
Total femur	**0.27***	**0.21***	0.17	-0.07	-0.11	-0.12
Both forearm	0.11	0.10	0.02	-0.11	-0.11	-0.12
Bone markers						
Serum osteocalcin (ng/mL)	0.00	-0.05	0.02	0.03	0.03	0.04
Serum NTX (nmolBCE/l)	0.16	0.13	0.13	**-0.25***	**-0.27***	**-0.27***
Urine CTX (µg/mmol·Cr)	0.06	0.04	0.05	-0.02	-0.02	-0.02

*P<0.05. n = 100. BCE, bone collagen equivalent. r: Unadjusted.
r^a Adjusted for age, physical activity, baseline YSM, dietary calcium and vitamin D intake.
r^b Adjusted for age, physical activity, baseline YSM, dietary calcium and vitamin D intake, and BMI.

Conclusion

In conclusion, six-month weight loss resulted in slight bone loss and decreased leptin and increased adiponectin levels. The positive effect of leptin on femoral BMD remained even after its decreased levels caused by weight loss.

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