



**WN** *Here I stand*

## **What they believe: 22. Ancel Keys** **The man who knew it all, *and other stories***



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*Rio de Janeiro, Juiz de Fora.* In my 'What they believe' series I appraise Ancel Keys, who since the 1940s has in various ways been the most influential nutrition scientist in the world. Then I commemorate Sidney Mintz, whose masterpiece *Sweetness and Power* shows that the triangular trade including slaves and sugar was the driving force of the Industrial Revolution. Then I say that Jean-Baptiste Lamarck was right all along when he claimed that evolution is driven at least in part by inheritance of acquired characteristics, not just by random mutation as Darwinists claim.

Those of you who work out in a gym will know the spiral above as the trademark of Nautilus, the ingenious machines that enable you to pep up all your bits in sequence and severity. Yes, I am working out, and also am working out the significance of physical activity, because I think most of the experts are wrong.



**WN Nutritionists**

## What they believe: 22. Ancel Keys The man who knew it all



*The US physiologist Ancel Keys (of the penetrating gaze, and on the cover of Time magazine) has proved to be uniquely influential. After sustaining the US army and studying the impact of starvation (top row) he insisted that saturated fat is a main cause of coronary heart disease, and promoted the 'Mediterranean diet'. Much of his work has turned out to be flawed, unhelpful, misleading, or wrong.*

The US physiologist Ancel Keys (1904-2004) is a titan of modern nutrition. He has had a greater impact on the nature and quality of US food systems and supplies, and therefore those of most countries, than any nutrition scientist in the post-vitamin era. Supremely self-confident and assertive, his ideas in areas that interested him came to shape dietary guidelines and industry strategies, and still do.

Most ambitious scholars climb to the top of their profession by being in the right place at the right time, or with one great sustained achievement. Ancel Keys, a phenomenal controller of collaborators, scored four triumphs. One was invention of the K (maybe for Keys) rations that sustained US soldiers in World War 2 and boosted production of ultra-processed products. Two was the mammoth 'Starvation Experiment' which should have proved that dieting makes you fat. Three was his relentless insistence that saturated fat is the leading dietary cause of coronary heart disease, which put him on the cover of *Time* magazine and became the 'consensus position' for half a century until its recent disintegration. Four was his discovery – or invention – of the unique protective properties of the 'Mediterranean diet'. Like some other celebrated scientists, his reputation rests on claims that became adopted scientifically, officially and commercially, which have turned out to be flawed, unhelpful, misleading, or wrong.

### ***One. Brand K***

Ancel Keys was energetic, zealous and persuasive. In his later 30s he got lucky. In 1940 he was called by Colonel Rohland Isker of the US Army Quartermaster Subsistence Laboratory, who asked him to devise 'combat meals' to be carried in a pack or pocket. Trained in political science, economics, zoology, biostatistics and physiology, this was all new to him. But necessity drives invention. With Col Isker, and support from the Wrigley gum company, he devised a diet from hard tack, dry sausage, candy and chocolate from Witt's, a Minneapolis grocery store, packing them into plastic Cracker Jacks boxes. This was adapted by the army as 'K' rations for GIs in battle.

Supplemented with packets of salt, sugar, coffee powder, gum, cigarettes and matches, plus free soda supplied by Coca-Cola, this combination of dry mostly very energy-dense products, delivering 3,200 kilocalories a day, was just the stuff to give the troops. In 1944 wartime, annual production was up to 105 million rations. This explains the cry of urchins in Europe, 'got any gum, chum?' US soldiers became accustomed to consuming packaged products. Food science and technology accelerated, shaping the US and then the global industrial food system. The legend – maybe correct – is that K stood for Keys. Aged 40 he was branded as a man who had helped to win the war.

### ***Two. The Starvation Experiment***

In 1944 Keys decided to mastermind study of the impact of food shortage, hunger and famine, then threatening or afflicting hundreds of millions of people. Opportunities for research were boundless. He masterminded a big team to undertake what became known as the Starvation Experiment, with 36 young conscientious objectors as subjects, carried out in 1944-1946. Funding came from famine relief organisations, the Sugar Research Foundation and the Dairy Council, and other sources. The findings were published in 1950 as a two-volume 1385 page *Biology of Human Starvation*. My good friend Claus Leitzmann sent a copy to me from the University of Giessen library, I read it as I researched the new edition of my book *Dieting Makes You Fat*, published in 2008, and it is on my desk here now.

