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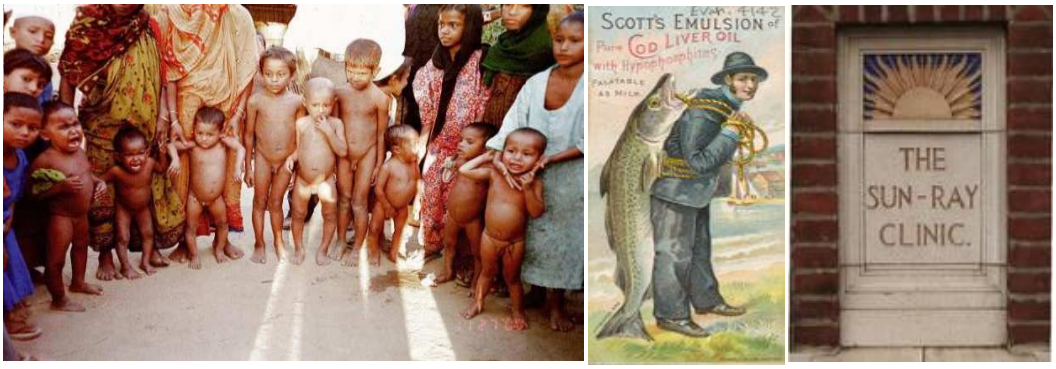
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Editorial

Things may not be what they seem



Bangladeshi children with rickets (left), and prevention and cure for rickets with cod-liver oil or with sun-rays (right). The sun itself is the best remedy

Those of us who have children or grandchildren get asked questions to which we may have no ready answers. Two such questions, 'why are some people pink and other people brown?' and 'why do I go brown when I stay in the sun?' are addressed by Oliver Gillie, in his commentary on vitamin D in this issue. A question certainly asked by children who are old-timers now, when they were growing up during the Second World War, was 'why are you giving me this horrid oil?' – 'this' being cod-

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liver oil (as advertised above, centre), which was one of the first mass-produced dietary supplements (1).

As professionals, we should also be able to answer questions asked at breakfast, as children look at food labels (depending on where you live and what's for breakfast). Such as 'why does milk have vitamin A and D added?' Or 'Why do my KrunchiKrazies and BrontoRocketScrummies have all these vitamins in them?' Or 'What's a vitamin?' Indeed, you could teach a child a history of modern food and nutrition science and technology just by riffing off the nutrition label of a sugary ready-to-eat breakfast cereal packet, or indeed of a tin of fortified post-weaning powder. But then, the child might lose interest after a minute or so and hopefully summon you outside to play. Besides, these aren't the type of products public health nutritionists have in the house, are they.

The 'sunshine vitamin'

A conventional definition of 'vitamin' or 'vitamins' is something like 'essential items needed in the diet', (2) or 'a substance found in food which is essential to human health and life', or else 'constituents of food… of an organic nature … essential for the life and well-being of the animal'(3). However, if these imply that vitamins are found only in food, then 'it is somewhat ironic that vitamin D, through an historical accident, became classified as a vitamin'(4).

There is no doubt that deficiency of the substance known as vitamin D causes rickets in children (such as seen above, left), and osteomalacia in adults. It is also certain that supplementation with oil from the liver of some fish, usually from cod or sometimes halibut (1), in liquid or capsule form, protects against these bone diseases. This is part of the 'classic' story of vitamins A, B, C – and then 'D' – as these substances were identified and tested, more or less a hundred years ago. In the UK Edward Mellanby and in the US Elmer McCollum induced rickets in animals, established that this was not because of deficiency of vitamin A, tried the already well-known cure of cod liver oil, found it worked, and in due course identified the active substance. Thus the practically universal prescription of cod liver oil for children in the US and UK, accelerated by the importance given to good population health during the Second World War. Thus the 'fortification' of margarine with vitamins A and D (5), and also of milk in the US, and, as a larger story, the rise of what is now the colossal vitamin supplement industry and with it, belief in vitamin supplements as essential to the protection of good health.

The irony with 'vitamin D' is that unless diets are supplemented with the oils of cod or other fish or synthetic forms of vitamin D, or else are fortified, they are poor sources of the substance. Indeed, Oliver Gillie is sure that with rare exceptions,

notably Inuit (Eskimo) populations leading traditional lives, diets are deficient in vitamin D, were they to be its only source.

The reason, as we all know, is that some oily fish and their livers aside, food as such is almost a trivial source of vitamin D. The principal source is not food, but sunlight. Elmer McCollum himself illustrates this in a story told by the Greek historian Herodotus (6). 'He visited the battlefield where Cambyses (525 BC) overcame the Egyptians, and inspected the skulls of the Persians and the Egyptians who were there slain. He noted that the Persian skulls were so fragile that the broke even if struck with a pebble, whereas the skulls of the Egyptians were strong and could scarcely be broken even when struck with a stone. The Egyptians told Herodotus that this was due to their going bareheaded from childhood and exposing their heads to sunlight. The Persians, on the other hand, covered their heads with turbans, which shaded them and made them weak… This seems to be the first reference to the physiological effect of sunlight'. Just a few years after cod-liver oil began to be commonly prescribed, 'sun-ray clinics' (such as that shown above, right), in which children were exposed to light from lamps emitting ultra-violet rays in order to prevent and to treat rickets, became popular.

