CSA IMAGES

Sugar and the heart: old ideas revisited

Forty years after he first put them forward, John Yudkin's warnings on sugar are finally being recognised. **Geoff Watts** reports

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- Research: Effects of high dietary sugar (*BMJ* 1980;281:1396.1)
- Research: Sugar and ischaemic heart disease (*BMJ* 1969;4:110.3)

"Diets high in added sugar raise heart disease risk"; "One soft drink a day raises heart attack danger"; "Added sugars increase heart disease risk." Few things are more prey to fad and fashion than alleged dietary influences on health. So the word "sugar" in headlines where, for 30 years, we've been accustomed to expect the word "fat" may be little more than a caprice. Alternatively it may indicate a more substantial change. Which is perhaps why Penguin Books is reissuing *Pure, White and Deadly*, John Yudkin's valiant, 40 year old attempt to warn us against our lust for sucrose.[1]

Born in 1910, Yudkin studied physiology and biochemistry at Cambridge University, embarked on a career in microbiology, but then switched to medicine and nutrition. In 1945 he was appointed professor of physiology at Queen Elizabeth College, London, and set about creating a department with an international reputation in nutrition. He died in July 1995.

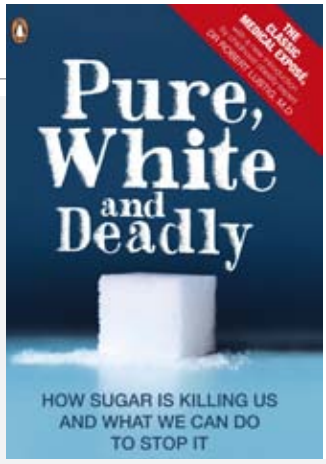
His book *Pure, White and Deadly* is about the uses of sugar, who consumes it, in what amounts, and how it's handled by the body. But most of all it's about what he saw as sugar's deleterious effects on health. As he points out, carbohydrates have always been part of our diet and, until 50 years ago, the general view was that the form in which you consumed them was neither here nor there. But the more he thought and read, the more doubtful he became—about this, and also about the role of fat in heart disease.

Back in 1957, commenting that much had been said on the role of diet in coronary thrombosis, he wrote: "In particular, many believe that the disease is related to the amount of dietary fat, or of a particular sort of fat. In support of these beliefs, we are presented with evidence of an epidemiological nature . . . From time to time, however, it becomes evident that some of the epidemiological data do not fit . . . As more and more of these awkward facts turn up, one begins to have the uneasy feeling that both the proponents and opponents of a dietary hypothesis are quoting only those data which support their view."[2]

One of the earliest exponents of the hypothesis that fat is the principal culprit was the American biologist Ancel Keys. Following epidemiological work that began in the 1950s and led eventually to the Seven Countries Study,[3] Keys suggested that a diet high in animal fats led to heart disease while one low in animal fat—a Mediterranean diet—offered protection against it. Although

MEDICAL CLASSICS

Pure, White and Deadly
A book by John Yudkin
First published in 1972



Becoming a prophet in your own country can be difficult. So can becoming a medical classic in the BMJ. The travails of both are illuminated by John Yudkin and Pure, White and Deadly, his most famous and recently reissued book.

Despite its startling title, the work is a sober analysis of the health problems, especially heart disease, associated with sugar. Published in 1972, it seemed perfectly timed for rapid conversion from nutrition science into nutrition policy. Yudkin was then serving on the advisory panel on heart disease of the UK Department of Health's Committee on the Medical Aspects of Food and Nutrition Policy (COMA).

But opponents, notably Ancel Keys, high priest of fat theorists, publicly ridiculed Pure, White and Deadly. Others ignored it. When COMA published its conclusions in 1974, Yudkin felt compelled to append a note of reservation, concluding that "the Report has exaggerated the possible role of dietary fat in causing IHD [ischaemic heart disease], and has minimized the possible role of dietary sucrose." The 1984 version of COMA never mentioned Yudkin or the role of sugar at all. Its 1994 report on coronary heart disease included a section on carbohydrates, but Yudkin was not among the 414 references. Meanwhile, unobserved by medicine, Yudkin became a cult hero in dental public health, broadening concern about sugar beyond teeth.