The experiment lasted six months. It had an unexpected result. After the men were no longer underfed and told they could eat as much as they liked, they gorged compulsively. After 20 weeks their weight was 5 per cent more than before the semi-starvation regime, and they were 50 per cent fatter. Over a year later they were still 2 per cent heavier and 5 per cent fatter. This finding seemed very important to me. It still does. But Ancel Keys had no special interest in obesity, let alone its causes.

*The Biology of Human Starvation* is a stupendous monograph. Very well written, it elaborates the physiological description and medical diagnosis of starvation. It is not concerned with the care and treatment of people who are starving, or with prevention of starvation. The fact that it was published too late to help organisations dedicated to postwar starvation and famine relief was immaterial. This was not its purpose. The experiment was elegant pure science. It was not followed up long-term. Ancel Keys moved on, as mastermind in a new type of war.

### Box 1

## A celebration of Ancel Keys

*This is an edited version of an uncritical account of Ancel Keys, found on the internet, with additions from his Wikipedia entry.*

Ancel Keys (1904-2004) was born in Colorado Springs. He had many jobs to support himself before becoming a renowned physiologist. As a boy he worked in a lumber camp for a while, and then shovelled bat guano in an Arizona cave. He served as a powder monkey in a Colorado gold mine and later as a clerk in a Woolworth store. In 1939 he married Margaret, a biochemist, and they would go on to work together studying physiology and nutrition.

Keys' initial work led him to study how the human body reacts to starvation. He had also been performing blood tests on himself in the Andes Mountains to see how the body reacts to high altitudes. The War Department heard about his work and in 1941 asked him to develop pocket-size food rations for Second World War paratroopers. This led to the legendary K rations (K for Keys) given to hundreds of thousands of American troops. The initial ingredients were procured at a Minneapolis grocery store – hard biscuits, dry sausage, hard candy, and chocolate. There were many complaints from the soldiers about the small nutrition-packed meals. But some others were thankful, like the 25 men who survived for ten days in a half-submerged transport plane with nothing but K rations and a gallon of water.

Later in the war, Keys and his colleagues at the University of Minnesota recognised the need to treat starvation safely, because simple overfeeding would be risky. In 1944 he devised and controlled his 'Starvation Experiment', with 36 conscientious objectors to war as test subjects. They were given a strictly supervised low-energy diet, obliged to become very physically active, and were measured as they became emaciated. The results were not collected and analysed until after the war. They were circulated to relief organisations in Europe and published in 1950 as the 1,385 page *Biology of Human Starvation*.

### *The saturated fat doctrine*

In 1956 Keys began what was then the biggest epidemiological initiative of its type. This was the *Seven Countries Study*. It followed 12,763 healthy middle-aged men living in Italy, Greece (Corfu and Crete), Yugoslavia, the Netherlands, Finland, Japan and the US. One striking finding was that in Finland and the US, where consumption of animal fats was then very high, the rates of heart attacks were far higher than in other places – most notably Crete, where consumption of fat from olive oil was measured as very high, but of saturated fat was low.

This and other findings led Keys to confirm his hypothesis that saturated fats are the main dietary cause of heart attacks. Following this he made it his mission to encourage people to eat less saturated fat, mostly from foods of animal origin such as meat, milk, butter and cheese, in order to protect against heart disease. For this and similar work he was featured on the cover of *Time* magazine in 1961. Since then, over 800,000 lives have been saved following his advice. He once said 'There's a little hotel in Brussels that I stop at now and then, and every time I go in there the *maitre d'* says, 'Ah, Monsieur Cholesterol!'

Positively, Keys determined that a traditional Mediterranean diet, which he identified as high in olive oil, pasta, bread, fruits and vegetables, protects against heart disease. In 1975 he and his wife Margaret moved permanently to Pioppi, a village in southern Italy near Naples, and he died in 2004 aged 100.

### ***Three. Saturated facts***

In 1955 Ancel Keys got lucky again. He had become intrigued by a new phenomenon – the number of middle-aged US men who were dropping dead from heart attacks. He guessed that the dietary reason was fat. He pioneered international epidemiological studies involving description and intervention, directing collaborators in Italy, Spain, South Africa and Japan as well as the US. These confirmed that high rates of heart disease and of dietary fat correlated, and *vice versa*. This was the start of his ‘Lipid Hypothesis’. As developed later, this identifies raised blood cholesterol, together with smoking and raised blood pressure, as the crucial ‘risk factors’ for heart disease.

