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Dietary magnesium loss due to cooking

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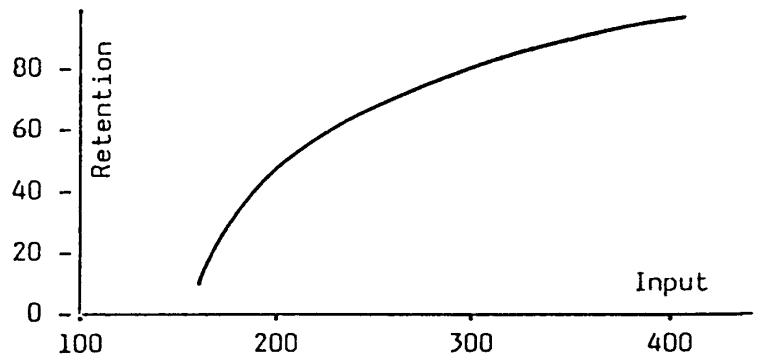
The importance of magnesium in human nutrition has been well established. We have previously reported (1984) that the experimentally supplemented 160 mg or more of daily magnesium showed positive balance in the study of Japanese young woman as Shown in Fig.1. However, the amounts of magnesium which are actually taken from foods often differs from those calculated from raw materials of food stuffs, because some of the eleements in foods would be lost during the cooking process. The purpose of this study is to asses the amount of magnesium loss due to cooking.

Fig.1 Dietary magnesium intake and the retention in adult female



The magnesium in both raw and cooked materials was analysed in this study. Since the cooking processes will vary in each case, we have assumed the following elementary processes which are typically used in Japan : 1) Broiling and boiling of fish 2) Soaking and boiling of vegetables. In the experiment of fish, several pieces of about 100 grams of meat were broiled. The half sizes of the same fish were boiled for 10 minutes. The vegetables were cut in different shapes and sizes according to the menues. They were soaked for 5 minutes. Another group of vegetables was boiled for 1 minute. Deionised water was used in each process. Tap water also used to compare the results with deionized water. Salted water or vinegered water was used ocassionally in the soaking and/or boiling processes. The samples which were cooked and uncooked were all homogenized and the aliquots were digested by heating with pure concentrated nitric acid. The magnesium level was determined atomic absorption spectrometrically.

The results are shown in the tables. The reduction rate of magnesium varied in each sample, much more in the broiling when compared to boiling process. Though a consistent rate throughout the kinds of fishes was not found, it was observed that about 8.3 % of magnesium in fish was lost by the broiling process and 21 % by boiling process (Table 1). The average reduction rate of magnesium in vegetables when they were soaked in deionised water was 10 % (Table 2). The reduction rates

varied, but the degree of reduction seemed to depend on the cut, shape and size rather than the kind of vegetables. Perhaps a cutting manner, such as to make the sectional area wider and expose the cross section of pholem or xylem of plant would make the interchange of water and water soluble substances easier between inner and outer sides of plant. For instance, an oblique cut to the axis will result in a greater loss of minerals to the vegetables than the perpendicular cut. The soaking process is often used in Japan to remove lye in some vegetables such as "edible burdock" or "East Indian lotus root". When salted water(1.5%) was used for soaking apples instead of deionised water, the reduction rate increased from 3 % to 12%, and from 15 % to 24 % according to the shape of the cut. No markable difference in reduction rates was found between deionised water and tap water which has slightly higher osmotic pressure. The reduction rates of magnesium in vegetables by boiling in deionised water was about 29 % (Table 3), which were larger than that by soaking. when salted water was used for the boiling of beans(immature), the reduction rate was incresed to 11 %, while 2 % by deionised water. The reduction by boiling in both fishes and vegetables will increase if boiling time is extended.

The loss of magnesium in foods due to the dissolution in water during cooking processes was examined. It was concluded that the percentage loss can be considered significant enough to warrant an increased dietary allowance of magnesium to ensure the daily requirement is met.

Suzuki,k. and Nishimuta,M.(1984): Magnesium requirement in Japanese young woman. J.Jap. Soc.Magnesium 3, 7-12.

Table 1 Reduction of magnesium in fishes in the processes of broiling and boiling

Samples	Reduction (%) Broiling	Boiling
Flatfish	16	24
Pacific saury	13	27
Horse mackerel	6	15
Spanish mackerel	6	19
Mackerel	3	17
Bluefine tuna	10	25
Yellowtail	4	20
Mean ± SD	8.3 ± 4.9	21 ± 4.4

Table 2 Reduction of magnesium in vegetables in the process of soaking in water (a>b>c : cut size)

Samples	Reduction (%)
Chinese cabbage	9.0
Cabbage	7.0
Celery	15
Onion	19
Welsh onion	9.0
Cucumber	8.6(a, 12(b, 14(c
Eggplant	1
Sweet pepper	18
Apples	3.0(a, 15(b
Edible burdock	1.4(a, 7.0(b, 13(c
Carrot	7.0
Daikon(Japanese radish)	14
Radish	12
Udo	7(b
East Indian lotus root	12(b
Mean ± SD	10 ± 5.1

Table 3 Reduction of magnesium in vegetables in the process of boiling

Samples	Reduction (%)
Chinese cabbage	20
Cabbage	28
Spinach	33
Chingentsuai	31
Komatsuna	44
Garland chrysanthemum	33
Kyona (Pot herb mustard)	40
Mitsuba	27
Water dropwort	35
Broccoli	23
Cauliflower	20
Flower-chester (Rape)	33
Turfed stone leek	18
Chinese chives	31
Carrot	24(a, 29(b
Mean ± SD	29 ± 7.2