As far back as the mid 17th century Francis Glisson, Regius Professor of Physic at Cambridge University, in his treatise on rickets observed that the disease was common among infants and young children of country farmers who ate well, and whose diets were known to include eggs and butter, but who lived in rainy, misty parts of the country and who were kept indoors during long severe winters (6). As from the 1920s a confluence of epidemiological studies led to the conclusion that epidemic rickets in cities had been and was caused by swaddling, being kept indoors, and by darkness, and fog, smoke, and other pollution that blocked sunlight.

In the 1930s policy in Europe – notably the UK and also Germany – was to promote fresh air and outdoor recreation and holidays. Beginning in the 1950s, clean air acts prohibited the use of coal for domestic fires and restricted emission of smoke from factories. Rickets ceased to be identified as a public health problem in high-income industrialised countries. For this reason, the official UK dietary guidelines issued in 1991 specify a 'reference nutrient intake' for vitamin D from food, for 4-64 year-olds, at a level of 0: 'no dietary intake is therefore necessary for individuals living a normal life-style' (7). By contrast, the most recent recommendations issued in the US recommend daily dietary intakes of 15 micrograms for adults, to protect against osteomalacia and generally to improve bone health (8-10).

Is vitamin D deficiency epidemic?

In common with a growing number of researchers, Oliver Gillie believes that vitamin D deficiency is in effect epidemic, while taking various forms. Two of the best-

attested reasons are as follows. First, the body's ability to synthesise vitamin D from sunlight depends on the degree of skin pigmentation. The lighter your skin, the more efficient is the synthesis. Selective pressure has evolved dark-skinned people in hot sunny climates, and light-skinned people in cold dark climates. But now, vast numbers of dark-skinned people have migrated to temperate countries. It is sensible to assume that they and their children are at increased risk of diseases and disabilities caused by inadequate vitamin D. This is all the more so if their custom is to cover up, as is the case notably with stricter Islamic and Jewish women, including in tropical countries (such as Pakistan, where the rachitic children shown at left, above, come from), or to stay indoors, as often happens among secluded immigrant communities.

The second well-supported reason, is that it is an error to suppose that the public health issue with vitamin D is solely bone disease caused by deficiency of vitamin D. Oliver Gillie points to an accumulation of evidence indicating that vitamin D is necessary for the health of many body systems, and also that avoidance of deficiency symptoms is not good enough. His commentary includes a table compiled using the Austin Bradford Hill criteria of causality, indicating or suggesting that adequate or optimal vitamin D protects against a multitude of disabilities and diseases, and conversely that inadequate or deficient vitamin D is causally implicated in these diseases – which include cancers of a number of sites, as well as diseases of compromised immunity (11).

If it is assumed that vitamin D deficiency, or at least insufficiency, is epidemic in the sense of being causally implicated in a substantial number of disabilities and diseases, what then? Given this, the trouble started with the identification of what is really a hormone generated by sunlight, as a vitamin. The open-air philosophy of the 1930s was right. Current advice to avoid exposure to the sun in order to protect against skin cancer is wrong. Avoid sun-burn, wear a hat especially if short of hair, and enjoy sunshine all the time you can, including on the beach.

Fortification and supplementation

But this is not the end of the story. What about all the dark-skinned people who now live in cold dark countries? What about people of any complexion who live further north than humans arguably are evolved to do? (12). What about populations and communities whose culture of covering up is intractable? Women in Saudi Arabia or indeed Iran or Afghanistan are not about to sun-bathe on the beaches in bikinis. In these cases, which add up surely to hundreds of millions of people, it seems unlikely that conventional advice, that a normal balanced varied diet supplies adequate amounts of micronutrients, is correct. Given this, the correct policy looks like being 'off the peg' fortification of some common foods (13), or alternatively, vitamin D supplements, which with professional supervision or personal research, can be 'made to measure'.

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Functional ultra-processed products



Soft drinks and ready-to-eat or snack foods that do make health claims (left) or have done so (right) or might do, given the addition of synthetic nutrients

Which if so, seems to open a very big door, to a way of seeing nutrition that is welcomed by alternative and orthomolecular practitioners, and which is the stuff of commercial life to the 'health food' trade, food technologists and the pharmaceutical industry, and now also transnational food and drink processors, but is usually rejected by the conventionally trained nutrition profession. The name of this enterprise is functional foods. Business in the US in products claiming some positive health function is annually close to 'double-digit' within a generally flat overall market, increasing from $US 28 billion in 2005 to $US 37 billion in 2009.

