

Ansel Benjamin Keys ([January 26, 1904](#) – [November 20, 2004](#)) was an American scientist who studied the influence of diet on health. In particular, he hypothesised that different kinds of dietary [fat](#) had different effects on health.

He examined the [epidemiology](#) of [cardiovascular disease](#) (CVD) and was responsible for two famous diets: [K-rations](#) formulated as balanced meals for combat soldiers in [World War II](#) and the [Mediterranean Diet](#), which, with his wife Margaret, he popularized. Science, diet, and health were central themes in his professional and private lives.

[\[edit\]](#) **Early life**

Keys attended the [University of California, Berkeley](#), where he received a B.A. in [economics](#) and [political science](#) (1925), an M.S. in [biology](#) (1929), and is a '30 [University of California, San Diego Alumnus](#) receiving a Ph.D. in [oceanography](#) and biology from the [Scripps Institution of Oceanography](#).^[1] He earned a second Ph.D. in [physiology](#) at [Cambridge](#) in 1938. In 1936, he became a professor at the [University of Minnesota](#), where he established the Laboratory of Physiological Hygiene. Keys directed the laboratory from 1939 until his retirement in 1975. After that he moved to Pioppi, a small village of fishermen in southern Italy where he lived until 2003 studying food habits of the locals, leading to the foundation of health evidence for the Mediterranean Diet.

[\[edit\]](#) **Professional**

During World War II, Keys studied [starvation](#) and [sustenance diets](#) using 32 [conscientious objectors](#) from [Civilian Public Service](#) as test subjects in the [Minnesota Starvation Experiment](#), and eventually producing his two-volume *Biology of Human Starvation* (1950).^[2] His interest in diet and CVD was prompted, in part, by seemingly counterintuitive data: American business executives, presumably among the best-fed persons, had high rates of [heart disease](#), while in post-war Europe, CVD rates had decreased sharply in the wake of reduced food supplies. Keys postulated a correlation between [cholesterol](#) levels and CVD and initiated a study of Minnesota businessmen (the first prospective study of CVD),^[3] culminating in what came to be known as the Seven Countries Study.^[4] These studies found strong associations between the CVD rate of a population and average serum cholesterol and per capita intake of saturated fatty acids. Then, as now, critics have rightfully pointed out that this "strong association" becomes weaker when data from other countries are added to the mix and there have been allegations that Keys "cherry picked" the data to support his hypothesis.

From the early 1950s, Keys actively promoted his findings to an increasingly health-conscious public. The resulting "cholesterol controversy" revealed sharp divisions in post-war scientific culture over whether the [statisticians'](#) "strong associations" could provide scientific certainty. In its simplest form, the debate over cholesterol, dietary saturated fat and CVD pitted "interventionists" against those calling for further studies--preferably clinical or laboratory studies. The role of cholesterol in CVD was confirmed in the 1990s, when huge studies with powerful cholesterol-lowering drugs showed definitively that lowering LDL cholesterol indeed reduced the risk of cardiovascular disease. (Law MR, Wald NJ, Rudnicka AR. Quantifying effect of statins on low density lipoprotein cholesterol, ischaemic heart disease, and stroke: systematic review and meta-analysis. *BMJ*. 2003 Jun 28;326(7404):1423. www.bmj.com/cgi/content/full/326/7404/1423). The significance of dietary saturated fat intake for cholesterol and CVD remains an area of heated debate.

However, already in the 1960s Keys was able to convince a sizable part of the US public that replacing saturated by unsaturated fat would reduce blood cholesterol and the incidence of coronary heart disease. The resulting changes in the composition of food fats led to a doubling of the proportion of the unsaturated fatty acid, linoleic acid, in the body fat of Americans between 1960 and 1975 (Katan MB, Beynen AC. Linoleic acid consumption and coronary heart disease in U.S.A. and U.K. *Lancet*. 1981 Aug 15;2(8242):371). Rates of coronary heart disease in the US began to fall from 1968 onwards, and about half of the decline was ascribed to changes in lifestyle including diet (Goldman L, Cook EF. The decline in ischemic heart disease mortality rates. An analysis of the comparative effects of medical interventions and changes in lifestyle. *Ann Intern Med*. 1984 Dec;101(6):825-36).

