

Photograph of Unfortunates in the Famine Districts of India who Have Died of Starvation.



How It Feels to Starve to Death

What Science Knows About the Pains and Processes of Slow Starvation as the Human Machinery Slows Up and Even the Bones and Eye-Balls Shrink in Size Until Death Supervenes

Fitzgerald, the first of the Irish hunger strikers to die, lived 68 days without food. In this period he would normally have eaten 211 pounds and 10 ounces of food, which would be over one-third more than his own normal weight.

By Arthur C. Jacobson, M. D., Associate Editor of The Medical Times.

THE hunger strike of the prisoners in the jails in Ireland has attracted world-wide attention to a subject which has always been of interest to the medical profession: How long can a healthy human being live without food?

Unfortunately, from the very nature of the matter, physicians have not had as much opportunity to study this subject as might be supposed. Many have starved to death after shipwreck, or earthquake, or coal mine disaster, or snow burial, or in the wilderness or Arctic region, but medical men, as a rule, have not been present to make observations, and, furthermore, in almost every instance a certain amount of some kind of nourishment has usually been taken until near the end.

Observations of what is popularly known as "starvation" in the course of diseases of one kind or another have, of course, been common enough, but medical men have had little opportunity to study healthy human beings who have persistently refused to take nourishment until death finally occurred, and it is unfortunate that in the present instance of the Irish hunger strikers the conditions have not been ideal for exact scientific observation. Still, considerable data of importance will doubtless accrue from these cases, and there is a good deal already known to the medical world in regard to the effects of voluntary starvation.

The popular belief, for instance, that a plump, well-nourished person, all things being equal, will "last longer" than one who has no considerable fat deposits, is true. The human body, in a sense, does feed itself for a time on its reserves of tissue when the normal food supply is cut off. Thus of two people of equal height, age and normal functional activity, one who weighs 200 pounds would probably live longer in a starvation contest than the one who weighs 100 pounds.

Our weight does not vary much in health, for the expenditure of the body precisely balances its income. A physiological equilibrium is maintained.

When an animal is starved the tissues themselves are consumed. The extent of this consumption differs very widely in the different organs. The heart, for example, loses very little in weight at first, while the other muscles lose relatively more throughout, though at a generally slow rate. The fat and glycogen (animal starch) completely disappear. The organs in which functional activity is most intense, such as the central nervous system, preserve themselves best, while the organs in which functional activity is less intense waste away.

The preservation of the working tissues is thought to be brought about by the disintegration of the other less active tissues. The products of this disintegrative process pass into solution in the blood, are carried to the master tissues, and there used. For example, certain facts which have been observed in the course of various studies of the metabolism (chemical tissue changes) of fasting subjects justify the inference that some of the carbon of the disintegrated muscles is actually reutilized in the form of glycogen, which is a great source of energy in the human body.

During starvation the loss of different tissues, before death occurs, averages 40 per cent of their weight. Those tissues which lose more than 40 per cent are: Fat, 93.3; blood, 75; spleen, 71.4; pancreas, 64.1; liver, 52; intestines, 42.4; muscle, 42.3. Those which lose less than 40 per cent are: The muscular coat of the stomach, 39.7; pharynx and esophagus, 34.2; skin, 33.3; kidneys, 31.9; respiratory apparatus, 22.3; bones, 16.7; eyes, 10; nervous system, 1.9.

The fat entirely disappears, with the exception of a small quantity which remains in the eye sockets and around the kidneys. The blood diminishes in volume and loses its nutritive properties. The muscles undergo a marked diminution in volume and become soft and flabby. The nervous system is the last to suffer, not more than two per cent disappearing before death occurs.

The appearances presented by the body after death from starvation are those of anemia and great emaciation, almost total absence of fat, bloodlessness, a diminution in the volume of the organs, and an empty condition of the stomach and intestines, the coats of which are thin and transparent. There is a marked disposition of the body to undergo decomposition, giving rise to a very fetid odor.

The duration of life after a complete deprivation of food usually varies from eight to thirteen days, though life can be maintained for a very long time if a quantity of water be obtained. The water is more essential under these circumstances than the solid matters which can be supplied to the organism itself.

Berard has reported life sustained in a French convict, on water alone, for 63 days.

