

**Worldwide incidence of hip fracture in elderly women: relation to consumption of animal and vegetable foods.**

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**BACKGROUND:**

Hip fracture, a major health problem in elderly persons, varies in incidence among the populations of different countries and is directly related to animal protein intake, a finding that suggests that bone integrity is compromised by endogenous acid production consequent to the metabolism of animal proteins. If that is so, vegetable foods might provide a countervailing effect, because they are a rich source of base (bicarbonate) in the form of metabolizable organic anions, which can neutralize protein-derived acid and supply substrate (carbonate) for bone formation.

**METHODS:**

We analyzed reported hip fracture incidence (HFI) data among countries (N = 33) in women aged 50 years and older, in relation to corresponding country-specific data on per capita consumption of vegetable and animal foods as reported by the United Nations Food and Agriculture Organization.

**RESULTS:**

HFI varied directly with total ( $r = +.67$ ,  $p < .001$ ) and animal ( $r = +.82$ ,  $p < .001$ ) protein intake and inversely with vegetable protein intake ( $r = .37$ ,  $p < .04$ ). The countries in the lowest tertile of HFI ( $n = 11$ ) had the lowest animal protein consumption, and invariably, vegetable protein (VP) consumption exceeded the country's corresponding intake of animal protein (AP):  $VP/AP > 1.0$ . By contrast, among the countries in the highest tertile of HFI, animal protein intake exceeded vegetable protein intake in nearly every case (10 of 11 countries). Among all countries, HFI correlated inversely and exponentially with the ratio of vegetable/animal protein intake ( $r = -.84$ ,  $p < .001$ ) and accounted for 70% of the total variation in HFI. Adjusted for total protein intake, vegetable food consumption was an independent negative predictor of HFI. All findings were similar for the subset of 23 countries whose populations are predominantly Caucasian.

**CONCLUSION:**

The findings suggest that the critical determinant of hip fracture risk in relation to the acid-base effects of diet is the net load of acid in the diet, when the intake of both acid and base precursors is considered. Moderation of animal food consumption and an increased ratio of vegetable/animal food consumption may confer a protective effect.