

Famines of history and of today

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There have been many famines in history, and their causes and effects have been set out many times (Lammert, 1890; Curschmann, 1900; Keys, Brožek, Henschel, Mickelsen & Taylor, 1950; McCance, 1951; Aykroyd, 1974). Within the last 50 years a perpetual risk of malnutrition affecting infants and young children in illiterate, underdeveloped parts of the world has come to light, and a great deal of time, work and thought has been devoted to its treatment, prevention and cure by scientists and doctors from the developed countries (McCance, 1971a). Any scientific discussion of famine must include this widespread and often fatal syndrome.

The causes of famine

1. *Droughts*. These are particularly serious after several years of light rainfall. There have been many of these, from Old Testament times in the Near East, throughout history in India and China, to the one in Ethiopia in 1973 (Aykroyd, 1974; see also Kipling's story called '*William the Conqueror*' (Kipling, 1908)).

2. *Floods*. These are prevalent in certain parts of China and India. The recent one in Bangladesh is a good modern example.

3. *Parasites and pests*. These again date from the years of the minor biblical prophets Amos and Joel to the potato famine in Ireland, 1845–7. In this one the crop was destroyed by *Phytophthora infestans*. It was preceded by a famine which was widespread in Belgium in 1844 and 1845 and was caused by the same fungus. This infestation was studied in Belgium and a sound method for its prevention and arrest was put forward.

4. *Climatic changes*. Good examples are the cold, wet springs in northern latitudes (Curschmann, 1900). They were a constant problem in parts of Britain and were the reason for the Viking civilization dying out in Greenland and nearly doing so in Iceland (Coon, 1939).

5. *Wars*. These led to famines due to the passage and re-passage of armies without any proper commissariat. The '30 Years War' is perhaps the best example of this (Lammert, 1890; Wedgwood, 1949) but Napoleon's advance to, and retreat from, Moscow is a good second. Famine also resulted from sieges of cities and smaller units in which populations were exposed to diseases to which they were not immune. Well-known ones are those of Athens, Jerusalem, Derry and, more recently, Leningrad. Armies suffered for the same reasons. Malaria has beaten many invading forces and the triad of war, pestilence and famine have been associated in men's minds since the writings of Hesiod in 700 BC. The various diseases that increased the misery of the local civilians in the closing stages of the recent tribal fighting in Nigeria are modern reminders of the association. Static

populations may, however, suffer from a severe shortage of food without widespread infectious diseases appearing. Germany and Austria escaped them in the closing years of the recent world wars, and India, although said to be very short of food at the moment, is not being ravaged by epidemic sickness. The converse is also true. The 'Black Death' was not accompanied by any major crop failures in Britain.

6. *Imprisonment.* Localized pockets of famine and disease have existed in civilian prisons for centuries and in the internment and concentration camps for suspects and prisoners of war during the last 100 years.

Apart from those listed above, the causes of infantile malnutrition are essentially the lack of a suitable food for weanling infants, ignorance about how to use one if it were available, and, to some extent, poverty.

Emotional effects of famine

If one is living without responsibility, and well fed, in a country which is in a state of affluence, a famine in India usually makes less appeal to the emotions than a local football match, but impressionable persons, and students in particular, are very apt to be carried away by a desire to help.

One gets quite another impression if one is in a country as an observer where the population has been undernourished for some considerable time, and knows it. The citizens of Wuppertal were in this state when I was working there just after the last war. The children were active and lively although they were considerably under their expected weight and height for age. Individuals stole right and left from allotments, gardens and delivery vans, and food for the family was collected wherever and however it could be: the family constituted the feeding unit. If a visitor called at a meal time the food tended to be concealed before the visitor was ushered in.

The evidence all goes to show that as a famine becomes worse and worse all morale begins to go and it becomes a matter of self first. This has been well documented, for example, in the Chronicle of Novgorod (Michell & Forbes, 1914) and by contemporary records of the Irish famine (Donovan, 1848; see also McCance, 1951).

Physical effects of famine

Adults lose weight if food becomes scarce, and at first the loss is mainly of fat. Children are thin and grow more slowly than on adequate diets. Persistently poor food and a hostile environment reduce adult height and weight (Oppers, 1963; Malcolm, 1970; McCance & Widdowson, 1974).

As food becomes scarce people become hungry and long to eat enough to make themselves feel really full. This desire becomes more intense as time goes on provided a little food is available, and it is astonishing how much food adults and children can and will then eat if they are healthy and are offered it. Rehabilitation at this stage is easy (Widdowson, 1951).

