Nutrition

Nutritional transition: a determinant of global health

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Much of the world's disease burden results from faulty nutrition, which is a largely preventable risk factor. It is now time for a global diet strategy.

Perhaps more than ever before in recorded history there is a huge gap between health as it could be and health as it really is. The management of patients with persistent affliction and unremitting pain increasingly dominates medical practice[1 2] and it is apparent that individual and public dietary habits are an important determinant in the mounting load of chronic suffering and illness.[3] Exorbitant rates of adult onset diabetes as well as an epidemic of paediatric and adult obesity have triggered a careful re-examination of national food guidelines and population dietary practices. In recognition of the health ramifications of faulty dietary intake, the World Health Organisation in May 2004 implemented a global diet strategy,[3–5] a move branded as a ''landmark achievement in global public health policy.''[5]

Distinct challenges related to nutrition and health in developing countries, such as food shortage and inequitable distribution of resources, often result from political, economic, and social factors. Even within developed nations enjoying prosperity, cutting edge medical technology, and accessible health care, however, it is increasingly evident that rates of chronic illness are mounting,[6–9] thus threatening the sustainability of health care systems in many jurisdictions. The Centers for Disease Control and other groups have provided substantial research data confirming that the rise in illness and chronic pain are, in part, attributable to nutritional choices.[3 10–12] As early as 1988, the US Surgeon General's Report on Nutrition and Health concluded that illness related to modern dietary habits had risen so noticeably that faulty nutrition significantly contributed to most deaths in the USA.[13]

The integrity of the physical body is determined, to a great degree, by the quality of consumed nutrients that continually nourish and rebuild the human structure. Deficiencies of ordinary micronutrients can be associated with a range of illnesses such as prostate cancer,[14] miscarriage,[15] and stroke,[16] as well as an array of paediatric afflictions including widespread behavioural and learning disorders,[17] certain congenital abnormalities,[18] and even such common ailments as ear infections.[19] The *Canadian Journal of Psychiatry*, for example, recently highlighted various psychiatric challenges including anxiety, depression, and hyperactivity problems associated with insufficient levels of essential fatty acids.[20] Primary reasons for micronutrient insufficiency include the following: food is commonly grown in soil that has become nutritionally deficient; microwaving and prolonged cooking at high temperatures diminishes nutritional value[21 22]; produce is commonly harvested in advance of vine ripening, the stage at which many basic nutrients develop; and toxins including various herbicides and pesticides may have an adverse effect on nutrients. Furthermore, fast food with its questionable nutritional status has become a dietary staple for many families.[23 24] As well as nutritional deficiency, exposures to potential toxins in foods are also a cause for concern.

Potentially toxic and allergenic agents in common foods are becoming more prevalent and, although much of the research on toxic effect remains at an early stage, there are increasing data that evoke concern.[25] To expedite rapid and maximal growth, many farm animals destined for human consumption are injected with potent hormones including oestrogens, as well as being fed potentially toxic growth promoting feed additives.[26–29] It is noteworthy that because of safety concerns, the European Union has steadfastly banned beef treated with growth hormones.[28] In North America, dietary analysis by public agencies has showed that some ordinary foods consumed by many families now contain pesticide residue, antibiotics, heavy metals, industrial chemicals, and untested genetically engineered ingredients.[26 30–35] Routinely consumed synthetic additives, such as artificial colours, flavours, and preservatives may provoke untoward reactions and long term effects of eating irradiated food have not been adequately studied. Toxins in food are also an important concern in obstetrical care: just as drugs and alcohol can affect the developing fetus, recent warnings that caution pregnant women to limit consumption of seafood because of teratogenic contaminants[36] give evidence of potential in utero impact of food toxins.

An accumulating body of evidence has pointed to hyperinsulinaemia resulting from dietary choices as an aetiological factor in the development of many chronic medical problems.[37–39] Hypertension, dyslipidaemia, coronary artery disease, and type 2 diabetes are among the most common chronic conditions seen by family physicians in western cultures, yet remain rare in less westernised societies. For example, 50 million Americans are hypertensive, 10 million have type 2 diabetes, and 72 million adults have dyslipidaemia.[38] Habitual consumption of high glycaemic food carbohydrates such as refined sugar and many common cereals promotes the development of insulin resistance and compensatory hyperinsulinaemia.[38] Awareness of the impact of raised insulin concentrations resulting from dietary challenges is increasing; research has implicated this physiological change with other common conditions such as acne and hair loss,[38] polycystic ovarian disease,[40] pre-eclamptic toxaemia,[41] as well as prostate, breast, and colon cancer.[38 42 43] As increased insulin concentrations also have a significant growth promoting hormone effect, higher fetal insulin concentrations in response to high glycaemic loads provided to the mother may be accounting for larger fetal growth. With high rates of cephalopelvic disproportion and associated caesarean section figures of 24% in the USA and 21% in Canada,[44 45] the issue of diet in pregnancy needs to be carefully considered. The myriad health sequelae associated with habitual high glycaemic consumption and mounting western type illness in developing nations adopting western dietary behaviours, explain the high glycaemic caution (in addition to the fruit and vegetable promotion) in the WHO ''Global strategy on diet, physical activity and health.''[3]

While the medical discipline of nutrition is emerging as an area of primary health importance, this domain has not been a focus for medical training and continuing medical education.[46 47] It would be outlandish for a building contractor or architect to complete training in construction without an all embracing knowledge of structural

What this paper adds

It is my desire that this commentary will bring attention to the contribution of nutritional factors to the escalating problem of chronic disease. Many people consider health and illness to be entirely independent of their own behaviour and voluntary choices, and regardless of unhealthy practices, perceive that health can be purchased in a medicine or vitamin bottle. Much of the general public now expects to consume medical services in much the same fashion that they consume fast food: rapid service, brief encounters, and immediate satisfication. As there is mounting evidence of the close relation between nutritional transition and disease, physicians need to be advocates for health promotion and prevention, in part, through dietary assessment and intervention.

