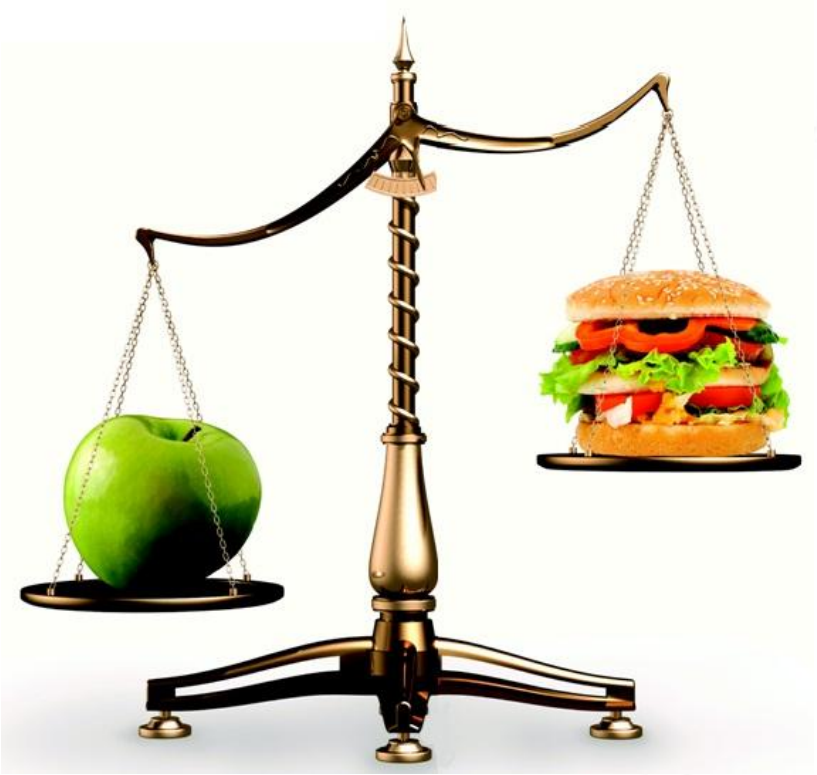
Feature Article

Tipping the Scales – Is a low calorie diet the key to delaying the ageing process?

Low calorie diets have long been considered solely in the context of weight loss programmes but research is suggesting that reducing the number of calories we eat could have an even greater impact on health through its potential to delay ageing process.



Summary of effects of a low calorie diet on ageing

Whilst much of our industry focus centres on what can be done to slow the effects of ageing from the outside, it would be naive to ignore the profound impact that the food we eat has on the body's ageing process. The type of food we consume is frequently discussed in regard to how we age. For example, we know that food containing a high density of antioxidants can counteract free radicals damage to cells. We also understand that anti nutrients such as sugars, refined carbohydrates and fried fats can up regulate the ageing process via a variety of mechanisms.

However, what is not so widely reported is how the quantity of food we eat impacts ageing.

It is claimed that calorie restriction (CR) with optimal nutrition prolongs 'health span' (the number of years an organism can live without any major chronic disease) and is the only known dietary measure capable of extending maximum lifespan.

Research dating back to as early as the 1930s has shown that such a dietary regime can improve health and extend the lifespan of species including worms, spiders, rodents, dogs, cows and monkeys. Even prior to scientific research, philosophical texts dating back approximately 5000 years –including Mundaka Upanishad (spiritual teachings) – suggest that for prolonging life, the stomach should be filled with 1/3 water, 1/3 food and 1/3 empty. Religious celebrations including Easter lent and Ramadan fasting are also based on calorie restriction. Hindu's practice Ekadasi -one day per month of fasting based on the lunar cycle.

In 1934, Mary Crowell and Clive McCay of Cornell University observed that laboratory rats fed a severely reduced calorie diet while maintaining micronutrient levels resulted in life spans of up to twice as long as otherwise expected. Experiments with mice conducted by Roy Walford and his Richard Weindruch in 1986 reported that restricting the calorie intake of laboratory mice not only increased their life span compared to the control group, they also maintained youthful appearances and activity levels longer and showed delays in age-related diseases.

In 2009, 20 years into a long term study conducted on rhesus monkeys by Ricki J. Colman and Richard Weindruch (University of Wisconsin), the researchers stated that the monkeys were showing many beneficial signs of caloric resistriction, including a significantly lower incidence of diabetes, cancer, and heart and brain disease concluding that "These data demonstrate that caloric restriction slows aging in a primate species". As much of the previous research was carried out on species less closely linked to the human race, these are exciting findings as they increase the likelihood of CR being beneficial in slowing ageing in humans.

Even though there has been research on CR for over 70 years the mechanism by which CR works is only starting to be understood and explanations include a variety of biochemical mechanisms.

Two predominant theories surrounding the link between ageing and CR relate to the processes of free radicals and glycation.

The free-radical theory of aging states that organism's age because of the damage caused over time to the body's cells by free radicals. Free radicals are atoms or molecules with a single unpaired electron in their outer shell, making them highly reactive. Generated through a number of mechanisms, they are the body's natural by-product of energy metabolism. When exposed to high amounts of energy, the body's mitochondria do not operate as efficiently and generate more superoxide – a toxic, potent free radical. With CR, energy production is reduced resulting in less free radical generation.

Glycation is the abnormal binding of sugars to proteins which, if excessive, leads to the formation of advanced glycation end products (AGEs), implicated in the progression of age related diseases. A person consuming a calorie restrictive diet will have less body fat and require less energy to support their weight, which in turn means that there is a lesser requirement for glucose in the bloodstream. Less blood glucose means less glycation of adjacent proteins resulting in a decreased production of AGEs.

