Nutrition – The Very Short Introductions Podcast – Episode 68

Rebecca Parker 00:07
Welcome back to The Very Short Introductions Podcast. From public health to Buddhist ethics, soft matter to classics, and art history to globalization, we'll showcase a concise and original introduction to a wide range of subjects, for wherever your curiosity may take you. So here is today's very short introduction.

David Bender 00:26
I'm David Bender. I retired some years ago, and I am Emeritus Professor of Nutritional Biochemistry at University College London. My book is called A Very Short Introduction to Nutrition, and its topic is, unsurprisingly, nutrition. We will eat food, about a ton a year for an average adult. We all know what we like and dislike. We all know something about calories, protein, fat, and carbohydrate, something about vitamins and minerals. Where we all need help is in distinguishing between sound, evidence-based nutrition advice, and the sometimes extremely flaky pseudoscience, promulgated in some books, some magazine articles, and, perhaps especially, by so-called influencers on social media.

David Bender 01:13
I became a nutritionist by what was probably a rather unusual route in that my father was a nutritionist, and I made a conscious decision to be a biochemist; he had originally qualified in biochemistry at Liverpool University. My fate as a biochemist was probably determined before the age of three, when I'm reliably informed that I'm visiting Dad in Craggs laboratory in Sheffield, I announced my first, if somewhat ungrammatical, full sentence, saying, "Labs is wonderful." I duly read biochemistry at Birmingham University, having chosen not to apply to Liverpool or Leeds because I had too many relations in those cities, Edinburgh because it was too far from home, and University of London Colleges because there were too close to home.

David Bender 02:01
After Birmingham I returned to London to do a Ph.D at the Courtauld Institute of Biochemistry of the Middlesex Hospital Medical School. I was tasked with attempting to purify and characterize an enzyme involved in the synthesis of the neurotransmitters dopamine and serotonin. At that time, one of the major interest of the department was neurochemistry. After my Ph.D, I remained in the department and my research moved on to a minor acid metabolism in schizophrenia. This led to comparisons between schizophrenia and the mental disturbances of the nutritional deficiency disease pellagra. I was now set on a nutrition-related career. As a junior lecturer at the Middlesex, I inherited two lectures from the head of department on aspects of nutrition, and over the years, gradually increased my portfolio of nutrition lectures as people began to recognize the importance of nutrition in medical education.

David Bender 02:58
I backed up these lectures not only with nutrition research on aspects of the metabolism of vitamin B6, niacin, and the amino acid tryptophan, but also writing on wider aspects of nutrition. There are of course roots other than biochemistry into a career in nutrition. Unlike the early 1960s, there are now multiple B.Sc courses in the UK and elsewhere in nutrition or nutrition with either dietetics or food

science. In advance of the merger of the Middlesex with University College in 1987, members of the Department of Biochemistry at UCL had set in motion a paperwork to create a course unit in Nutritional Biochemistry for me to organize and teach. It was very popular among the third-year students as a pointer to a potential career path.

David Bender 03:49
Other routes into a career in nutrition include, on the one hand, clinical medicine, dentistry, veterinary medicine, microbiology, pharmacology, physiology, agriculture, perhaps even analytical chemistry, and on the other hand, social and behavioral sciences, anthropology, psychology, statistics, public health medicine. A degree in nutrition may lead you into a laboratory career investigating the underlying biochemical and physiological mechanisms, research and clinical nutrition and nutritional medicine involving clinical trials and working with human beings, research in or practice of sports medicine, dietetics, public health nutrition, or international development.

David Bender 04:33
You may end up working in a university school or college of further education, in a hospital, in a government department dealing with public health, food safety and standards, or agriculture, in a non-governmental organization in a developing country, in a food company developing food, either for people or for farm or domestic animals, in a pharmaceutical company developing supplements. I know of at least two nutrition graduates who took their knowledge into practical nutrition by opening restaurants. If you read even a relatively advanced textbook with nutrition, you might gain the impression that we have answered all the questions. Not so. In Britain, the nutrition society runs four major conferences each year, each lasting several days, and publishes five research journals and one review journal, all of which are continually expanding, as each increase in our knowledge leads to more questions to be answered.

David Bender 05:30
Other learning societies and scientific publishers are similarly expanding their journals with high quality nutrition research. There are regular and frequent international and regional nutritional conferences where new data and new ideas are exchanged, discussed, and explained. We have reliable measurement of energy expenditure and, hence, total calorie requirements for people at various stages of life and under various conditions by using non-invasive techniques involving the use of dual isotopically labeled water, water labeled with stable isotopes of hydrogen or oxygen; the subjects just drink the labeled water and provide urine samples over a period of two to three weeks. In short term studies, we can measure oxygen consumption, carbon dioxide production, and heat output from the body over a few hours under various conditions and in various activities.

David Bender 06:26
These studies also let us estimate the relative amounts of fat, protein, and carbohydrate being metabolized for energy. Even here, there is a lot more research to be done. How about energy expenditure in extreme activity, moderate physical activity, in response to reduced food intake for weight reduction, in recovery from severe undernutrition, especially in developing countries, in disease and so on? There is considerable interest in potential changes to farm animal diets, both to increase

productivity and the efficiency of conversion of feed into meat and eggs, and also for ruminants to reduce the production of methane, which is a potent greenhouse gas.