Keys had concluded that saturated fats as found in milk and meat have adverse effects opposite to the beneficial effects of the unsaturated fats found in vegetable oils. These same unsaturated fats and oils are however, found in meats and to a larger extent than Dr. Keys ever gave these foods credit for in any of his work. This message was obscured for a 20-year period starting around 1985, when all dietary fats were considered unhealthy. This was driven largely by the hypothesis that all dietary fats cause obesity and cancer (Prentice RL, Sheppard L. Dietary fat and cancer: consistency of the epidemiologic data, and disease prevention that may follow from a practical reduction in fat consumption. *Cancer Causes Control*. 1990 Jul;1(1):81-97). The tide turned in the late 1990s because the link between fat and cancer could not be substantiated, and because low-fat diets were found to be ineffective against the obesity epidemic which was engulfing the US in spite of reductions fat intake (Katan MB, Grundy SM, Willett WC. Should a low-fat, high-carbohydrate diet be recommended for everyone? Beyond low-fat diets. *N Engl J Med*. 1997 Aug 21;337(8):563-6; discussion 566-7).

With the advent of ever-more powerful cholesterol lowering drugs, high cholesterol has ceased to be a major cause of premature heart disease in affluent countries. Its place has been taken by obesity and the subsequent type 2 diabetes, problems for which the diets developed by Keys offer no solution, though he appreciated the connection between obesity and cardiovascular disease (*Circulation* 1952;5: 115-118).

Keys also popularized the use of the [body mass index](#) (BMI) as a measure of body fat, following a 1972 paper.

Keys was always considered an interventionist. He generally shunned food fads and vigorously promoted the benefits of the "reasonably low-fat diets," he contrasted with "the North American habit for making the stomach the [garbage disposal](#) unit for a long list of harmful foods." [1] Keys' studies and recommendations have had a substantial impact on changes in the U.S. diet ^[citation needed] that may have caused a downward trend in CVD. [2]. Several recent studies have vindicated Keys' thesis that unsaturated oils are more effective at improving markers of CVD than high-carbohydrate low-fat foods. Because of his influence in dietary science, Keys was featured on the cover of the [January 13, 1961](#) issue of [Time magazine](#).

Ancel Keys died on [November 20, 2004](#), two months before his [101st birthday](#). A year earlier, he had left Pioppi, his beloved village in Italy where he had spent 28 years of his life. ^[5]

[edit] References

1. [^] Hoffman W (1979). "[Meet Monsieur Cholesterol](#)". *University of Minnesota Update Winter*. http://www.mbbnet.umn.edu/hoff/hoff_ak.html.

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3. [^] Keys A, Taylor HL, Blackburn H, Brozek J, Anderson JT, Simonson E (01 Sep 1963). "[Coronary heart disease among Minnesota business and professional men followed 15 years](#)". *Circulation* **28** (3): 381–95. [PMID 14059458](#). <http://circ.ahajournals.org/cgi/content/abstract/28/3/381>.
4. [^] Keys, Ancel (1980). *Seven Countries: A Multivariate Analysis of Death and Coronary Heart Disease*. Harvard University Press. [ISBN 0674802373](#).
5. [^] The American Physiological Society (2004). "[Ancel Keys](#)". Press release. http://www.the-aps.org/membership/obituaries/ancel_keys.htm. Retrieved 2007-11-13.

[\[edit\]](#) External links

- Blackburn, Henry. "[Ancel Keys](#)". [University of Minnesota](#). http://mbbnet.umn.edu/firsts/blackburn_h.html. Retrieved 2007-04-15.

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Ancel Keys, Ph.D.

In addition to his role in establishing modern cardiovascular disease (CVD) epidemiology, Ancel Keys (born on January 26, 1904) is closely associated with two famous "diets," one loathed by soldiers and the other beloved by health-conscious and taste-conscious diners. As an advisor to the U.S. Department of Defense during World War II, he formulated balanced meals for combat soldiers that became known as K rations. Later, Keys and his wife, Margaret, popularized the Mediterranean diet with a series of best-selling books. Science, diet, and health have been central themes of his professional and private lives.



Source: University of Minnesota Archives

Keys attended the University of California, Berkeley, where he received a B.A. in economics and political science (1925), an M.S. in biology (1929), and a Ph.D. in oceanography and biology (1930). He earned a second Ph.D. in physiology at Cambridge in 1938. In 1936, he became a professor at the University of Minnesota, where he established the Laboratory of Physiological Hygiene. Keys directed the laboratory from 1939 until his retirement in 1975.

During World War II, Keys studied starvation and subsistence diets, eventually producing his two-volume *Biology of Human Starvation* (1950). His interest in diet and CVD was prompted, in part, by seemingly counterintuitive data: American business executives, presumably among the best-fed persons, had high rates of heart disease, while in post-war Europe, CVD rates had decreased sharply in the wake of reduced food supplies. Keys postulated a correlation between cholesterol levels and CVD and initiated a study of Minnesota businessmen (the first prospective study of CVD) (1), culminating in what came to be known as the Seven Countries Study (2). These studies found strong associations between

the CVD rate of a population and average serum cholesterol and per capita intake of saturated fatty acids.

