



Conference on ‘Food and nutrition security in Africa: new challenges and opportunities for sustainability’

Nutrition and cancer – global and African perspectives: a focused update

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The burden of cancer worldwide is predicted to almost double by 2030 to nearly 23 million cases annually. The great majority of this increase is expected to occur in less economically developed countries, where access to expensive medical, surgical and radiotherapeutic interventions is likely to be limited to a small proportion of the population. This emphasises the need for preventive measures, as outlined in the declaration from the United Nations 2011 High Level Meeting on Non-communicable Diseases. The rise in incidence is proposed to follow from increasing numbers of people reaching middle and older ages, together with increasing urbanisation of the population with a nutritional transition from traditional diets to a more globalised ‘Western’ pattern, with a decrease in physical activity. This is also expected to effect a change in the pattern of cancers from a predominantly smoking and infection dominated one, to a smoking and obesity dominated one. The World Cancer Research Fund estimates that about a quarter to a third of the commonest cancers are attributable to excess body weight, physical inactivity and poor diet, making this the most common cause of cancers after smoking. These cancers are potentially preventable, but knowledge of the causes of cancer has not led to effective policies to prevent the export of a ‘Western’ pattern of cancers in lower income countries such as many in Africa.

Nutrition: Cancer: Urbanisation: Demographic transition: Nutrition transition

The WHO estimates that worldwide cancer mortality will rise from about 8.2 million deaths in 2012, to 8.7 million in 2015 and 12.6 million in 2030⁽¹⁾. This 45 % increase is largely due to increasing numbers of people living to older ages, when cancers are most common. In Africa, WHO estimates that between 2015 and 2030, the number of cancer deaths will rise from about half a million (5.3 % of all deaths) to nearly 1 million (8 % of all deaths). This disproportionate increase is mainly attributable to the expected demographic trends, but also to changes in health behaviours associated with urbanisation of previously rural populations (the nutrition and epidemiological transitions). These transitions are also expected to change the pattern of cancers from one dominated by smoking and infection related cancers (lung, cervix and liver) to one additionally burdened by cancers related to increasing body fatness and

reduced physical activity (breast, colon, oesophageal adenocarcinoma).

Alone, these increasing rates represent an overwhelming health burden for populations with little resource to address it. The costs of cancer treatment with chemotherapy, radiotherapy, surgery and other investigations and treatments place it beyond the realistic accessibility of all but the few most wealthy people. Consequently, the fatality rate of common cancers in low-income countries far exceeds that in high-income countries by approximately 2-fold, for example with a ratio between incidence and mortality for breast cancer of 2.5 compared with 4.2. Five-year survival from breast cancer is 12 % in the Gambia, compared with 80 % in China or Singapore.

This emphasises the critical role that prevention has in tackling the future burden of cancer, as identified in the

Abbreviations: WCRF, World Cancer Research Fund.
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United Nations 2011 High Level Meeting on Non-communicable Diseases⁽²⁾. Although smoking remains the greatest single preventable cause of cancer worldwide, increasingly nutritional factors are recognised as major contributors to cancer incidence and mortality.

Nutrition and cancer

Patterns of cancer vary widely around the world. For instance, breast cancer age standardised incidence in 2012 was 92 per 100 000 in North America, compared with 34 per 100 000 in sub-Saharan Africa. Colon cancer varies from 30 per 100 000 in Europe to 6 per 100 000 in sub-Saharan Africa, whereas cervical cancer is 35 per 100 000 in sub-Saharan Africa compared with 11.4 per 100 000 in Europe. In North America, liver cancer incidence is 4 per 100 000, only half that in North or sub-Saharan Africa⁽¹⁾. In theory, there are various reasons for this variation, including environmental factors and fixed genetic predisposition, but several pieces of evidence point strongly to a dominant environmental cause.

A remarkable feature of these geographic variations is their plasticity. When populations migrate between regions, their cancer patterns rapidly assume that of the host region. The well-studied migration of Japanese from Miyagi to Hawaii in the late 1960s showed a transformation within two generations from the then typical Japanese pattern of low breast and colon cancer, and high stomach cancer, to that typical of Hawaii, with high breast and colon cancer rates, and low stomach cancer⁽³⁾. Such rapid changes cannot be due to wholesale genetic drift in these populations, but they strongly implicate environmental factors as the dominant determinant of cancer patterns. Clearly there are genetic and other fixed factors that determine individual susceptibility to different cancers, and consequently the individuals within a population who eventually develop cancer, but these cannot be the cause of the rapid changes in observed patterns among populations. In addition, changes in cancer incidence within countries may be too rapid to ascribe to genetic change and clearly implicate environmental factors. For instance, colon cancer incidence in Japan increased more than 5-fold between 1960 and 1995 from about 10 to over 50 per 100 000.