The phenomena which characterize starvation are as follows: hunger, intense thirst, uneasiness and pain in the stomach and intestines, muscle weakness and emaciation, a diminution in the quantity of carbon dioxide exhaled (showing that the body tissues tend to become acid), a lessening of the activity of the kidneys, a diminution in the volume of the blood, an exhalation of a fetid odor from the body, vertigo, stupor, delirium, and at times convulsions, a fall of bodily temperature, and, finally, death from exhaustion.

The heart does not suffer during the first part of a fast nearly so much as the other muscles, but after a certain point is reached in a very protracted fast the heart muscle begins to show marked changes. Nothing injures the heart muscle more than prolonged starvation. During the later stages of a long fast the heart steadily diminishes in size and is pale and soft. Its surfaces are anemic and flabby. In the well known series of Berlin observations on fasters the investigators emphasized the harmful effects of starvation upon the heart. They noted a loss of tone in the blood vessels, producing diastolic, or a doubled pulse



Lord Mayor MacSwiney, Who Died on the 74th Day of His Hunger Strike

If Mrs. Vernon Castle, Weighing Perhaps About 100 Pounds, and Lillian Russell, Weighing Something Less Than 200 Pounds, Should Be Compelled to Entirely Stop Taking Food, Science Would Expect Lillian Russell to Outlast Mrs. Castle Because the Vital Organs and Blood Are Able to Feed

Upon the Fleshy Reserves of the Human Body Until They Are Exhausted.

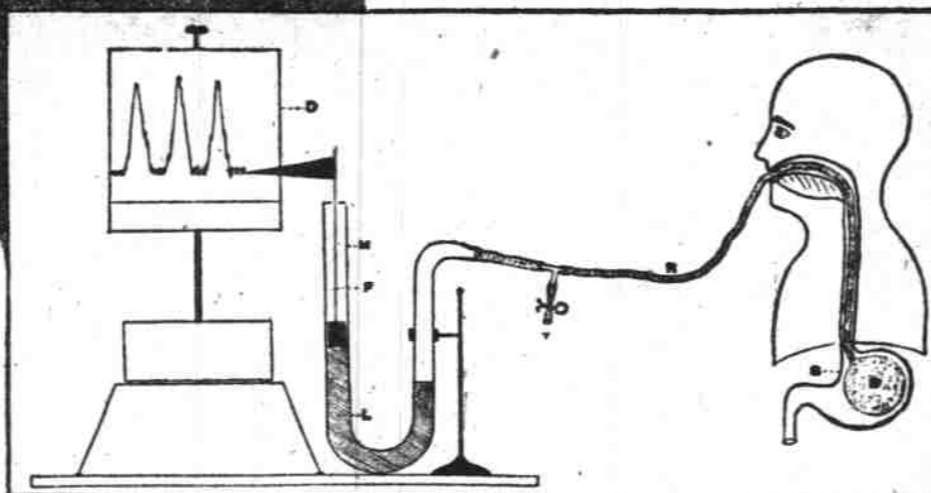


Diagram Showing Method of Recording Gastric Hunger Contractions of the Empty Stomach of Normal Persons; B, Rubber Balloon in Stomach; D, Kymograph; F, Cork Float With Recording Flag; M, Manometer; L, Manometer Float (Bromoforn, Chloroform or Water); T, Rubber Tube Connecting Balloon With Manometer; S, Stomach; T, Side Tube for Inflation of Stomach Balloon. —From "The Control of Hunger in Health and Disease," by Professor Carlson.

beat. This increased as the fast progressed, and in one subject on the tenth day the pulse was so weak that satisfactory observations could not be made.

Francis G. Benedict, in the course of his recent study of a man who fasted under his observation for thirty-one days at the Nutrition Laboratory of the Carnegie Institution, found that the blood pressure when the subject was lying down was invariably somewhat higher than when the subject was in a sitting posture, with a general tendency for the difference between the two to become greater as the fast progressed. In other words, the slight exertion of sitting weakened the heart measurably, a certain sign of cardiac exhaustion. On the eleventh day the heart sounds became less distinct and a murmur was heard all over the area corresponding to the heart. This murmur disappeared after the fifteenth day, but the sounds remained distinct throughout the fast, and after the twenty-fifth day the first sound of the heart (which is an index of its muscular tone) was indistinct.

