



## Eating Fewer Calories Linked To Delayed Disease And Longer Life, Animal Study

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US scientists found that when rhesus monkeys were kept on a nutritious but reduced calorie diet for 20 years they led a longer and healthier life with delayed onset of diseases of aging such as cancer, diabetes, cardiovascular disease and brain atrophy.

The study was the work of lead author Ricki J Colman from the Wisconsin National Primate Research Center, University of Wisconsin (UW) in Madison, and colleagues and is published online in the 10 July issue of *Science*.

Previous research on rodents, yeast and roundworms has already shown that these species live longer when they eat fewer calories. But this is the first study to show this effect in primates, and is the closest so far to suggest that the same could be true of humans.

Co-author Richard Weindruch, who leads the National Institute on Aging-funded study and is a professor of medicine in the UW-Madison School of Medicine and Public Health, said the study shows that calorie restriction without malnutrition "can slow the aging process in a primate species" and "reduced the risk of developing an age-related disease by a factor of three and increased survival".

"There is a major effect of caloric restriction in increasing survival if you look at deaths due to the diseases of aging," he explained.

Half of the animals that were allowed to eat unrestricted have survived while 80 per cent of those that ate the same diet but limited to 30 per cent fewer calories, have survived.

For this study, which started in 1989, Colman and colleagues used rhesus macaques and focused on the relationship between diet and aging, by monitoring what they called the "bottom-line indicators of aging: the occurrence of age-associated disease and death".

They started with 30 rhesus macaques and then added 46 more 5 years later. All the animals joined the study when they were between 7 and 14 years old. Half the animals were allowed to eat freely while the other half were fed a calorie restricted diet that limited their calorie intake to 30 per cent less of what they would normally eat.

The researchers also gave the restricted monkeys vitamin and mineral supplements so they did not become malnourished and they treated any animals that fell sick.

At the end of the study 33 monkeys were still alive, the oldest is 29 years old. 20 of the monkeys continue to be on a calorie restricted diet. Rhesus macaques have an average life span of about 27 years in captivity.

The results showed that:

- In terms of overall animal health, the calorie restricted diet led to longer lifespan and improved quality of life in old age.
- Calorie restriction delayed the onset of age-associated pathologies: specifically it reduced the incidence of diabetes, cancer, cardiovascular disease, and brain atrophy.
- Incidence of cancerous tumors and cardiovascular disease in monkeys on a restricted diet was under half that seen in those allowed to eat freely.
- None of the monkeys on the calorie restricted diet developed diabetes, whereas the monkeys allowed to eat freely developed impaired glucose regulation or diabetes at the expected rate.
- Calorie restriction appeared to "preserve the volume of the brain in some regions," said co-author Sterling Johnson, a neuroscientist in the UW-Madison School of Medicine and Public Health.

- In particular, it preserved those regions used in motor control and executive functions, such as working memory and problem solving to be better preserved in the calorie restricted monkeys.

Johnson suggested that calorie restriction may have an effect on reducing the loss of brain cells. He said motor speed and mental speed usually slow down with aging, but these were the areas of the brain that were better preserved in the calorie restricted monkeys. However, he cautioned that:

"We can't yet make the claim that a difference in diet is associated with functional change because those studies are still ongoing."

All they can say is that "there are regional differences in brain mass that appear to be related to diet," said Johnson.

But Weindruch points out that this in itself is a new discovery:

"The atrophy or loss of brain mass known to occur with aging is significantly attenuated in several regions of the brain. That's a completely new observation," he said.

There has been a mixed reaction to the study.

A molecular biologist at the Massachusetts Institute of Technology in Cambridge, Leonard Guarente, who has studied aging in yeast, told *ScienceNOW* that not enough monkeys have died yet to be able to make definitive comparisons between the restricted and non-restricted groups.

"The gap [in survival rates] may separate more, but it's still too early to tell," he said.

However, molecular biologist Matthew Kaeberlein of the University of Washington, Seattle said the difference in survival between the two groups was already compelling. He said the difference in age-related deaths between the two groups is the most important statistic and the fact it is already statistically significant suggests the effect will be even more "robust" by the time they finish the study.

The researchers hope to continue the study for at least another decade.

Weindruch told *ScienceNOW*:

"If we reach the 40-year-old life span, the study could continue for another 15 years."

"That would probably round out my career," he added.

***"Caloric Restriction Delays Disease Onset and Mortality in Rhesus Monkeys."***

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