Both epidemiologic and experimental evidence point to nutritional factors (diet, nutrition state including body composition, and physical activity) as important environmental factors that influence cancer risk. Experimental evidence has identified several components of food, including but not limited to essential micronutrients that can critically influence cell division, differentiation and apoptosis, and render cells more or less likely to accumulate genetic change that can manifest as the phenotypic hallmarks of cancer. In addition, there is increasing evidence that the internal milieu associated with obesity and the metabolic syndrome can itself promote the abnormal cell growth that characterises carcinogenesis.

Epidemiologic studies over decades have identified many potential links between nutritional exposures

related to diet, anthropometric measures or physical activity and risk of various cancers. Because of inconsistencies in the results of different studies, and in the face of rapidly increasing amount of data, World Cancer Research Fund (WCRF) International embarked on a major project to synthesise and summarise the evidence. A series of systematic reviews, using a novel method developed by an independent working group convened by WCRF, including epidemiology as well as experimental evidence, was conducted by independent academic institutions in the UK, USA and continental Europe. The resulting reviews were then judged by a Panel of independent experts from around the world. The resulting report Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective, was published in 2007⁽³⁾. This report is widely regarded as the most authoritative review of the topic available.

The Panel identified several nutritional exposures judged to be probable or convincing causes of, or protective factors against, different cancers. As increasing body fatness was found to increase risk of several cancers, they also identified nutrition and physical activity exposures that were judged causal factors in the development of overweight and obesity. Based on these conclusions, the Panel made recommendations for cancer prevention, synthesising the reductionist approach implicit in the scientific literature into a more holistic pattern of diet, nutrition and activity.

The recommendations can be summarised as follows: be as lean as possible within the healthy weight range; avoid energy dense foods and drinks that promote weight gain; be physically active as part of everyday life; eat plenty of plant foods (wholegrain, pulses, vegetables and fruit); eat modest amounts of red meat and avoid processed meat; limit intakes of alcohol and salt; avoid dietary supplements for cancer prevention; infants to be breastfed and mothers to breastfeed; for cancer survivors, follow the recommendations for cancer prevention as far as possible.

The most substantial impact was judged to be that related to the linked exposures of body fatness and physical activity, which influence risk of cancers of the colorectum, breast, oesophagus (adenocarcinoma), pancreas, kidney, endometrium and gallbladder. In addition, vegetables and fruit probably protect against upper aerodigestive cancers, whereas high dietary fibre intake protects against colorectal cancer. High intakes of red and processed meat increase risk of colorectal cancer. Alcohol increases risk of upper aerodigestive cancers, as well as cancers of the breast, liver and colon. The advice against dietary supplements is explicitly in relation to chronic disease prevention, specifically cancer. The studied dietary supplements have generally failed to reduce cancer risk and have sometimes unexpectedly increased it. This does not affect other uses of dietary supplements, such as to assure micronutrient adequacy in the nutritionally compromised or for women in the earliest stages of pregnancy to prevent neural tube defects.

Since the publication of the report in 2007, the evidence is being updated for WCRF International by a



team at Imperial College London. These updated reviews, conducted according to the same robust process as for the 2007 Report, are judged by an independent Panel, and the updated reports published as part of the WCRF International Continuous Update Project⁽⁴⁾. These updates have largely confirmed or strengthened the conclusions from 2007, but also have identified excess body fat as a cause of some types of ovarian cancer.

Therefore the pattern of diet and activity that is protective against cancer (high in relatively unrefined plant foods, with modest amounts of meat but little or no processed meat, and limited amounts of alcohol, and salty, fatty or sugary foods, allied with a generally physically active lifestyle) is similar to that recommended for prevention of other chronic diseases (CHD, diabetes, obesity).

Demographic and nutritional patterns in Africa

Until the mid-1990s, life expectancy was increasing in all regions of Africa, in parallel with, although lower than, other parts of the world (approximately 50 years compared with 70–80 years in 2005–2010)⁽⁵⁾. This trend has continued in most regions of Africa except Southern Africa, mainly due to the impact of HIV/AIDS.

