



## Position paper: Dangerous diets

This January, as is usual after the Christmas celebrations, the paperback best seller list was packed with books on dieting, about which there is little new to be said. Most of these are about how to lose the weight gained in the previous month, and claim to reveal “secrets” hitherto unknown about diets that will make you thinner and/or healthier. In truth there are very few secrets still to be revealed.

Since World War II we have learned a great deal about human nutritional requirements. There was an urgent need to know how to design rations for the civilian population, and to rehabilitate survivors from starvation in prison camps. Intravenous feeding saved the lives of severely wounded people who could not have been fed by mouth. A by-product of this was that we learnt far more precise information about the daily requirements of micronutrients than could be obtained by analysis of oral diets. In 1969 the Department of Health reported on daily requirements of 10 nutrients, by the time they reported in 1991 this had increased to 40 nutrients, but there has been little change since then.

### Lethal diets

If addition of a poison is excluded, the only way in which the diet of a normal adult could be altered so as to cause death in less than a week is to exclude all water. Someone deprived of any non-salty water because they are trapped under debris from an earthquake, or adrift in a lifeboat after a shipwreck, will soon die. How soon depends largely on the temperature and humidity, and hence the rate of evaporative loss of water.

Even if enough water is available total starvation will also inevitably cause death, but after a much longer period. The survival of victims of famine due to drought or warfare is usually threatened by disease as well as hunger, and they may be having small amounts of edible vegetation, so they do not provide reliable information about the lethal effects of starvation alone.

A healthy adult of normal build who takes no nutrients apart from water—such as a hunger striker—will probably die in about 10 weeks. Between 1964 and 1970 there were several reports of severely obese patients who were treated by total starvation for long periods. The longest period recorded is 249 days starvation, during which she lost 64.9 kg. However some people on starvation diets unexpectedly died and at autopsy were found to have severe damage to their heart muscle, so this treatment was abandoned.

The largest reported weight loss (227 kg) was on a low calorie diet (800

kcal/day) and took 2 years as a hospital inpatient [1]. The patient was admitted weighing 310 kg, but an unknown proportion of that was water, since he was initially massively oedematous. Since 1970 it has been accepted that prolonged total starvation is too dangerous, but 800 kcal/day will keep the patient alive and losing weight quite quickly. There is still controversy about how much lower than 800 kcal it is safe to go, since a few patients have died while using very low calorie diets, although there has been insufficient evidence to implicate the diet itself as a cause in these cases. Our research indicates that it is not the prescribed energy intake, but the actual rate of weight loss, that determined the danger. A desirable rate of weight loss in obese patients is 0.5 to 1.0 kg per week.<sup>2</sup>

### Macronutrient imbalance

The dangers of too great a reduction in total energy intake have been considered above, but many commercial diets emphasise alterations in the balance of protein, carbohydrate and fat, from which dietary energy comes. (Alcohol is also a source of dietary energy, but it will not be considered here since the dangers of a high intake of alcohol are well known).

Human beings tolerate very large differences in macronutrient balance. For example vegetarians have a much lower intake of protein and fat than omnivores, but the amount of protein in vegetables is enough to maintain health in adults if total energy intake is adequate. However small children have a higher requirement of protein in relation to body weight because they need extra protein to support growth, and they cannot eat such large quantities of the bulky carbohydrate diet as adults. Hence in chronically undernourished populations the deficiencies show up first in stunted growth of children. Protein supplements are not very effective in improving the health of children who also have an inadequate energy intake: both deficiencies need to be remedied.

The other two macronutrients, carbohydrate and fat, are the main sources of energy. High fat diets (of which the popular “Atkins” plan is an example) have been advocated for weight loss, because if carbohydrate is restricted total energy is almost bound to be restricted also. Very severe reduction of carbohydrate causes ketosis (signalled by an unpleasant smell on the breath), since some carbohydrate is needed for the normal metabolism of fat. There is good evidence that a high fat diet causes a high concentration of lipids in the blood, so if a high-fat diet is used repeatedly or adopted as a long term strategy there is an increased danger of cardiovascular disease and coronary thrombosis.

On the other hand, extreme restriction of fat such as in the most stringent versions of the low-fat diets popular in the 1990's causes reduction in the intake of fat-soluble vitamins A and D and possible deficiencies in these nutrients.

## Micronutrient deficiency or excess

In affluent countries deficiency of vitamins or minerals is very rarely found among people who are having an adequate energy intake from a variety of foods. I have worked in some countries where dietary deficiency of vitamin A, iron, or iodine cause serious illnesses, but I have never seen such cases in the UK. The problems usually arise in adults who are deliberately restricting energy intake in order to lose weight, and are taking inappropriate supplements in order to correct the resulting deficiency of micronutrients. The exceptions to this general statement are old people who are not exposed to sunshine; pregnant women; and adults or children who have metabolic diseases or dietary intolerances.

There is a huge industry that promotes micronutrient supplements on the false premise that if a deficiency of Vitamin X causes ill health then a massive intake must bring extra good health. The reverse is nearer the truth. Especially when the supplement contains a dose of a single micronutrient that could never be encountered in a diet of normal food. For example health food shops offer capsules containing single amino-acids which can never be helpful except in rare metabolic diseases. Aminoacids are the building blocks from which protein is synthesised. A single amino-acid such as leucine or lysine are “essential” amino-acids, so without them protein cannot be synthesised. But a supplement of one of these does more harm than good, because an excess of one amino-acid cannot make protein unless the others are present in the appropriate proportions. The extra aminoacid therefore has to be used to make urea and excreted, resulting in a net loss of protein to the body.

Trace elements such as zinc and copper are required in very small quantities. Transport mechanisms in the gut wall normally absorb the right quantities, but a large supplement of one (for example zinc) may overload the transport system and block the absorption of copper. This can create clinical problems that are very difficult to diagnose. If you do not know about the zinc supplements you have to be quite astute to recognise copper deficiency in a patient who has a normal amount of copper in his diet, but an inadequate absorption of copper caused by an excess intake of zinc.

## Importance of kidney function

This brief review has implied that so long as you eat a reasonable amount of ordinary food you will avoid major problems. However this depends on having kidneys working well so that if you take an excessive amount of fluid, or water-soluble vitamins, the kidneys will excrete the excess in urine. The situation is very different in people with impaired kidney function.

The commonest supplement-related life-threatening situation is when someone with damaged kidneys and legs swollen with fluid is advised to take supplements containing potassium. The concentration of potassium in the blood may then rise to a level at which regulation of the heartbeat is disturbed, and this may cause death.

Attempts to achieve rapid and marked weight loss, or consume inappropriate amounts of dietary supplements, should be discouraged. A safer and more useful approach would be to aim for a smaller but sustained rate of weight loss, and to modify eating habits so as to maintain the desired level of weight achieved.

Position paper prepared by John Garrow and approved by the HealthWatch committee January 2009

### References

- 1) Bortz WM. Am J Med 1969; 47: 325–331.
- 2) Garrow JS. Obesity and related diseases. Churchill Livingstone, Edinburgh, 1988.