The book went out of print, and Yudkin died in 1995 just as his greatest impact was developing—low carbohydrate diets. Controversy focused on Robert Atkins, not coincidentally a cardiologist and a more combative character than Yudkin. But dozens of low carb diets appeared, by Agatston, Sears, Kenton, Holford, Brand-Miller, and many others. A passionate and polemical debate over low fat versus low carb ensued, only subsiding after Atkins' death in 2003. With hindsight, Yudkin played a largely unacknowledged role as John the Baptist to a multitude of low carb prophets.

Public attention on sugar and health, however, continued. The World Health Organization's report on diet, nutrition, and chronic disease in 2003 drew attention to sugar and obesity, and provoked initially fury and then subsequent engagement from food multinationals. Regular pieces of journalism, such as those by Gary Taubes, and frequent television exposés, such as "The Men Who Made Us Fat" (BMJ 2012;345:e4465) earlier this year, kept the pot bubbling.

The turning point came with a 90 minute lecture by paediatrician Robert Lustig in 2009, which has attracted three million viewings on YouTube. It has been expanded into a book, Fat Chance: the Bitter Truth about Sugar, also just published in the UK.

Lustig also wrote the introduction to the reissue of Pure, White and Deadly, and was more generous than others in acknowledging his intellectual debt. "I'm proud to be a Yudkin disciple . . . Every scientist stands on the shoulders of giants . . . Dr John Yudkin was indeed a giant."

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considerably refined since then, it's this view that remains broadly prevalent.

In 1957 Yudkin tried his own hand at analysing the available statistics on heart disease and diet. He found a "moderate but by no means excellent relationship between fat consumption and coronary mortality." Moreover he noted that the relationship with sugar consumption was actually closer. Typically, he also pointed to an even better one between coronary mortality and the possession of radio and television sets. "He could be a bit of a tease," says Tom Sanders of King's College London, the man who now occupies what was Yudkin's chair in nutrition and dietetics.

From reading and thinking Yudkin moved to experiments: "not always very well organised," according to Sanders. But his findings, initially on animals and later on humans, reinforced a growing conviction that fat was not the only or even the main culprit. By the time he published the second (1986) edition of *Pure, White and Dead ly* he was even more certain that sugar was the guilty substance. In his first chapter he wrote, "If only a small fraction of what we already know about the effects of sugar were to be revealed in relation to any other material used as a food additive, that material would promptly be banned."

Industry dismissal

The sugar industry responded to Yudkin and his views with a mixture of public rebuttal and private subversion. Jobs and research grants that might predictably have come Yudkin's way did not always materialise. He comments in the second edition of the book that while the sugar industry's product is pure and white it would be difficult to use these adjectives to describe the behaviour of some of its supporters. And in the end, thinks Yudkin's son Michael, sometime professor of biochemistry at Oxford, the focus on fat rather than sugar as the prime culprit had as much—or more—to do with commercial pressures as with science. In the final chapter of the second edition of his book Yudkin itemises some of the responses of the industry to his views. These include the abrupt cancellation of conferences suspected of promulgating anti-sugar findings; attacks on *Pure, White and Deadly* as a work of fiction; and the application of pressure to other food industries that were drawing attention to the harmful effects of sugar. This all left the field clear for fat to assume the role of chief culprit.

Sanders dismisses any suggestion that Yudkin was devastated by the unenthusiastic reception for his ideas. "He had a sense of proportion," says Sanders, adding that he wasn't a "conviction scientist" like Denis Burkitt or Hugh Trowell, the pair who campaigned so vigorously in favour of dietary fibre. However, Michael Yudkin says that his father did feel a sense of personal disappointment. "He was disappointed not so much for himself as for the implications for public health. Public health was something he'd worked on since he was a young man."

Medical interest in the sugar hypothesis faded. The only lively discussion focused on its generally accepted role in dental caries. The book went out of print—but in Britain at least never entirely out of mind, partly on account of its clever title. The phrase "pure, white, and deadly" is memorable for the way in which the upbeat confidence of the first two adjectives is so swiftly contradicted by the damning verdict of the third.

New evidence

In recent years, and slowly, the sugar hypothesis has been making a comeback, driven in part by the emerging perception of heart disease as a consequence of what's now described as the metabolic syndrome: obesity, dyslipidaemia, raised blood pressure, and insulin resistance. Although there is still no consensus about the causes of the syndrome, an excess of fat in the liver—a response to dietary sugar—is one of the acknowledged possibilities.[4 5] Fructose, found in large quantities in nearly all added sugars, is known to increase lipogenesis in the liver and the synthesis of hepatic triglyceride.