He got lucky because in 1955 the then US president, war hero Dwight (Ike) Eisenhower (in office 1953-1961), suffered the first of a series of heart attacks. Paul Dudley White (1886-1973), the leading US cardiologist, then became appointed a personal physician of the president. White was a friend of Keys. They both enjoyed vacations in southern Italy, and had seen for themselves that rates of heart disease and of fat consumption were very low in the northern Mediterranean region.

Keys decided that he would fix the problem of heart disease in the US and worldwide. The Ike Factor secured him unprecedented human, material and financial support for what became the Seven Countries Study. It formally began in 1958 after pilot studies in various countries. It was initially funded with an unprecedented \$US 2 million over ten years from the US Public Health Service, with extra support from the US National Heart, Lung and Blood Institute, the American Heart Association, and many other sources in all the countries studied.

This was the beginning of Big Epidemiology. Keys tested his fat hypothesis on what became a total of 12,763 rural active middle-aged men in the US, Finland, Italy, the Netherlands, Greece, Yugoslavia and Japan. At that time these were big numbers.

This initial idea failed. The total fat hypothesis was contradicted. What jumped out of the data as compiled and interpreted, were correlations between rates of heart disease and consumption not of fat in general, but of saturated fats, a term then little known except to specialists. Another result, based on findings from Crete, was that monounsaturated fats were innocuous. Using food composition tables, the Cretan subjects were recorded as consuming up to 42 per cent of dietary energy from fat, much the same as people in the US where coronary heart disease had become the number one killer, but mostly from olive oil, which is high in monounsaturated fats.

Long before the Study results were first formally published in 1970, Keys made his mind up again and refined his hypothesis, stating categorically that the chief dietary cause of heart disease was saturated fat, as contained in milk, cheese, butter, lard, beef and pork, and in margarines, shortenings and chocolate. In December 1960 he was backed by the American Heart Association, having dominated their dietary guidelines committee, and he stamped on alternative theories, including those that implicated sugar and in general refined carbohydrates. On 13 January 1961 he was nationally famous again, on the cover of *Time* magazine. Saturated fats became demonised.

But the Seven Countries Study is problematic. Ancel Keys set out to ‘prove’ that diets high in fat cause high rates of heart disease. Then he switched and set out to ‘prove’ that the cause is diets high in saturated fats. But failing overwhelming contradictory evidence, ‘you find what you look for’. A trouble with all big studies, especially those conducted in official and media spotlights, is that the funders, the investigators and the public expect definite results. Studies with null results do not attract more money.

Keys was a magnet for human, material and financial resources. The colleagues he directed, the public authorities in the seven countries, and the grant-giving organisations, were beguiled by his unswerving self-belief that he was going to come up with the answer to heart disease. Further, and as a consequence, he promoted the careers of scores and eventually hundreds of colleagues who became his followers – or even disciples. By sticking with the lipid hypothesis they eventually became themselves magnets for grants which by the 1980s were totalling hundreds of millions of dollars. Keys and senior colleagues in the US and continental Europe ‘ran the show’. The lipid hypothesis, and the mighty research machine it has generated, started to collapse only after most of Keys’ collaborators became inactive or died.

The Study has many problems. Aspects were crude even by the standards of early nutritional epidemiology. Methods of dietary measurement varied between the cohorts and were often ‘rough and ready’. While Keys exulted over the sheer number of men enrolled in the Study, only 3.9 per cent – 499 of the 12,763 – had their dietary intakes measured and analysed. Also, rates of detectable heart disease were correlated with diets as assessed at the same period of time. But like other chronic conditions, heart disease takes a number of years to develop. A true correlation would have been with diets consumed say between 10 and 20 years previously, when most European countries including much of the Netherlands, Italy and Finland, and throughout Yugoslavia and Greece, suffered from food shortage and often extreme deprivation. Plus, no attention was paid to industrial *trans*-fatty acids, whose malign significance, which confounds the whole Study, were unknown at the time.

It gets worse. The branch of the Study conducted in Crete, with results apparently showing the benefits of olive oil as a large part of a generally fatty diet, is the cornerstone of the ‘Mediterranean diet’ hypothesis. It is extremely problematic. Of the 686 men in the cohort, between 30 and 33 had their diets assessed, on three occasions. Any assessment carried out say 15 years previously, when Crete was devastated by the impact of war, would have identified frugal diets, low in dietary energy and in fats and sugar. Further, the original Cretan records were lost and so cannot be reexamined.

