Nutrition science past and future: celebrating a multidisciplined approach

Book

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Editorial

The British Nutrition Foundation: 50 years of making nutrition science accessible to all.

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This Special Issue of *Nutrition Bulletin* marks the 50th anniversary of the establishment of the British Nutrition Foundation (BNF) in 1967. Professor Alastair Frazer, who set up the Foundation and became its first Director General, was something of a visionary who foresaw the implications of post-war socio-economic and technological developments on food availability and population health. Food production, with intensive farming practices, farm subsidies and developments in food processing, were enabling the majority of people across the UK to have reliable access to sufficient food -a situation that had not universally applied in pre-war times. Children's growth rates improved and nutritional deficiencies were becoming less common, and indeed rare, in most parts of the UK. However, incidence of diseases such as heart disease were on the rise, with scientists and clinicians beginning to consider the possibility that war time rationing might have had some beneficial, if incompletely understood, impacts on population health. Within this more complex dietary and public health environment, Frazer considered links across academia, government and the food industry needed to be strengthened if improvements in the nutritional health of the population were to be sustained. The Foundation was set up, as an independent charity in public benefit, in order to provide credible evidence-based information on nutrition and support advances in the science of nutrition and in the training of professionals. Those principles remain true today, through the Foundation's continuing mission to 'make nutrition science accessible to all'.

As anticipated by Frazer, the 50 years since 1967 have brought major advances in technology and socio-economic and political changes that have had profound effects on how the food we eat is produced, processed, sold and consumed. The articles in this Special Issue have focused on a number of key themes which collectively illustrate how our understanding of the British diet, and of the relationships between diet and population health, have advanced since the 1960s. They take us through a retrospective look at diet in the UK from 1947 to 2017, and advances in the measurement of food composition, including 'new' components such as the phytochemicals present in plants. They illustrate how notable developments in the science of nutritional epidemiology, in its infancy in 1967, have significantly advanced understanding of the links between diet and health and now form

much of the evidence base for public health nutrition. Advances in molecular biology and in biomedicine have provided insights into the biological mechanisms underlying the diet-disease relationships revealed by epidemiology and that together, substantiate evidence for adverse effects of diet on health outcomes, such as cardiovascular diseases, type 2 diabetes and some cancers. In this anniversary issue, Givens (2017) illustrates the role which reformulation, via both food processing and agricultural routes, can play in modifying diet to reduce potentially harmful, and enhance potentially beneficial, dietary components in people's diets. It is evident that such changes require long-term planning and a strong evidence base upon which to make compositional and other changes in food products, in much the same way as is the case for government recommendations on diet and health. Whilst the need for strong links between those studying impacts of diet on health and those in the food industry is as important now as in Frazer's time, such links remain controversial. Many agree there is now urgent need for a clear code of practice for research collaborations between academia and industry, both to protect the independence of the researcher and to ensure the role which industry could play in improving the diets of populations is optimised.

During the second-world-war the provision of a 'recommended diet' was far simpler than it is today, due to war time rationing and government control of the food supply chain. At that time, the Ministry of Food established a national dietary survey which provided the basis for planning the British diet throughout the period of conflict and for a number of post-war years. In 1947, the survey became the *National Food Survey* and through various iterations, to the present day *Family Food Survey*. This represents the longest running dietary survey world-wide, providing invaluable information on British food and nutrient intakes and trends in consumption for over 70 years. As described in the 40th BNF anniversary article by Foster and Lunn (2007) and updated by Lee and Worth (2017)for this 50th anniversary issue, the survey provides fascinating insight into the impact of social, economic and political change on our eating habits. The most marked changes in diet since the early 1960s have been the reductions in whole milk, butter and animal based cooking fats, with these replaced by semi-fat milks, reduced fat spreads and plant based oils. Similarly there have been