Endocrinologist Robert Lustig, professor of paediatrics in the University of California at San Francisco, has contributed an enthusiastic introduction to the reissue of Yudkin's book. He does not deny that fats—trans fats and omega-6 fatty acids in particular—have a role in the genesis of heart disease, but he does think sugar has been neglected until recently.

"There's been a lot of research that's come out lately showing that fructose, because of the way it's metabolised, is different from glucose," he says. "It contributes specifically to the emergence of the metabolic syndrome." This, more than anything else, is what has started the ball rolling once again in a sweet direction. Fructose does things that other carbohydrates don't, Lustig adds. "Because it's metabolised in the liver it gets converted to liver fat, and this causes insulin resistance, which drives the metabolic syndrome."

In the US, in parallel with awareness of the food industry's increasing use of high fructose corn syrup, more researchers do seem to be giving sugars serious consideration. Last year a group at Emory University, Atlanta, found a statistically significant correlation between dietary added sugars and blood lipid levels in adults.[6] More recently a *New England Journal of Medicine* editorial commenting on dietary fructose and the development of insulin resistance said: "An emerging association between the increased consumption of sugar-sweetened beverages and chronic diseases such as type 2 diabetes, hypertension, and coronary heart disease is a major concern."[7]

In similar vein, a prospective cohort study of more than 40 000 men by Lawrence de Koning and colleagues at Harvard School of Public Health has shown that consuming sugar sweetened drinks is associated with an increased risk of coronary heart disease, while consuming artificially sweetened drinks is not.[8] As Yudkin recalled in *Pure, White and Deadly*, as a child when he was thirsty he had a glass of water. "Nowadays when children are thirsty," he went on, "it seems almost obligatory that they quench their thirst with some sugar-laden cola or other drink. And this is true for adults too." Three decades later, he would have argued, we are witnessing the consequence.

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Not surprisingly, the sugar lobby maintains its opposition to Yudkin's views. In an email to the *BMJ* Dr Richard Cottrell, director of the World Sugar Research Organisation (WSRO), dismissed his theories as "based on flawed experiments in rats, whose metabolism of carbohydrate differs from that in humans." Invited to comment on the de Koning study he said it will not "lead to any revision of the WSRO position statement, since the nature of this study is inherently unable to attribute causality to any associations observed. In addition, the relative risks quoted in this study are below the threshold for credibility normally set by epidemiologists for this kind of study."

Since 1986 when Yudkin revised his book, much has been learnt about the metabolism of the carbohydrates, and its consequences. But the bones of the "new" view of sugar are already there. As Yudkin writes on page 105, "If the cells have become insensitive to insulin, the pancreas produces more and more insulin in order to counteract the insensitivity." He also writes extensively of the links between heart disease, diabetes, obesity, and high blood pressure. The metabolic syndrome is there in all but name.

Where this debate on the role of sugar will lead is hard to predict. Michael Yudkin draws an analogy with smoking. "As time went on the denials that smoking tobacco had adverse effects became less and less tenable . . . I think we're seeing the beginning of a similar shift in public opinion."

Right now, beyond reiterating sugar's obvious importance as a source of calories, even the British Heart Foundation feels that present uncertainties prevent it taking a position on other effects it might have. But Lustig remains confident that things will continue to move in his (and Yudkin's) direction. We have causation as well as correlation, he says. "These shifts occur slowly. I think we're in the middle of a shift. We will see where it goes."

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EDITORIAL p 7; RESEARCH p 12

Corrections and clarifications

Sentinel node biopsy for melanoma: unnecessary treatment?

In the course of researching this Feature on sentinel lymph node (SLN) biopsy (*BMJ* 2013;346:e8645, doi:10.1136/bmj.e8645) we were not clear with one of the interviewees who kindly spoke to our reporter how any of the interview might be used in the final article. In addition, some of the quotes attributed to Marc Moncrieff misrepresented his views. We would like to make it clear that in the transcript of the interview Mr Moncrieff makes positive comments about the practice of SLN biopsy and we should have included a proportion of them. This would have led to a fairer report.