That is not all! The results failed to allow for fasting, which following a report in 2003 I pointed out in 2004. The Cretan peasants studied were practicing followers of the Greek Orthodox religion, which requires fasting not merely for Lent but for 200 days a year, on low-energy diets high in vegetables, legumes and fruits, and low in – olive oil. But astonishingly, the Study did not separate results from unrestricted periods from fasting periods, during which times the overall consumption of fat and of olive oil and therefore monounsaturated fat in Crete was not high. Why this omission?



## Box 2

### Books by and about Ancel Keys

Most of Ancel Keys' work is published in scientific journals or as monographs. Books and reports that list him as author were never written by him alone. They include *The Biology of Human Starvation* (co-authors Josef Brozek, Austin Herschel, and many collaborators) 1950. *Eat Well and Stay Well* (with Margaret Keys), 1959. *Coronary Heart Disease in Seven Countries* (editor), 1970. *The Benevolent Bean* (with Margaret Keys), 1972. *Eat Well and Stay Well the Mediterranean Way* (with Margaret Keys), 1975. *Seven Countries. A Multivariate Analysis of Death and Coronary Heart Disease* (with Christos Aravenis, Henry Blackburn, Ratko Buzina and many others) 1980. *Lessons for Science from the Seven Countries Study* (with Henry Blackburn and many others) 1994. By other authors. *The Great Starvation Experiment: Ancel Keys and the Men Who Starved for Science* (Todd Tucker, 2007). *Genius and Partnership. Ancel and Margaret Keys and the Discovery of the Mediterranean Diet* (Joseph Dixon, 2015).

The 1983 report was from Crete's leading nutrition scientist Anthony Kafatos, and I corresponded with him. His published letter in reply states

It still remains unknown whether the results of the Seven Countries Study in Crete, which have been very widely cited and have crucially influenced dietary guidelines and industrial practices all over the world, were about olive oil in particular, the Mediterranean diet in general – or the beneficial effects of fasting in the sense of regular restriction of certain foods, notably those of animal origin. From our own recent studies, we are sure that the effects on serum lipids and longevity of fasting according to Greek Orthodox Church practices would have been significant, if relative data had been made available in the Seven Countries Study. Geoffrey Cannon was right to propose this.

Ancel Keys' saturated fats doctrine, which until a few years ago was dominant, and still is a basis for dietary guidelines all over the world, may well be a house of cards.

#### **Four. His 'Mediterranean diet'**

'Everybody knows' that the 'Mediterranean diet' is especially healthy, that olive oil is a staple part of that diet, and that olives have been grown in the Mediterranean region for 4,000 years or more. In his 1975 book *Eat Well, Stay Well, the Mediterranean Way*, coauthored by Margaret his wife, written as they prepared to leave the US permanently to live in Pioppi, a village near Salerno in south-western Italy, Keys celebrates his discovery of the Mediterranean diet as uniquely life- and health-preserving.

But there is no one 'Mediterranean diet'. The term as used applies only to the traditional and originally ancient diet of the north and eastern part, where olive trees are abundant, and in particular Greece (including Crete), and southern Italy, France and Iberia. Also, while there are general universal rules for good health – meal-based diets mostly made from a great variety of foods of plant origin, for example – the best specific dietary pattern for any part of the world is that which works best in that specific culture, climate and terrain. The notion that the 'Mediterranean diet' should be 'exported' all over the world is extravagant nonsense.

### Box 3

## A criticism of Ancel Keys

*This is an edited version of a critical account of Ancel Keys's saturated fat hypothesis by John Tierney published in the New York Times in 2007*

In 1988 the US surgeon general, C. Everett Koop, proclaimed ice cream to be a public-health menace right up there with cigarettes. He announced that the American diet was a problem of comparable magnitude, chiefly because of the high-fat foods that were causing coronary heart disease and other deadly ailments. He introduced his report with these words: 'The depth of the science base underlying its findings is even more impressive than that for tobacco and health in 1964'.

This was a ludicrous statement. The notion that fatty foods shorten your life began as a hypothesis based on dubious assumptions and data; when scientists tried to confirm it they failed repeatedly. It may seem bizarre that a surgeon general could go so wrong. After all, wasn't it his job to express the scientific consensus? But that was the problem. Dr. Koop was expressing the consensus.

Unable to keep up with the volume of research, doctors look for guidance from an expert — or at least someone who sounds confident. In the case of fatty foods, that confident voice belonged to Ancel Keys, a prominent diet researcher a half-century ago. He became convinced in the 1950s that Americans were suffering from a new epidemic of heart disease because they were eating more fat than their ancestors.