significant shifts away from red meat, with poultry now the dominant meat consumed in the UK. The success of policies aimed at reducing fat and saturated fat intakes, and the relative speed at which these changes took place in the 1970s and 80s, are fully evident from the survey data. The decline in heart disease rates over the following twenty years have also been well documented with these starting to occur within a few years of the dietary changes (British Heart Foundation 2011) and prior to the extensive introduction of pharmaceutical approaches to prevention of heart disease. More challenging has been the corresponding increase in obesity which has risen fourfold between 1970 and 2015. Whilst increasingly sedentary lifestyles are undoubtedly part of the explanation for this unfavourable outcome, the survey data show that dietary advice for greater consumption of fruit, vegetables and fibre and lesser consumption of sugars-sweetened beverages, have been much less successful than those for dietary fat.

The extraordinary progress made in nutritional science between 1900 and 1940, including the establishment of the essential roles of amino acids, vitamins, minerals and some polyunsaturated fatty acids, as well as the nutrient compositions of every day foods, came about because of advances in other disciplines such as chemistry and biochemistry. By the late 1960s, when the BNF was launched, it may have seemed that our knowledge about essential dietary nutrients was complete. However by the 1990s, further advances in analytical capability and large scale epidemiological and detailed human metabolic studies, had begun to suggest that components of foods other than the main nutrients listed above, might have important effects on human health. The article in this issue by Williamson (2017) summarises recent progress made in elucidating the role of dietary polyphenols, found in fruit, vegetables and beverages, in disease prevention. As Williamson notes, although much has been achieved, as yet, there is insufficient information on the types and amounts of specific polyphenols required for optimal protection against chronic diseases to justify these compounds to be classified as nutrients. The article by Finglas, Roe & Astley (2017), confirms that advances in our understanding of the functional role of dietary polyphenols, has been complemented by marked advances in our ability to analyse foods for a much wider range of

constituents, including the many different types of dietary polyphenols. Finglas and colleagues illustrate the important part which European funding and collaborative networks such as *European Food Information Resource (EUROFIR)* have played in enabling the collation, archiving and management of dietary data across different European nations. The Foundation contributed to this work, with the Director General, Professor Judy Buttriss, acting as one of the experts leading a Work Package within the consortium. In 2017, the UK now sits on the brink of leaving the European Union, with unknown impact of this and other future political changes on funding and scientific collaborations, which many would argue have been highly beneficial to UK nutrition science.

Perhaps the single biggest contributor to advances in nutrition science of the past half century has been the major progress made in studying relationships between diet and health through nutritional epidemiological studies, notably large scale population cohort studies. Wiseman (2017) describes major advances, both methodological and conceptual, which have been made in such studies since the early post-war period. He describes the contribution of epidemiological studies to our understanding of the relationships between diet and cancer risk, but emphasises how that understanding still remains incomplete. He demonstrates how early hypotheses, such as those concerning relationships between fruit and vegetable intakes and cancers at certain sites, have not been fully borne out by meta analyses of epidemiological cohort studies, whereas other relationships, such as those between bodyweight, obesity and cancer, have been strengthened.

The contribution of epidemiology to the development of the dietary fat-cholesterol-heart disease hypothesis, which emerged in the late 1960s, has been highly significant. Recognition that raised levels of blood cholesterol were important in relation to heart disease risk came from the findings of the *Multiple Risk Factor Intervention Trial* (*MRFIT)* cohort of 350 000 US men (Kannel *et al.* 1961). Links with dietary fat were later demonstrated by controlled feeding trials which showed highly predictable effects of saturated fats in raising, and polyunsaturated fats in lowering, LDL cholesterol (Hegstead *et al.* 1965; Katan *et al.* 1994; Mensink *et al.* 2003). However, at this immediate point in