As fasting proceeds the contractility of the heart muscles, as well as the general tone of the peripheral vessels, decreases. The acid poisoning incidental to starvation probably plays a part in depressing the heart muscle, aside from the failure of nutrition. "The human tissues," says a distinguished authority, "in general require, as a constant condition of their life, that they be bathed in an alkaline fluid. This requirement would seem to be an inheritance from the primordial era when our remotest ancestors began life in the ocean. Acidosis constitutes as universal and constant a chemical menace to the life of our tissues as bacteria do a biologic one."

In regard to the loss of body heat, a very noticeable difference in the heat production occurs from day to day in a case of starvation. This would naturally be expected, since the individual grows smaller every day, and it is known that a small animal will give off less heat than a larger one. Therefore as the fast progresses less heat is apparently lost, but allowance must be made for body weight and volume loss. The pains in the stomach experienced by many fasters are due to the hunger contractions described by Carlson, to the irritation

of acid digestive juices, and, according to Prausnitz, to peculiar psychical conditions occurring in some subjects. During the 30-day fast of Jacques there was no gastric pain, while Merlati, in the course of a 50-day fast, suffered extreme discomfort and pain.

Succi never suffered much during his long fasts. It appears, however, that both Jacques and Succi used opium in small amounts to prevent possibly unpleasant sensations.

Special caution has to be exercised after a long fast in administering food. The ingestion of a large amount of solid food into the stomach after a long period of rest causes serious disturbance. It is best to begin with milk (half a glass at a time) and orange juice. No solid food should be given for several hours. On the second day twice as much will be tolerated, and on the third day three times as much. After the third day the subject can usually consume enormous quantities of food without harm. The stimulus due to the ingestion of food results in an excessive flow of the digestive juices and increased peristalsis (wave-like movements of the intestines which propel their contents). After recovery the subject's original weight is likely to be exceeded.

According to the researches of Professor Sohn, the distinguished British dietician who has figured the necessary daily intake of food to sustain the health and weight of a normal man, Fitzgerald, the first of the Irish hunger strikers to die, would have normally consumed during his 68 days of fast the following amounts of food:

	Pounds.	Ounces.
Milk	17	..
Sugar	4	4
Meat, fish and eggs	68	7
Butter and cheese	4	7
Bread	68	..
Fruits and vegetables	59	8

Total 211 10
Lord Mayor MacSwiney, who expired on the 74th day of his fast, would have normally eaten in that length of time slightly more than 230 pounds of food—over one-half more than his own normal weight.

The danger of using alcohol ought to be obvious when it is remembered that it destroys the structure and composition of the cells of the brain and spinal cord—and it is the long-maintained integrity of the central nervous system that chiefly determines how long the faster shall live. Not until disintegration occurs in the nervous system does the human machinery come to a standstill.

With respect to the length of time that the Irish hunger strikers have fasted, one must take into consideration the skillful nursing that these men have received, and the artificial maintenance of body heat, in judging the validity of their performance—not to mention the conservation of their energy through physical quietude and spiritual contentment. Their suspended animation, maintained over so long a period, recalls the remark of no less an authority than Benedict, to the effect that it remains to be proven that there may not be instances of suspended animation in which man may subsist on his own body substance for a period of months.

When one reads that one of Benedict's subjects, after a fast of 21 days, spoke extemporaneously before a body of physicians for approximately three-quarters of an hour, standing during the whole period and

gesticulating, and that later in the day he actually sang and danced in anticipation of the closing of his long fast, one's credulity need not be unduly strained with respect to the Irish hunger strikers, whose beginning deaths, at this writing, also serve to convince doubters of the genuineness of their sacrifice.