Now please turn to the second commentary in this issue, by Carlos Monteiro. The pictures above are of just a few products manufactured by most if not all leading transnational food and drink processors. What is special about some of the products (a few of which are shown at left and at right), is that in common with very many other products that are or have been sold in supermarkets, they make health claims. The claims are not that the products can prevent or treat disease, which is not allowed, but that they have special healthy qualities, based on their 'fortification' with synthetic micronutrients or with other bioactive constituents. There is a grey area between health claims and medical claims, as attested by the US Federal Trade Commission (whose Mary Engle is pictured with some products in the picture above, right). With some reformulation, many other ultra-processed products (like those a small sample of which are shown above, middle), could do so too.

Healthy for whom?

Ever since chemists transformed the art of dietetics into the science of nutrition, almost 200 years ago now, food has been manipulated to make it more valuable. The question has always been, more valuable for whom? From the beginning, one of the claims made to

justify food technology has been that as a result, the health-giving qualities of the manipulated product will be enhanced. In parallel with this development, food chemists have invented edible food-like substances by combining ingredients with chemicals to make products that resemble food and that are intensely palatable. Transnational corporations are free to promote such ultra-processed products worldwide. The result is of course pandemic obesity. The only mystery here is that anybody might think that the process is mysterious. The additional process has been and is the promotion of a vastly increased number of products formulated with the addition of one or many synthetic versions of nutrients, with health claims.

Anybody who goes into a drugstore or pharmacy or 'health food' shop in many countries now, can see this is good business. Anybody who goes into a supermarket now is likely to see, including at check-outs, that variations of products usually mostly sold cheap, as fun, are being sold with their added economic value translated into higher prices, promoted as healthy – including for young children. We need to get wiser to this.

Notes and references

1 Cod-liver oil was used to prevent and treat rickets certainly since the early 19th century. Contrary to common belief, cod's liver is not the richest natural source of vitamin D. That of halibut is richer and those of sea bass, swordfish and yellow-fin tuna are intensely more concentrated sources. Striped tuna liver may be a thousand times more concentrated in vitamin D than cod. The reason that cod liver oil was the most common supplement is simply because cod has been a very common and cheap North Atlantic fish, with a total catch peaking at well over a million tonnes a year, and it was a simple matter to extract oil from its liver.

2 Yudkin J. *The Penguin Encyclopaedia of Nutrition*. London: Penguin, 1985.

3 Marks J. *A Guide to the Vitamins. Their Role in Health and Disease*. Lancaster: Medical and Technical Publishing, 1975.

4 Norman A. Vitamin D. [Chapter 13]. *Present Knowledge of Nutrition*. Eighth edition. Washington DC: ILSI Press, 2001.

5 'Fortification' is a tricky term. It sounds like it means addition to levels not found in food in its whole form. It can mean this. It also refers to partial replacement of nutrients lost in processing (as B vitamins when added to refined white flour and thus white bread). It further refers to addition of nutrients usually to products whose formulation initially did not contain them, like margarine.

6 McCollum E. Investigations on the etiology of rickets. Vitamin D. [Chapter 18]. In: *A History of Nutrition*. Boston: Houghton Mifflin, 1957.

7 Department of Health. *Dietary Reference Values for Food Energy and for Nutrients for the United Kingdom*. Reports on Health and Social Subjects 41. Committee on Medical

Aspects of Food Policy. London: HMSO, 1991. The 0 figure has caveats. Thus it excludes those who are confined indoors, pregnant women, and 'certain at-risk individuals or groups'. It also adds a † to the whole list with a footnote † 'May require supplementation of the diet', with a specific reference in the text to ethnically Asian women and children.

8 US Institute of Medicine. *Dietary Reference Intakes for Calcium and Vitamin D.* Washington DC: National Academies Press, 2011.

9 Brody J. The long and short of calcium and vitamin D. *The New York Times*, 24 January 2011.

10 It is not part of the purpose of this editorial to join in the debate about what levels of vitamin D from food (fortified or not) or from supplements, should be recommended. This is well covered in a series of nine letters in the April issue of our sister journal. See: Letters to the editor. *Public Health Nutrition* 2011, **14**, 4: 740-750. This issue also contains a guest editorial: Gillie O. Blinded by science, pragmatism forgotten. [Editorial].*Public Health Nutrition* 2011, **14**, 4: 566-567.

11 Grant W. How strong is the evidence that solar ultraviolet B and vitamin D reduce the risk of cancer?: An examination using Hill's criteria for causality. *Dermatoendocrinology* 2009, **1,** 1**:** 17-24.

12 The last great ice age was, after all, less than 15,000 years ago. As already mentioned these considerations do not apply to Inuit (Eskimo) people who, when living traditionally, consume lots of fish, including their livers.

13 By analogy with the fortification of salt with iodine to prevent goitre and cretinism, except that the case for vitamin D fortification and supplementation seems more complex.

The editors

Acknowledgement and request

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