history, some recent meta-analyses of cohort studies, aided by much popular media exposure, have questioned the dietary fat-cholesterol-heart disease hypothesis, emphasising findings which have failed to find the same consistent relationship between saturated fats intake and heart disease risk. Whilst the various strengths and weaknesses of individual studies and limitations of meta-analyses have been much debated, it is puzzling to note that none have made the important point that over the period of follow up of many of the cohort studies, population dietary fat intakes had changed out of all recognition. As we have seen from the UK *Family Food Survey* data, very significant changes in total fat and fatty acid intakes took place during the 1980s (Lee & Worth 2017). For many of the cohort studies it is clear that the (mostly) single baseline diet measurements, that provide the basis for classification of subjects' habitual diets, will have provided a poor marker of an individual's overall saturated fat exposure during the subsequent period of follow-up. Indeed the contemporary challenge of interpreting outcomes from the cohort studies of fat intake and heart disease, lies in the very success that most developed countries have had in changing population fat intakes (and risk of heart disease) over the last 40 years. It can be argued that these marked demographic and dietary changes now invalidate the use of population cohorts in studying the dietary fat hypothesis, since the variables of interest (diet and heart disease) are no longer independent of one another (Williams & Salter 2015). The challenge of rapid changes in population diets over time is clearly one which epidemiological cohort studies need to address with greater transparency in future debates around the evidence base for diet and health.

Griffin (2017) acknowledges the complexity of the evidence linking saturated fats with heart disease mortality, but contributes to the debate through a detailed consideration of the biochemistry and metabolism of LDL particles (amount, size and particle number). He re-emphasises the important impact of replacing saturated with polyunsaturated fats on LDL cholesterol, including evidence from a recently published meta-analysis of randomised controlled trials, where studies which replaced saturated fat with polyunsaturated fats reduced cardiovascular mortality by 27%, with the greatest reduction seen in the sub-group which showed the greatest reduction in cholesterol (Hooper *et al*.

2015). Griffin considers how advances in lipoprotein biochemistry have elucidated our understanding of this complex area of nutritional science and reiterates the key role of mechanistic studies and use of biomarkers such as LDL cholesterol, in understanding disease risk.

Until the mid-1980s, much of the epidemiological research into effects of diet on health had focused on the consequences of mid- and later-life nutrition on risk of chronic diseases. However Robinson (2017) outlines how epidemiological studies of mothers and their babies born in the UK in the early part of the 20th century, led to the Barker hypothesis put forward in 1986 (Barker & Osmond 1986). This seminal work identified that diet and growth during early life had a significant impact on an individual's later risk of obesity, heart disease and type 2 diabetes. This work must be considered to be one of the most important developments in our understanding of diet-disease relationships during the 20th century. It shifted attention back towards consideration of long-term impacts of undernutrition in infancy and childhood and the importance of protein adequacy and micronutrients, such as folate. It also stimulated much interest in the biological mechanisms which might underlie this 'programming' response to adverse early life nutrition exposures. Although a detailed understanding of potential mechanisms remained elusive for many years, the article by Malcomson & Mathers 2017) includes a discussion of the potential importance of epigenetics in early life programming of later disease. Epigenetics is a relatively recently studied biological mechanism, which involves small chemical changes in the structure of DNA that occur throughout life as a result of environmental and other exposures. There is now plausible evidence that, over the lifecourse, diet can lead to epigenetic changes in DNA, with resulting modulation of key regulatory genes involved in development. It seems likely that epigenetics may provide the biological key for the long-term effects of early life nutritional exposures first postulated by Barker in 1986. Malcomson and Mathers discuss how epigenetic patterns may also have potential as biomarkers of ageing, with functional application in nutritional epidemiology and dietary intervention studies.

If we look forward to the 60th anniversary of the establishment of BNF, it seems unlikely we shall be celebrating a reversal of the rise in overweight and obesity amongst the UK population that has marked the past 50 years. However we can hope that advances in understanding human behaviours that underpin food intake and satiety and the complex interactive relationships between energy intake and energy utilisation, that are outlined in the articles by Blundell (2017) and Rolls (2017), in this anniversary issue, will begin to shed light on more effective approaches to human bodyweight regulation, than is presently the case.

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