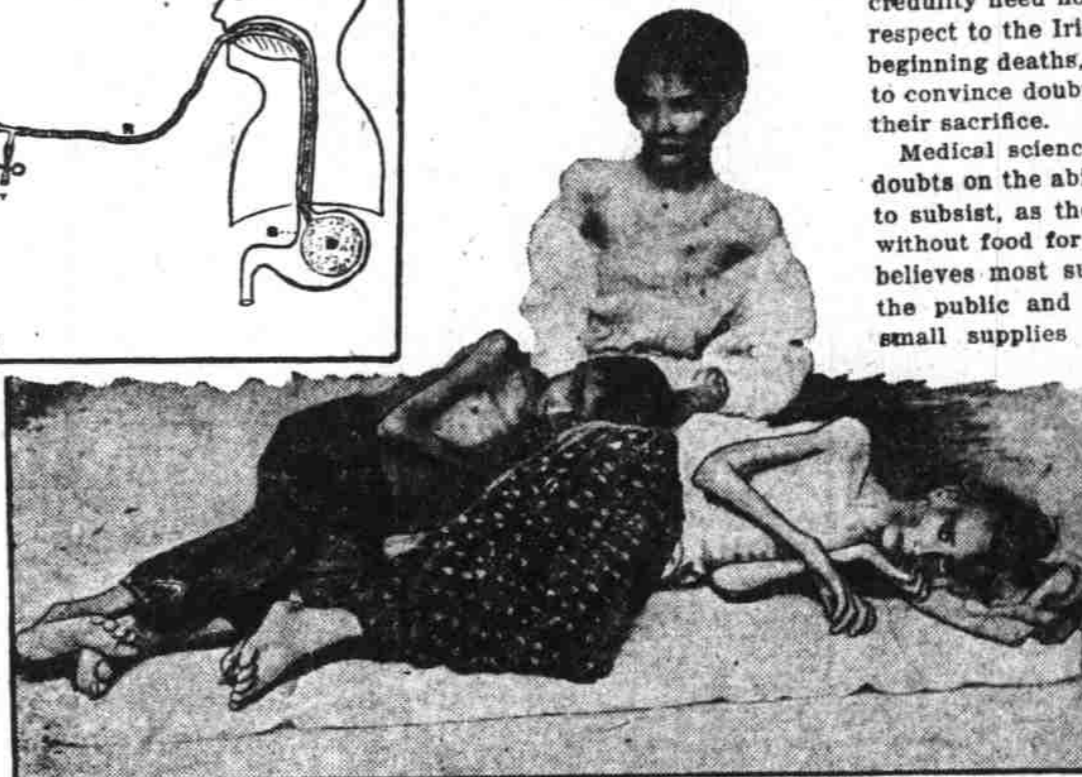
Medical science has always cast serious doubts on the ability of professional fasters to subsist, as they claim they do, entirely without food for frequent long periods. It believes most such persons are deceiving the public and that they probably have small supplies of food administered to them in their drinking water or by other surreptitious means.

"If food and drink," says Professor John D. Comrie, the distinguished English physician, "be entirely suspended two results quickly follow—the body becomes thinner and lighter as it draws upon its stored-up nourishment, and also the temperature gradually falls. If water be taken in large quantities, the process of

using up the fat and muscles in order to maintain the activity of the heart, lungs and other vital organs, proceeds to an extreme extent, and the body grows very much emaciated before death. If water be withheld, death results much sooner, and the sufferings are great. Whether water be taken or not, death results from loss of temperature long before all the available stores of nourishment in the body are used up. If the body be well protected by clothes and blankets the loss of heat is slower, and life is prolonged beyond the time that it lasts if the fasting person be poorly clad or exposed to severe cold, as in the case of Arctic explorers.

"It follows, too, that a person fasting and doing no work can survive very much better than one who is compelled at the same time to put forth great exertions, and so use up more of the bodily store of food. Persons are subjected to the worst combination then when they are not only deprived of food, but have also a poor supply of water, are exposed to severe cold and must make great muscular efforts. "Under the last-named circumstances life could not be prolonged more than two or three days. But in the case of miners imprisoned by a fall of earth or flooding in a mine, and well supplied with water, life and health has been prolonged without food as long as eight days, as in a case at Pontypridd in Wales in 1877.

"Dogs may be kept alive for five or six weeks, and it is known that human beings may also survive for long periods if given water but no food. Science has found that fat is the most suitable food for sustaining life, if the food is to be reduced to a minimum."



A Pathetic Photograph of Starving Armenian Girls Who Were Rescued Before Death Overtook Them.