To bolster his theory, Ancel Keys in 1953 compared diets and heart disease rates in the US Japan and four other countries. Sure enough, more fat correlated with more disease. But critics noted that if he had analysed all 22 countries for which data were available, he would not have found a correlation. The evidence that dietary fat correlates with heart disease 'does not stand up to critical examination', the American Heart Association concluded in 1957. But three years later the AHA changed position — not because of new data, but because Dr Keys and an ally were on the committee issuing the new report. It asserted that 'the best scientific evidence of the time' warranted a lower-fat diet. The AHA report was big news and put Dr Keys on the cover of *Time* magazine, which devoted four pages to the topic. That set the tone for decades of news media coverage.

### *Keys casts a long shadow*

Sceptical scientists were sidelined and the public debate and research agenda became dominated by the fat-is-bad school. Later the National Institutes of Health held a 'consensus conference' that concluded there was 'no doubt' that low-fat diets 'will afford significant protection against coronary heart disease' for every American over the age of 2. But when the theories were tested in clinical trials, the evidence kept turning up negative. The low-fat recommendations, besides being unjustified, may well have been harmful by encouraging people to switch to refined carbohydrates.

Edward Ahrens, a lipids researcher, spoke out against the low-fat consensus. In the late 1970s he was asked at a Senate hearing headed by George McGovern to reconcile his scepticism with a survey showing that the low-fat recommendations were endorsed by 92 percent of 'the world's leading doctors' He replied 'I recognise the disadvantage of being in the minority', but pointed out that most of the doctors in the survey didn't work in this field themselves. 'This is a matter of such enormous social, economic and medical importance that it must be evaluated with our eyes completely open. I would hate to see this issue settled by anything that smacks of a Gallup poll'.



### ***The wise guy***

Nutrition – like other sciences – is not just a dispassionate methodical search for and discovery of facts that accumulate as evidence eventually judged to be ‘the truth’. That’s what many scholars like to think. This is a myth. The reality is much more inclusive and interesting. As Karl Popper states in his *Logic of Scientific Discovery*, in all really original work ideas come first, followed by concepts and principles, then tested against reality, including what is ‘out there’ – situations and circumstances.

Also, scientists are not disinterested. They may think and say that they are, but most important is their situation, passion, ideology and character. The quest of the most ambitious researchers is for the big idea which they then transform into findings they strive to own, either by the momentum of publication, or by recognition by prizes up to the big one – the Nobel. Some secure patent protection and set up businesses.

Further, to rise to the pinnacle of fame and power, nutritionists – and other scientists – typically need zeal, luck, charm, pull and force. Ancel Keys had all these going for him, plus the special luck of war. Wars are always a supreme driver of new technology and catalyst of innovation and initiative. They are usually won by the best supplied and fed forces, and lost by those that run out of food or become severely deficient in specific nutrients. Keys became a dictator, marshalling mind-boggling arrays of data amassed by teams of researchers, designed to prove his points. He knew that ideas come first. He also ‘knew’ that his big ideas were true simply because they were his ideas. In slang language, he was a ‘know-all’ or a ‘wise guy’.

Few great personalities are wholly good or bad. Acts also have unforeseen consequences. Ancel Keys could be judged as follows. K rations sustained the US army but accelerated the technology of ultra-processed products, now wrecking the health of populations throughout the world. The colossal Starvation Experiment never helped people who starve in the real world, and its evidence that low-energy dieting regimes cause the problem they are supposed to solve has never been influential.

His doctrine that saturated fats are the leading cause of coronary heart disease was supported by tendentious and even spurious data, was ignorant of the vast confounding factor of *trans*-fatty acids, minimised evidence against sugar and refined carbohydrates, concentrated its attack on fresh and less processed animal foods, and was – and is – mystifying. The ‘Mediterranean diet’ as he formulated it is also based on rickety data, and is just one example of dietary patterns based on appropriate regional or local foods which take different forms all over the world.

Little of this would matter if Ancel Keys was ‘just another’ nutrition scientist. But he is the Napoleon of nutrition, supreme during his times of triumph, who after his death remains a shaper of official and professional thinking, policies, decisions and actions. Leading policy-makers and scholars believed in his hypotheses because they believed in his doctrines, and in him, as fervently as he did. They still do now, even without knowing much if anything about him. On the whole, I reckon that his impact on world health has been and still is disastrous.