

**Mechanism of action of cocoa on bone metabolism in calcium- and estrogen- deficient rat model of osteoporosis: evidence for site and dose-related responses and involvement of IGF-I**

**ABSTRACT**

The present study evaluated the impact of cocoa on skeleton of ovariectomized rats. Animals were randomized into four groups: sham (basal diet: AIN-93M Ca and P-deficient), and three ovariectomized groups: OVX (basal diet), C6 and C12 (6% and 12% cocoa powder, respectively). Urinary calcium loss was decreased in C6 but not C12, while serum insulin-like growth factor (IGF)-I increased in both cocoa groups. Improvement in bone quality and strength was observed in femur mid-shaft in C6 but not C12. Bone density, quality and strength of lumbar vertebrae were improved in both cocoa groups. Cocoa improved systemic oxidative stress and inflammatory biomarkers. In bone tissue of C12, higher levels of H<sub>2</sub>O<sub>2</sub> and lower levels of glutathione peroxidase (GPx) were observed. Cocoa down-regulated osteoblast- and osteoclast-related genes while upregulated GPx and superoxide dismutase (SOD). Cocoa decreased bone turnover in ovariectomized rats. Its effects depended on the dose applied and the bone site.

**Keyword:** Cocoa; Bone quality; Bone strength; Oxidative stress; Inflammatory biomarkers; Postmenopausal osteoporosis