Mr Moncrieff does not believe that the use of SLN biopsy leads to overtreatment, but that the majority of patients who have a lymphadenectomy after SLN biopsy have no evidence of further disease. Accordingly, the MSLT-II trial hopes to identify those patients who may not benefit from a completion lymphadenectomy (and thus avoid any further surgery) by the use of ultrasound follow-up alone.

In the Feature, Mr Moncrieff says: "Eighty-eight per cent of patients don't have further disease in their nodal basin." He would like to make it clear that this 88% figure only relates to patients studied at the Norfolk and Norwich University Hospitals Foundation Trust.

We apologise to Marc Moncrieff for misrepresenting his views.

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Journey of an oximeter

It takes only a few months for a donation to Lifebox to transform surgery in hospitals in low income countries **Jane Feinmann** follows your money

Surgery at Niamey National Hospital in the Republic of Niger is a challenging experience, dangerous even by developing world standards where lack of access to properly equipped surgical care is a near universal public health crisis. Niger is among the poorest, and most youthful, countries in the world. Most of the 4000 operations in the hospital's seven operating suites are on children or teenagers who have been injured in road crashes or as a result of unsafe working conditions.

But operating conditions at the hospital are improving dramatically because of a donation to Lifebox, the *BMJ*'s Christmas Appeal charity.

Maman Sani Chaibou, the hospital's lead consultant in anaesthesiology and intensive care, was "very happy" to receive a delivery in March 2012 of a robust, portable, audible, rechargeable Lifebox pulse oximeter costing just £160 (€194; $250). "It has changed my practice by keeping my patients safe throughout their treatment," he says. "For me, the greatest benefit is that it can follow the patient from the operating room to the postoperative room, keeping them secure beyond surgery."

The donation was made by Janet Dewan (right), an American nurse anaesthetist based at Northeastern University, Boston, who had worked as a volunteer in Niger in the 1970s and returned two or three times a year between 2006 and 2009, when she worked alongside Chaibou. He had impressed her as one of the first African doctors to engage with the World Health Organization's *Surgical Safety Checklist* as well as being an influential academic and trainer. "It was gratifying to be able to earmark my donation for someone I knew needed it and would use it," says Dewan.

She made the donation in February 2012 just as the *BMJ*'s 2011 Christmas appeal for Lifebox had raised a record £34 000, funding 210 pulse oximeters for low income countries.

The blueprint for Niamey National Hospital's new oximeter was developed after anaesthesia experts helping to put together WHO's *Surgical Safety Checklist* in 2008 insisted that a pulse oximeter was an essential prerequisite of safe surgery.[1] Further research found that more than 70 000 of the world's operating theatres lacked this essential piece of kit.[2]

Lifebox oximeters are manufactured in Taiwan, according to a specification written by WHO and the World Federation of Societies of Anesthesiologists.

The direct contact between the charity and the anaesthesia provider allows transparency, avoiding the bureaucratic hurdles that can plague equipment donation. A further priority for the charity's small but energetic staff is the speedy delivery of the devices. "We follow up every oximeter as it leaves the factory until it reaches its recipient, no matter how remote the destination," says Iain Wilson, a Lifebox trustee and past president of the Association of Anaesthetists of Great Britain and Ireland. Niamey National Hospital's Lifebox arrived just one month after Dewan's donation was received—and she was delighted when Chaibou emailed a photograph of it in use in a theatre just a day or so later.

Training

A further priority, as Lifebox chair Atul Gawande points out, is the provision of training for practitioners who lack experience in using oximetry. "If all we were doing was parachuting in a bunch of pulse oximeters, we wouldn't have such a tremendous impact," he explains. It's this aspect of Lifebox's work that may make the crucial difference to healthcare in low income countries. So the delivery of 36 Lifebox oximeters to Connaught Hospital in Sierra Leone's capital, Freetown, in March 2012, all funded by last year's *BMJ* appeal, was accompanied by two half day courses using manuals provided by Lifebox. Meanwhile Naimey National Hospital is on the Lifebox waiting list to receive more oximeters. "It would make a huge difference if each of our operating rooms had its own pulse oximeter. It would be a wonderful gift from *BMJ* readers," says Chaibou.

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References are in the version on bmj.com.
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Blog: Lifebox Q and A: El Salvador—education, education, education (http://bit.ly/V9EyX3)