Restricting Food Intake of Rodents Increases Life Span and Postpones Age-related Pathology

In 1935 a paper was published in the Journal of Nutrition by Clive McCay and his colleagues showing the life span of rats increased markedly when the food intake of young rats was reduced compared to the food intake of rats with continuous access to food. The figure below shows the survival data of rats who have continuous access to food throughout their lifetime (Group A) and rats whose food intake was restricted to 60% the amount eaten by the Group A rats (Group B). In McCay’s study and the study shown in the figure, restriction of food intake is started early in life and maintained throughout the life of the rats. The effect on life span is stunning: when all the rats in Group A are dead, almost 70% of the Group B rats are alive. If we were to “translate” this rat data into human terms, we could say the lifespan of man could be increased from 100 to 150 years by reducing the calories consumed by 40%.

Figure showing the survival characteristics of male Fischer 344 rats eating ad libitum (Group A) and restricted to 60% of the Group A food intake (Group B).

Should we recommend each person reduce her/his food intake drastically in order to reach the age of 150 years? There are reasons why this is illogical. First, the diet fed the rats is maximized to insure the Group B rats are not malnourished. To reduce our calorie intake by 40% would be difficult, if not impossible, without producing malnutrition. Malnutrition can be devastating during periods of growth when bone and muscle mass are increasing. Second, when we describe the Group A rat as having continuous access to food, we mean precisely that. This would be analogous to someone having continuous access to a fully stocked refrigerator and pantry. Only the most gluttonous of us consumes food as if this were the case. Studies using non-human primates in place of rats are currently in progress and it would be prudent to await the outcome of these studies before recommending
everyone seek to achieve a long life by restricting calories.

If the results of these studies show primates respond to calorie restriction in a manner similar to rodents, strategies to implement this regimen in humans should be devised because calorie restriction produces a spectrum of effects in concert with life extension. Scientists at The University of Texas Health Science Center at San Antonio are responsible for discovering many of these anti-aging actions of food restriction.

Among them are:

- calorie restriction slows the increase in serum cholesterol which occurs with age,
- dietary restriction maintains the youthful responsiveness of target tissues to endocrine regulators,
- recovery from stress becomes prolonged with age and food restriction prevents the lengthening of this recovery,
- calorie restriction prevents the age-related increase in the levels of glucose and insulin in the blood,
- dietary restriction slows the progression of age-related diseases such as renal and heart diseases,
- food restriction delays the onset of leukemia, and
- dietary restriction maintains the integrity of the immune system thereby preventing the rise in the autoimmune disorders that accompany aging.

These seven examples are not an exhaustive list of the benefits of calorie restriction in animal models used in research. The central message is that not only are the lives of calorie-restricted rodents extended, their longer lives are healthier as well.