David Bender 07:07
We can be fairly confident that we've identified the essential nutrients for human beings, for domestic and farm animals. We have reasonably good estimates of the amount of each required to prevent deficiency disease. However, it's notable that different expert committees and different national and international bodies come up with different estimates of appropriate levels of intake. For example, we can justify a reference intake of vitamin C at any level will between 40 and about 120 milligrams a day, based on the same, somewhat limited, experimental data, depending on what assumptions are built into the interpretation of the data.

David Bender 07:48
There was considerable, and sometimes acrimonious, debate over appropriate levels of protein intake and the relevance of protein quality, the amino acid composition of different proteins, and the extent to which different proteins are digested and their component amino acids are absorbed. Here, interpretation of the relatively few direct studies of people maintained on varying levels of intake are confounded by the fact that as protein intake changes, so do the rates of breakdown of tissue protein and their replacement from the diet, so the protein requirements adapt in response to changes in intake.

David Bender 08:25
So the length of experimental studies is an important factor that we taken into account has enough time been allowed for full adaptation to each level of intake. Where we have even less certainty, especially about vitamins and minerals, is in estimating levels of intake that may promote optimum health, something that in itself is almost undefinable, and life expectancy. The problem here, of course, is that we cannot begin to consider conducting experimental trials of intake of individual nutrients over a period of 80 to 90 years or more.

David Bender 09:01
There are a number of long term observational studies. Probably the oldest is the 1946 Birth Cohort in the UK, in which every child born in the second week of March in 1946 is still being followed. The Framingham Study, in USA, began in 1948. And again, the original participants, and now their descendants, are still being followed. While the results of these and other long term studies are interesting, a great many factors have changed over the last 70 plus years. In 1946, in Britain, food was still rationed. Many foods that are now commonplace were unknown, even into the 1960s and 1970s. And, of course, diet is far from the only change. Another approach is to conduct a so-called cross-sectional study, looking at older people and seeing how their diet may reflect their health. Here we have two problems in interpreting results. We can examine their current diet, but we have little or no information about what they ate years, perhaps decades ago, when dietary factors may have initiated the processes involved in chronic disease.

David Bender 10:08

There are studies showing that older people, perfectly fit and in good health, living in their own homes and looking after themselves, consumed considerably more fat, more saturated fat, and more sugar than we consider prudent or advisable. The problem here, of course, is that we know nothing at all about those people from the same community who didn't survive to take part in the study. With vitamins and minerals, we also have to consider whether higher levels of intake, as opposed to promoting optimum health and longevity, may be hazardous.

David Bender 10:42
Here we have considerably less experimental data but various national and international bodies have extrapolated from such data as are available and applied the usual safety margins that we apply to toxicity of drugs and food additives to come up with tolerable upper levels of habitual intake. We know it's relatively easy to achieve an undesirably high level of intake of vitamins A and D from supplements, but perhaps not from normal foods, although levels of food fortification or enrichment do need to be monitored. For vitamins and minerals, we have the problem of their availability from foods as opposed to studies with purified nutrients that have led to our estimates of desirable or appropriate levels of intake.

David Bender 11:31
Purified nutrients may well be more or less 100% absorbed, while this is unlikely to be so for nutrients from a complex matrix of foods. We can add a further problem. People do not eat just one food at a time, so there may well be interactions between different foods in the same meal. Certainly, we know that the absorption of carotene from carrots ranges between very low indeed when raw carrots eaten on their own to nearly 100% when cooked character eaten in a meal containing a modest amount of fat. Then we have to consider the effects of intestinal microflora, the utilization of nutrients from our diet by the microflora, and the contribution of bacterial and other metabolites to our nutrient and micronutrient intake. We also have to consider the effect of our diet and, especially, starch that resists digestion and non-digestible carbohydrates and other compounds on the growth and metabolism of the intestinal microflora.

David Bender 12:30
Until recently, identification of intestinal bacteria was a tedious and, frequently foul-smelling, process of culturing fecal samples under various conditions. Advances in molecular biology mean that we can now identify individual bacterial species easily by extracting their small ribosomal RNA, all of which have many common features, which permits their easy extraction, and then sufficient differences to prevent identification of individual species after separation of amplification. This has led to an explosion in our knowledge of the interactions between diet, intestinal flora, and our health and well being.

David Bender 13:12
Having considered all of these problems, we have to convert nutrient guidelines into dietary guidelines. We don't eat nutrients, we eat foods. This means that we have to consider traditional patterns of food intake, and what is likely to be available locally. What do people like or dislike, and how likely are they to eat, or even to try, novel or strange foods? Finally, we have to persuade people to make what we consider to be appropriate changes in their diet. It's depressing to learn that several decades of public

health nutrition interventions in Britain have not led to any significant changes in overall patterns of food intake, and certainly no noticeable effect on excessive food intake leading to overweight and obesity.

David Bender 14:01
So the take home message is that if you embark on a career in nutrition, however you came into the discipline, and whichever area you specialize in, there are still plenty of unknowns for you to research and plenty of opportunities to promote and teach about more appropriate and desirable patterns of food consumption to improve public health.

Rebecca Parker 14:23
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