From the early 1950s, Keys actively promoted his findings to an increasingly health-conscious public. The resulting "cholesterol controversy" revealed sharp divisions in post-war scientific culture over whether the statisticians' "strong associations" could provide scientific certainty. This controversy left greater opportunity for competing food industry groups, health promotion associations, food faddists, physicians, and insurance companies to use the ambiguities and methodologic quibbles inherent in such studies to pursue their own agendas. In its simplest form, the debate over dietary fat and CVD pitted "interventionists" against those calling for further studies--preferably clinical or laboratory studies.

Keys always has been considered an interventionist. He generally has shunned food fads and vigorously promotes the benefits of "reasonably low-fat diets," instead of following "the North American habit for making the stomach the garbage disposal unit for a long list of harmful foods." Keys' studies and recommendations have had a substantial impact on changes in the U.S. diet and the resulting downward trend in CVD.

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Commentary

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Ancel Keys: a tribute

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Abstract

Ancel Keys, Ph.D., who died in November, 2004, at the age of 100, was among the first scientists to recognize that human atherosclerosis is not an inevitable consequence of aging, and that a high-fat diet can be a major risk factor for coronary heart disease. During World War II, he and a group of talented co-workers at the University of Minnesota conducted a large-scale study of experimentally-induced human starvation. The data generated by this study – which was immediately recognized to be a classic – continue to be of inestimable value to nutrition scientists. In his later years, Keys spent more time at his home in Naples, Italy, where he had the opportunity to continue his personal study of the beneficial effects on health and longevity of a Mediterranean diet.

Outline

Ancel Keys, who died in November, 2004, was an excellent testimonial to the health-promoting effects of his beloved Mediterranean diet. He lived to be 100 and, as the *New York Times* obituary put it, "remained intellectually active through his 97th year." His latter years were spent mostly at his home in Naples, Italy. I never had the privilege of knowing him well, but encountered him occasionally at scientific meetings where we were both speakers. He was friendly but, I thought, reserved. What struck me about Ancel was his remarkable absence from the counsels of the nutrition establishment. Despite his acknowledged expertise and importance in the field, he was not a member of AMA's Council on Foods & Nutrition (at least not during the many years I served on that organization). I never saw him at any of the NIH advisory committees on which I served. He did not play a role in the deliberations of the Food and Nutrition Board of the National Research Council. He was not involved in the American Society for Clinical Nutrition during its heyday. Why was this? Perhaps the fact that he was a physiologist (later an epidemiologist) and not a physician played some role. Also, I think he preferred to go his own way, and – to some extent – he remained aloof from "academic nutrition." Yet he was willing to lecture to many audiences and was not considered to be a scientific eccentric; to the contrary, his epidemiological work was frequently cited and praised, and his monumental study of experimentally-induced semistarvation in human subjects [1] was immediately recognized to be a classic.

Keys and his capable associates conducted careful physiological and psychological studies of 32 initially healthy conscientious objectors (to World War II) through 6 months of experimentally induced semistarvation, followed by a year or more of rehabilitation. These studies generated a cornucopia of data – data that are all the more valuable now because such an experiment would not have a chance of being approved by today's Institutional Review Boards. Protein-calorie malnutrition (PCM) – in effect, famine – remains endemic in many parts of the world; moreover, PCM is the most common nutritional problem encountered in U.S. hospitals and nursing homes. The studies carried out by Keys and his co-workers make it possible for us to distinguish the effects of semistarvation on the body's strength, composition, physiological status, and mood from the confounding effects of such underlying diseases as cancer, intestinal malabsorption, renal insufficiency, emphysema, etc. – illnesses that often give rise to conditioned PCM. The Minnesota group showed clearly that semistarvation can be independently responsible for an array of psychological problems such as anxiety, depression, and hypochondria. From their studies, it is possible to demonstrate a clear relationship between a decline in fat-free mass and PCM-associated morbidity.

Keys's major scientific achievements are enumerated in some detail by Jane E. Brody in her *New York Times* obituary, dated November 23, 2004. For those of us who worked for so many years to call attention to the relationship of serum total cholesterol to risk of coronary heart disease (CHD), and to the cholesterol-raising effects of certain saturated fats, Keys will always be one of the major prophets who provided the early evidence that atherosclerosis is not an inevitable concomitant of aging, and that a diet high in saturated fat content can be a major risk factor for CHD. The practical outcome of the work in this field – to which Ancel contributed so much – is the extraordinary decrease in mortality from coronary heart disease that has occurred during the past half-century. Cancer has finally replaced heart disease as America's number one killer. Ancel had his well-deserved reward – a long, productive life unencumbered by an excess of committee meetings, and the opportunity to contemplate the Tyrrhenian sea while enjoying the benefits of a Mediterranean diet.

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