In the developing world, Africa has experienced the highest urban growth during the past two decades at 3.5% per year and this rate of growth is expected to hold up to 2050. Projections also indicate that between 2010 and 2025, some African cities will account for up to 85% of the population. In 2010, the share of the African urban population was about 36% and is projected to increase to 50 and 60% by 2030 and 2050, respectively⁽⁶⁾.

Patterns of diet and activity vary enormously across the African continent. In particular, Northern Africa has a pattern that is similar to that found in Middle Eastern countries, whereas sub-Saharan Africa shows a pattern of traditional diets based on local starchy staples, and often marginal in micronutrients. South Africa shows a mixed picture between a more European pattern and traditional African diets. However, the broad trend to urbanisation brings a change from these traditional patterns to a more globalised diet, with increasing international food outlets, and reduced active living. There has been an increase in BMI in both rural and urban areas, but BMI is consistently higher on an average in urban populations compared with rural populations.

The consequence of these changes will increase the rates of those cancer common in high-income countries, as well as other diseases such as diabetes and CVD, due to increasing life expectancy, increasing BMI and a more 'Western' dietary pattern higher in meat and lower in plant foods. Because these changes are in process and not yet embedded, there is at least in theory scope to introduce policies to reduce the impact of the demographic changes on nutritional state and rates of cancer and other chronic disease⁽⁷⁾.

Therefore not only is the burden of cancer in Africa projected to increase dramatically, mainly due to demographic changes, but also the pattern is expected to change the following nutritional and rural urban transitions. Conversely there is no projected decrease in infection related cancers in the short term, leading to a particular kind of double cancer burden.

Potential policy options

The question arises whether the projected scenario is inevitable, or whether these impacts can be mitigated. In high-income countries, the effects of sedentary living and higher-energy diets promoted through international food outlets and other changes has led to an embedded situation where the environment is conducive to sedentary living and overconsumption of energy, with ever increasing rates of obesity and its complications, even among children.

Governments in these countries have tended to focus on encouragement of individuals within their populations to adopt healthier habits, as the cornerstone of policy to address these changes. Although healthier habits are taken up by some in the population, often those more affluent and educated, such policies have failed to impact on the general tendency within the population as a whole, and to some extent may have widened inequalities.

It is important to understand the main drivers of the behaviours of populations as a whole, as well as individuals within them. A systematic review of such determinants was performed by WCRF leading to their 2009 companion report to the 2007 report, Policy and Action for Cancer Prevention⁽⁸⁾. This review found that while personal factors (such as knowledge, attitudes and beliefs) that are influenced by policies based on providing education and information can impact on behaviour, the size of effect is small. Such policies may be taken up by some people and influence how much they are able to maintain a healthier pattern of behaviour than the norm, but they do not importantly influence the norm.

It is the norm, the embedded usual pattern of behaviour, that provides the default which most people, if they are not determined to be different, adopt. The evidence reviewed for the WCRF Policy Report identified that the norm is most importantly influenced by environmental factors out of the personal control of most people. Such factors may be local (such as the local urban environment) or national (such as the prevailing food retail industry) or even international (such as European or global food systems). These social, political, environmental and economic factors are experienced by people as making healthy choices more, or less, accessible, available or affordable, and are the key drivers of the usual pattern of behaviour in a population, around which personal factors may influence individual variation.

The WCRF Policy Report, and subsequently the WCRF International policy programme, has identified several examples of policies that have been effective in



influencing these environmental determinants of behaviour, and these are described in the WCRF NOURISHING framework and archive⁽⁹⁾.

It is therefore possible for governments in Africa to develop policies that might mitigate the projected adverse impact of demographic and nutritional change on the burden of cancer and other chronic diseases, before they occur. Any such policies would need to consider economic consequences, but the adverse economic impacts of ill-health are substantial as well.

The evidence suggests that success in achieving impact on behaviour comes when there is synergy between the various factors that determine the environment, from government and industry, through the third sector and health and other professionals, and institutions such as schools, to people themselves. Such synergy requires leadership, principally from health professionals. There is therefore a critical need to build capacity in nutrition and health, as well as in vital information gathering through establishment of cancer registries, as a basic requirement for developing effective policies to maintain and promote healthy behaviours throughout Africa as it undergoes economic growth and development.

Financial support

None.

Conflicts of Interest

None.

Authorship

M. J. W. conceived and wrote the manuscript.

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