Objective:
New food strategies should be developed to fight against child malnutrition and growth retardation in developing countries. Spirulina alga, one of the richest sources of vegetable protein, contains all essential amino acids. We hypothesized that impaired peak bone mass acquisition caused by dietary protein deficiency could be prevented by Spirulina supplementation in growing rats.

Material & Methods:
One-month old female Sprague Dawley rats were fed three different isocaloric diets during 8 weeks:

- 10% casein diet (N=8)
- 5% casein diet (N=8)
- 5% casein + 5% spirulina diet (N=7)

- Analysis of body composition by DXA
- BMD by DXA
- Analysis of tibia bone microarchitecture by microCT
- Bone strength by three-point binding or compression test
- Blood analysis by ELISA

Assessment of the body weight every week
8 weeks

Results are expressed as means +/- SEM. The significance of difference between groups was evaluated using a one-way analysis of variance (ANOVA) or repeated measures ANOVA for the evolution of body weight, followed by a Fisher’s test. A p-value <0.05 was considered as statistically significant.

Results:

### Body weight evolution

![Graph showing body weight evolution over time](Image)

- *p<0.05 between the 10% casein and the 5% casein groups.
- #p<0.05 between the 5% casein and the 5% casein + 5% spirulina groups

### Body composition

- Fat mass (g)
- Lean mass (g)

![Graph showing body composition](Image)

- 10% casein 5% casein 5% casein + 5% spirulina

Proximal tibia

- BV/TV (%)
- Tb.Th (µm)
- BV/TV (%)

![Graph showing bone mineral density and bone strength](Image)

- 10% casein 5% casein 5% casein + 5% spirulina

Midshaft tibia

- BV/TV (%)
- Tb.Th (µm)

![Graph showing bone mineral density and bone strength](Image)

- 10% casein 5% casein 5% casein + 5% spirulina

Serum Insulin like growth factor-I (IGF-I)

- *p<0.05 between the 10% casein and the 5% casein groups.
- #p<0.05 between the 5% casein and the 5% casein + 5% spirulina groups

![Graph showing serum IGF-I levels](Image)

- 10% casein 5% casein 5% casein + 5% spirulina

Conclusion:
We demonstrate that Spirulina supplementation prevents cortical and trabecular bone alterations, as well as bone strength decrease induced by isocaloric dietary protein deficiency during growth, in association with the maintenance of optimal IGF-I levels. Spirulina is an effective nutrient to prevent impaired peak bone mass acquisition in protein deficient growing rats.