The Department of Biochemistry, University of California, has reported that CR has a direct effect on protein renewal. Within the body new proteins are constantly formed while damaged proteins are eliminated, but with age, fewer new proteins are created and abnormal proteins are not eliminated quickly enough. CR has the ability to alter this decline, by stimulating the creation of new proteins plus enhancing the effective and quick removal of any damaged ones. It appears to have this effect by modulating the molecules which take part in the formation, repair and elimination of proteins; chaperones.

Hormesis is a term referring to the long term benefits of mild, repeated stress or stimulation. Mild stress such as increased external temperature, mild radiation exposure, or hypergravity, as well as nutritional stress (i.e. CR), have been shown to improve a range of parameters associated with aging. In the case of CR both an inhibition of growth of cancer cells, and a stimulation of growth of healthy cells have been demonstrated.

Calorie restriction also has an impact on genes involved in the ageing process. A study conducted by the Salk Institute for Biological Studies and published in the journal Nature in May 2007 determined that the gene PHA-4 is responsible for the longevity behind calorie restriction in roundworms, "with similar results expected in humans".

Calorie restriction gives rest to the metabolic and endocrine organs balancing the secretions of enzymes and hormones.

Clinical application

As with the clinical application of any protocol, it is essential to consider the specific needs of the individual. Anyone considering a CR regime should do so under the care of an adequately trained clinician to ensure they remain optimally nourished, can manage the potential risks and do not have any contraindications as there are undoubtedly cases where reducing caloric intake would be detrimental to health. One should also be cautious with patients who have eating disorders or obsessive compulsive behaviours towards food.

The question remains, how many calories should one consume if they wish to follow a CR regime? This will depend on the individual and is worked out as a percentage reduction of the total recommended daily calorie intake, calculations for which are as follows:

Standard basal metabolic rate is calculated as follows:

Women: BMR = 655 + (4.35 x weight in pounds) + (4.7 x height in inches) - (4.7 x age in years)
Men: BMR = 66 + (6.23 x weight in pounds) + (12.7 x height in inches) - (6.8 x age in year)

These should be considered crude measurements as they do not take into account factors such as exercise, caloric expenditure from other activities, health conditions or natural variations in metabolic rate between individuals. Using a metabolic VO2 Max machine can give a more accurate reading Once the BMR has been calculated, one can then apply the appropriate percentage reduction, however, what this percentage reduction should be remains unclear.

Research carried out has reduced calorie intake of various species by between 30-70% less the amount of food taken when there is no restriction. Most sources recommended that when applied to humans, a CR diet should aim to reduce intake of calories to a level 20 – 60% lower than is typical, depending on the individual, while still obtaining all the necessary nutrients. This should be done on a gradual basis over a period of time to allow the body to adapt to changes.

Where should those calories come from?

In reducing the volume of food consumed, one will also be reducing their intake of vitamins, minerals and essential fats, vital for maintaining health. It is therefore essential that food consumed under a CR regime should be as nutrient dense as possible. Some basic guidelines to consider:

- Eat a wide variety of vegetables of different colours which provide a broad spectrum of nutrients. Vegetables tend to contain the highest density of nutrients for their calorie content.
- Carefully select fat sources- opt for monounsaturated and polyunsaturated fats, avoid saturated and Trans fats, and consume adequate Omega-3 fats.
- Ensure adequate low fat lean protein is consumed.
- Avoid anti nutrient foods such as simple sugars, refined carbohydrates and fried foods.

Supplementation

Our diets have become increasingly nutrient devoid over the years due to a number of factors. Intensive farming, higher consumption of refined, processed food and the higher demand for nutrients created by factors such as stress, alcohol consumption and pollution (xenoestrogens interference with absorption of micronutritients) mean that many people are often nutritionally deficient even before they embark on a restrictive dietary regime.

Nutrient deficiencies can compromise countless metabolic processes, not least the production of energy. At the very least, someone on a CR diet should be supplementing a high strength multivitamin and mineral. As fat is naturally high in calories it is likely that a CR diet will be low in the essential fats, Omega 3 and Omega 6 and therefore these should also be supplemented in the appropriate ratios. In addition, one could consider use of a product to help control appetite and cravings. Full Fast is a clinically proven appetite control spray rich in Hydroxytonin Complex providing the amino acid 5-HTP – a nutrient essential to the production of serotonin.

Whilst research strongly links calorie restriction to a decrease in the ageing process, most people are unlikely to undertake such a regime long term and consuming optimal calorie intake to maintain healthy body weight is a more realistic target for many.

Research is being carried out into CR mimetics – drugs and supplements which induce similar effects to CR, without the compromise of reducing food intake, however no drug or supplements could substitute such a regime.

It will be interesting to note over the coming years, further studies on human subjects regarding the extent to which calorie intake impacts ageing as well as the development of practical dietary strategies which could provide ways to effectively incorporate such a regime into our daily lives.

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Kim is a qualified Nutritionist and has worked in the field of health, nutrition and food for over ten years.

She works with the national press providing articles and professional opinions to female glossy magazines, sport and health titles and national papers. She is the resident diet expert for TV show MyFaceMyBody. Kim works with a range of individuals, including celebrities and Olympic athletes, as well as corporate organisations and academic institutes to educate on the importance of nutrition in health, wellbeing and beauty. Her areas of speciality are weight loss, skin and anti-ageing.

Kim loves food and cooking and believes healthy eating should be simple, practical and tasty, as well as improving health and looks.

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