If the food supply continues to deteriorate, people get weak, begin to be less active, feel the cold intensely, tend to adopt a characteristic stooping posture if standing or walking about and ultimately become 'skin and bone'. They may at this

stage begin to suffer from diarrhoea. Although this has been on record certainly since the siege of Athens in 430 BC the cause is not yet clear and may be a multiple one. It is often accompanied by a loss of all self-respect and habits of cleanliness.

The skin usually becomes very pale and may be hyperkeratotic and more rarely a black melanin pigment may be deposited in it, probably the origin of the poetic phrase about the siege and sack of Jerusalem in 587 BC: 'Our skin was black . . . because of the terrible famine' (McCance & Barratt, 1951).

Many of the accounts of famines contain records of oedema in some, but only some, of the sufferers in the terminal stages (McCance, 1951). Since then, discoveries have been made about the causes of oedema largely due to the work on infantile malnutrition, on the renin-angiotensin-aldosterone system and on studies of salt and water metabolism (McCance, 1971a, 1972).

Kampala is a particularly good place for the study of infantile malnutrition for it exists there in two forms each with a rather characteristic age incidence (McCance, 1971a). It is now settled that the marasmic type which affects children mainly around 1 year old is due to a defective energy intake. The trouble is usually neglect, twins or a failure of the mother's milk. Protein is not the outstanding deficiency, the serum chemistry remains essentially normal and there is no oedema (Gopalan, 1968). These children rehabilitate well in the absence of complications (McCance, 1971b; McCance & Widdowson, 1974). The kwashiorkor syndrome, characterized by misery, skin lesions and oedema, appears between 18 months and 3-4 years. It is unquestionably due to a protein deficiency, which is generally believed to arise from the consumption of the plantain banana (*Musa paradisiaca*) as the staple food in that area. A high intake of sugar in very weak tea is, however, also important, particularly if given to an ailing child who is taking little else. Protein deficiency is uncommon in dry regions in the north of Uganda and in most other parts of the world where the staple foods are cereals. In such places, and all over the Middle East, energy deficiencies are the presenting problem in infants and adults (McLaren, 1974). All children round Kampala tend to become anaemic from hookworm (*Ankylostoma duodenale*) and other infestations and may be extremely so. Wharton (1968) discovered that a common cause of death in the early days of treatment was heart failure, accentuated by quite a moderate sodium intake. The increase in the circulating extracellular fluids and in the anaemia, brought about by the renin-angiotensin-aldosterone mechanism, accentuated the right-sided venous congestion and the falling arterial output, and all these together were just too much for the failing heart. This work shows that if cardiac failure can cause death in kwashiorkor, a failing heart should be taken into account as a cause of famine oedema, and possibly one of death.

Since that time Coward, Whitehead and others have shown, partly on baboons (Coward & Whitehead, 1972) and partly by long-term studies on children, that oedema only appears when the oncotic pressure of the plasma has fallen to a certain level. This reduction is due mainly to a large decrease in albumin, counterbalanced to some extent by a rise in the γ -globulins in response to the multiple infections to which these children are subject. To reproduce the whole picture of kwashiorkor, particularly the fatty livers, these authors have also shown

that it is necessary to add a certain amount of cane sugar to the experimental diets of the baboons. This confirms the conclusions reached by McCance (1971a).

Famines are not caused by eating sugar but by insufficient food, and mainly by a deficient intake of energy. Oedema is uncommon in the early stages and we did not find any in the German civilians in Wuppertal except among the elderly (McCance & Widdowson, 1951). In them the serum albumin was not very low and sometimes normal, but in sixteen cases of malnutrition from internment camps and gaols, many of whom were oedematous, some low serum albumins were found without, however, any correlation between the concentration of the albumin and the extent of the oedema (Kekwick, 1951). Extensive wasting, however, among the civilians was always accompanied by an increase in extracellular fluid volume and the fluid altered its distribution with posture so that nocturnal polyuria was common, as in the famines of history, and was sometimes extreme. On the basis of the work on kwashiorkor, moreover, a fall in the albumin and oncotic pressure of the plasma might be predicted in the terminal and preterminal stages of famine, as met with in the field. The worse the famine the more the diet has often tended to degenerate into highly salted vegetable soups. In the terminal stages any oedema must have been encouraged by these, by anaemia if present, and by incipient heart failure. Diarrhoea would have tended to reduce it.

Famine relief

The successes and failures of famine relief are matters of history (McCance, 1951; Aykroyd, 1974). The information the newcomer requires is, first, whether steps can be taken in advance. These were taken in India in the days of the British Raj, and granaries were built and filled when there were surpluses in the areas at risk. Joseph took just the same precautions during the 7 years of plenty in Egypt.

