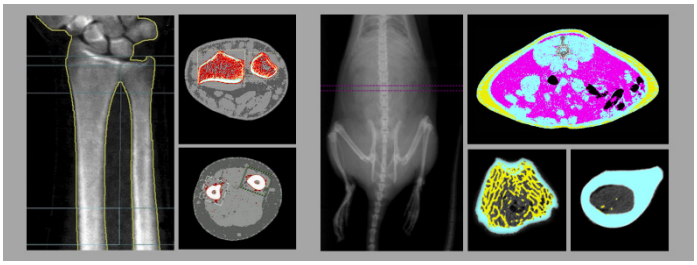

The biological importance and mechanisms of long-chain polyunsaturated fatty acids on bone growth in diet-induced obesity: Investigation in children with obesity and rodents

Oral Defence by PhD Candidate Ivy Mak

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Abstract

The majority of bone mass is acquired during childhood and adolescence. However, excess adiposity during growth, due in part to the combination of poor dietary pattern and sedentary lifestyle limit bone acquisition. Long-chain polyunsaturated fatty acids (LCPUFA) dually influence bone mass and adiposity during growth, with opposing effects of omega (n)-3 and n-6 LCPUFA. The relationship between bone health and LCPUFA intake and status was examined in children with obesity (6-13 y). Higher adiposity was associated with lower LCPUFA status and is consistent with suboptimal dietary intakes of n-3 LCPUFA in children with obesity. Children with high AA status had deficits in forearm bone and muscle mass, along with early signs of insulin resistance. Subsequently, longitudinal changes in bone mass accrual were characterized in an animal model of diet-induced obesity supplemented with n-6 arachidonic acid (AA) and *in vitro* in an adipose cell line. AA exacerbated adiposity development in the animal model, but showed differential effects on bone depending on skeletal site. *In vitro*, AA increased the proportion of adipocytes with multiloculus-lipid droplets and elevated leptin secretion. AA, at least in moderate amounts, has pivotal roles in childhood growth. It remains to be determined if correction of low n-3 LCPUFA status in children with obesity through encouraging fish or seafood intake will modulate the relationship between AA and bone growth.

About the Candidate

Ivy completed her BSc in Nutritional Sciences with a specialization in Nutritional Biochemistry at McGill. She then began her MSc in Human Nutrition and transferred to the PhD in 2014 under the supervision of Dr. Hope Weiler. Her research interests in bone metabolism and nutritional applications related to optimizing bone mass during growth and aging have resulted in 8 publications.