Policy implications

The recent World Health Assembly strategy to introduce a new dietary initiative is an important first step in the commitment to improve global nutritional practices. However, there is much literature to confirm that most physicians are not trained in nutrition and do not consider this important field when managing illness. This paper will hopefully contribute to increasing physician awareness and facilitate the introduction of policies and programmes to educate the public about the need for prevention and promotion of community health, in part, through diet.

materials, yet most physicians have received limited instruction about dietary nutrients, the building materials of the human frame. As a result, consideration of nutritional causation for medical problems occurs infrequently in everyday clinical practice[48] and the underlying aetiology of various health difficulties is commonly unexplored.

Despite ample evidence confirming the need for good nutrition as a prerequisite for optimal health,[10] dietary habits have changed substantially over the past few decades with accumulating research showing that many contemporary foods are nutritionally inadequate and that some contain potentially harmful substances. Study of ''nutritional transition'',[25] the changing nature of food consumed by the average person, and its relation to human health, is an area of intense investigation that requires careful consideration when exploring the health status of individual patients as well as health trends within populations. With the realisation that much of the world's disease burden results from faulty nutrition, a largely preventable risk factor, the WHO has recently unveiled a global diet strategy, emphasising the inextricable relation between nutrition and human health.

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Mathematical modelling

Mathematical modelling of health impacts

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Mathematical modelling is seldom applied to research of global measures of health or health inequalities mainly because of the lack of studies of interventions necessary to underpin modelling research.

In this issue, Cole and his colleagues elegantly demonstrate the use of modelling to estimate health impacts of a policy.[1] The Los Angeles City living wage ordinance sets a minimum wage for certain city employees. It also requires employers to contribute towards health insurance premiums for the affected workers or to add that payment to their wages. Using results from other studies in a novel way, they found that provision of health insurance is a more cost effective measure to improve health than a modest rise in income in their Los Angeles population.

This is unsurprising in the American context. For the relation of health to the provision of any type of resource, there is likely to be a diminishing return so that the gradient of the relation becomes flatter as the level of the resource increases.[2] The steepest part of the curve is the increase above zero. The many uninsured in the USA will therefore gain appreciably even from low levels of access to health care. However, even for low paid workers, the steepest part of the curve between income and health passed as soon as they were in employment/compared with the unemployed. In any other economically developed country, the relative impacts would probably be different.

The minimum level for a living wage to live up to its name will vary according to the costs of meeting needs in different locations. Morris *et al* calculated that minimum living costs in 1999 for young, single men exceeded earnings based on the then national minimum wage by up to 55% of earnings (income depending on age, and costs on region). However, the minimum costs were two to three times the basic social security (unemployment benefit) rate.[3] Any attempt to reduce inequalities in health (or ''differences'' as they are officially termed in the USA, in a use of language reminiscent of Thatcherite ''variations'') must ensure universal access to health care and to income sufficient to meet all basic needs.[4]

The problem with applying the method of Cole and colleagues more widely is the paucity of evidence on which their modelling depends for quantification of heath impacts. Health impact assessment prompts scientific questions for which there is little evidence to provide adequate answers. For example, there is a vast literature on inequalities and health but it is difficult to quantify the effect of added income on health. Even where there is excellent evidence for a causal relation, quantifying the difference an intervention is likely to make is fraught with difficulties. These are reduced but not abolished when a change model is used.[5] Such questions cannot be answered using cross sectional surveys. In this instance, one needs to know the effects on health of a change in income, studying the same individuals. This may differ from the postulated effects extrapolated from differences in health between individuals, or groups, with different incomes.

Mathematical modelling is well established in infectious disease epidemiology[6] but is seldom applied to non-communicable diseases or global measures of health or health inequalities, despite its great potential. Problems are threefold. Two—lack of research funding to examine health impacts of non-healthcare policies and the lack of interest of most major journals in publishing public health research—are compounded in the UK by the Research Assessment Exercise that has led to a dearth (or death?) of academic public health posts and research. The third is the lack of studies of interventions to underpin modelling research. This is both the most important and would be the easiest to address, given political will and the accompanying funding.

What is needed to take forward this type of research? Firstly, good quality primary studies on the effects of change.[5] Even where there is good evidence of a causal relation, reversibility cannot be assumed[7]: as a quantified illustration, the magnitude of the effect of a rise or a fall in cigarette price on cigarette consumption (the elasticities) differ.[8] In relation to socioeconomic inequalities, while cross sectional studies of unemployment and health are subject to direct and indirect selection effects,[9] factory closure studies overcome this problem,[10] but do not directly answer the question, ''how much health gain would be expected from the creation of a certain number of jobs?''—which arises frequently in the context of health impact assessment.

In the UK, the 2004 Wanless Report lamented the lack of evidence of cost effectiveness of interventions to improve population health.[11] Where such evidence does exist, almost all focuses on individual level interventions, yet health impact assessments consider projects, programmes, or policies that affect whole populations or significant groups. Explaining the health effects of interventions requires a robust study design that is able to answer the question asked[12] but it does not require that the researchers initiate or implement the intervention whose effects are being examined. Wanless suggested that a useful design is to exploit opportunities of ''natural experiments''[11]; for example, there is good evidence of some income redistribution in the UK in the past seven years, but so far there seems to be no interest in assessing the health impact, even though it is likely to reflect well on the government. It remains to be seen whether the UK or other governments and funders of research will become interested in the type