Secondly, the size of the task must be known; for the bigger it is the more difficult it is. This is why India as a whole is in such a dangerous position today, and Peru seems to be in a similar one. According to most authorities the great majority of the population in both countries is short of food, certainly by Western standards. Even if one accepts the recent newspaper reports on India as being journalistic and snide, one has only to ask oneself two questions: (a) who could afford to provide the food required by India unless she could pay for it? and (b) would the food supplied be distributed equally and without profiteering?

Thirdly, one needs to assess the available supplies and transportation, always with reference to the money available, the size of the area and of the population at risk. This is where Aykroyd's (1974) book is so instructive for the beginner. The available roads, canals, railways, ships and, nowadays, aircraft have all to be planned and provided.

Fourthly, the stage of development of the country at risk must be known. Has it an efficient civil service which can take over the distribution of the supplies once they arrive? or must this be done for them from outside?

Fifthly, the particular supplies that are needed, and, particularly for a backward society, the staple food must be known. It is useless importing rice for a wheat-growing society, for they will not know how to cook it even if they have the means

to do so. One may assume in advance that in an area of famine the children and the old people will be suffering most, for they always do. One must remember too that the supply of energy is the presenting problem. 'Protein' foods are only really essential for infants and those *in extremis*, and these should have milk (McLaren, 1974) unless genetically they are lactose-intolerant.

Sixthly, one needs to know whether one can rely on the integrity of the local population. The answer is no; but in some places the risks are greater than others.

Most of the points brought out above were well illustrated by the Irish famine, and it has been written up rather emotionally and certainly somewhat politically several times. The urgency of the crisis was not appreciated at first in England, and then the relief planned consisted of the payment of money in return for work provided for the people to do. This failed. The same method was tried also in India at one time, and failed there also. There was no real civil service in Ireland in 1846, transportation was primitive, the population was illiterate and an epidemic of typhus complicated the issue. One cereal available for relief was maize and the English government made the mistake of importing it. Wheat would have been little better—and it was not the last time this sort of mistake was to be made. The population had subsisted on potatoes with a little milk and vegetables. Mills for the cereals were not ready to hand and the people did not know how to cook the cereals if they had been. When ground maize did arrive it was referred to contemptuously as 'Peel's brimstone'.

Undernutrition in small groups

The loss of all moral sense and the breakdown of human relationships had been only too common in communities in the last stages of undernutrition (Donovan, 1848; Lammert, 1890; Curschmann, 1900; Michell & Forbes, 1914; McCance & Widdowson, 1965). Small groups, however, actuated by a sense of purpose, have often faced severe undernutrition and even complete starvation, shown superb loyalty to each other and emerged triumphant. One has only to read the account of Shackleton's (1909) return journey to base to realize this, and there are many other records (Keys *et al.* 1950).

Fasting has been undertaken voluntarily on innumerable occasions. Some of these have been actuated by financial or political motives and periods of fasting and undernutrition have been made an integral part of many religions, primitive and otherwise. The motive for this is not always clear, even within the Christian religion. Prayer is easy, however: anyone can pray; but fasting is difficult and undernutrition most unpleasant. The constant association of the two suggests that to undertake a period of severe food restriction was proof of the sincerity of one's prayer. There is however more in it than that. Prolonged undernutrition, successfully accomplished, seems to result in the uplift, strength of mind and sense of achievement that we call morale (Père X, 1959).

Fasting, as it was imposed almost fanatically by the Greek church, led to considerable undernutrition and can have done no one any good (Morgulis, 1923), but morale is a man's best contribution to his, or his colleague's, survival. The permission to think, engendered by the reformation, led gradually to the

abandonment of fasting, even during Lent, as a part of religion. The pancakes on Shrove Tuesday and the hot cross buns on Good Friday survive; but how many people realize their significance?

The future

The whole of physics and indeed chemistry have become unpopular subjects with the idealistic, internationally-minded young men and women of today, originally because of the discoveries of the atomic scientists. The atomic bomb may indeed lead to the destruction of biological life as we know it, but the discoveries of the medically minded biologists are doing so just as surely so far as Man is concerned. Anyone who doubts this should read the books by Paddock & Paddock (1968) and Hardin (1969) on the future of the global population and food supplies. The population of the world can be maintained at its present level of subsistence, and is being maintained so, but could it be maintained at a desirable level? And who could afford to pay for the beef and other animal protein recommended for everyone by our Western experts?

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Printed in Great Britain