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Insight into why low calorie diet can extend lifespan -- even if adopted later in life

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New research being presented this week is giving scientists new insight into why a restricted diet can lead to a longer lifespan and reduced incidence of age-related diseases for a wide variety of animals. Scientists have known for some time that a restricted diet can extend the lifespan of certain animals but this work shows how it affects ageing mechanisms - and significantly has also shown that the effects occur even if the restricted diet is adopted later in life.

The work could help scientists to better understand, and ultimately, prevent a range of age-related diseases in humans.

The research is being presented at the conference of the British Society for Research on Ageing (BSRA) in Newcastle. It was conducted by scientists at the BBSRC Centre for Integrated Systems Biology of Ageing and Nutrition (CISBAN) at Newcastle University.

Working with the theory that cell senescence - the point at which a cell can no longer replicate - is a major cause of ageing the researchers set out to investigate what effect a restricted diet had on this process. By looking at mice fed a restricted diet the team found that they had a reduced accumulation of senescent cells in their livers and intestines. Both organs are known to accumulate large numbers of these cells as animals age.

Alongside this the CISBAN scientists also found that the telomeres of the chromosomes of the mice on restricted diets were better maintained

despite their ageing. Telomeres are the protective 'ends' of chromosomes that prevent errors, and therefore diseases, occurring as DNA replicates throughout an organisms lifetime but they are known to become 'eroded' over time.

The adult mice were fed a restricted diet for a short period of time demonstrating that it may not be necessary to follow a very low calorie diet for a lifetime to gain the benefits the scientists found.

Chunfang Wang, the lead researcher on this project at CISBAN, said: "Many people will have heard of the theory that eating a very low calorie diet can help to extend lifespan and there is a lot of evidence that this is true. However, we need a better understanding of what is actually happening in an organism on a restricted diet. Our research, which looked at parts of the body that easily show biological signs of ageing, suggests that a restricted diet can help to reduce the amount of cell senescence occurring and can reduce damage to protective telomeres. In turn this prevents the accumulation of damaging tissue oxidation which would normally lead to age-related disease."

Professor Thomas von Zglinicki, who oversaw the research, said: "It's particularly exciting that our experiments found this effect on age-related senescent cells and loss of telomeres, even when food restriction was applied to animals in later life. We don't yet know if food restriction delays ageing in humans, and maybe we wouldn't want it. But at least we now know that interventions can work if started later. This proof of principle encourages us at CISBAN in our search for interventions that might in the foreseeable future be used to combat frailty in old patients."

CISBAN is one of the six BBSRC Centres for Integrative Systems Biology. The centres represent a more than £40M investment by the Biotechnology and Biological Sciences Research Council (BBSRC) to support the development of systems biology in the UK. The centres are

also supported by the Engineering and Physical Sciences Research Council.

Systems biology uses the study of a whole, interconnected system - a cell, an organism or even an ecosystem - with computer modelling to better make the outputs of biology more useful to scientists, policymakers and industry.

Prof Douglas Kell, BBSRC Chief Executive and keynote speaker at the BSRA Conference, said: "As lifespan continues to extend in the developed world we face the challenge of increasing our 'healthspan', that is the years of our lives when we can expect to be healthy and free from serious or chronic illness. By using a systems biology approach to investigate the fundamental mechanisms that underpin the ageing process the CISBAN scientists are helping to find ways to keep more people living healthy, independent lives for longer."

Provided by Biotechnology and Biological Sciences Research Council