

# Nutrition and prevention of chronic diseases: a unifying eco-nutritional strategy

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## Abstract

*Increasing efforts are being made to address, in public health policy (PHP), both the persistence of nutritional deprivation in economically disadvantaged communities, and the increase in so-called “chronic disease” (abdominal obesity, diabetes, cardiovascular disease, certain cancers, osteoporosis, arthritides, and inflammatory disease) in communities at all stages of economic development. The problems in the “chronic disease” descriptor are that its origins may be as early as conception, rather than during the postnatal lifespan, or even in previous generations; it may appear abruptly or slowly; and it may be amenable to environmental and behavioural intervention well into its course and in older age groups. It is also not necessarily “non-communicable”, a qualifier often used for “chronic disease” (chronic non-communicable disease or CNCD) and often has inflammatory features, for example the inflammatory marker C-reactive protein is a predictor of macrovascular disease and ischaemic events can, in part, be prevented in the affected by influenzal vaccination. The nexus between immunodeficiency, inflammatory processes and nutritional status which is characteristic of “infective” and food-borne illness, is also more and more evident in “chronic disease”. It may be more helpful to consider “chronic disease” as “eco-disease” with*

*its environmental and behavioural contributors, and to regard that which is clearly nutritionally dependent as “eco-nutritional disease”.*

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## Introduction

Our understanding of the nature of disease and well-being is changing rapidly. Older terminology may need to give way to newer terminology if we are to tackle human health needs in a contextual and cohesive way (1).

### Chronic disease

By “chronic disease” we generally mean that kind of disease which may or may not be abrupt at the time in its expression, but whose impact lasts longer than days or weeks and which may be recurrent, as well as lasting. It is exemplified by obesity (especially abdominal obesity), the macrovascular diseases (MVD) (of medium and distributing arteries) and the consequences of ischaemia on end organs (like heart, brain, kidney, reproductive organs, and limbs), impaired fasting glycaemia (IFG) and diabetes, certain cancers (notably lung, breast, colorectal, prostate and skin), osteopenia and osteoporosis with fracture, the arthritides (especially osteoarthritis) and impaired cognition and dementia. These may be manifest in communities, irrespective of income, although they are generally first evidenced in high income communities with demographics relatively more aged. Whilst chronic diseases have characterized older more affluent people, they are increasingly affecting younger people (especially insofar as obesity and its consequences are concerned) and the

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socio-economically disadvantaged, notably communities in transition (2-7).

There has been a tendency to refer to these diseases as “non-communicable”, as though they were unrelated to infectious disease. Increasingly, it is recognised that chronic disease may have infective contributors - viral in obesity (8, 9); bacterial and possibly viral (10) in atherosclerosis (11) and inflammatory processes in most. Indeed, risk factors for atherosclerotic macrovascular disease now include inflammatory markers like erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), which may be a more potent risk factor than lipoproteins (9, 10, 12-15).

“Over-nutrition” was thought to presage chronic disease, and “under-nutrition” infective disease, but now we know this is not as clear-cut. Both may alter immune function unfavourably with various health consequences for infective and non-infective illness. Under-nutrition may predispose to “chronic disease” (as well as communicable disease) and include that of amino acids (like arginine, important for arterial function) (16), micronutrients (like vitamins B<sub>6</sub>, B<sub>12</sub> and folic acid leading to homocysteinaemia, thrombosis and arterial damage) (17) and phytochemicals (which are required from a spectrum of foods for at least their antioxidant, if not other, properties to protect tissues from chronic disease) (18), as described above. However, it should be observed that even under-nutrition of the protein-energy malnutrition (PEM) kind, or reflected in growth retardation, is rarely short-lived and usually chronic.

Operationally, “over-nutrition” often represents positive energy balance on the basis of physical inactivity, rather than over consumption (although this may, of course, occur because of eating pattern, large serving size, or high food energy density).

These various considerations have led to the over-arching health policy advice by organisations like Nutrition Australia (the Australian Nutrition Foundation) for “Optimal Health through Physical Activity and Food Variety” (<http://www.nutritionaustralia.org>).

#### *Burden of Chronic Disease*

The Burden of Chronic Disease mainly comprises:

- malnutrition (which may extend from conception to old age);
- immunodeficiency and recurrent infection;
- cardiovascular disease (CVD);
- neoplastic disease;
- metabolic, especially cumulative positive energy balance:
  - over-fatness with insulin resistance;

- loco-motor disease:
  - osteoporosis,
  - sarcopenia (reduced skeletal muscle mass) (19);
- arthritis;
- central nervous system (CNS) disease:
  - mood,
  - cognition,
  - stroke.

An increased ability to measure disability and the burden of disease and how it affects healthy longevity is now reflected in Disability Adjusted Life Expectancies (DALES) (19). The top and bottom 10 countries are shown in Table 1.

Food Based Dietary Guidelines (20, 21) acknowledge the importance of incorporating the best available nutrition science and evidence into identifiable food cultural settings for health advancement. This is now progressing at the community, national and international levels. Such guidelines encourage both food adequacy and the use of quality food and food patterns which are safe and nutritious (generally nutrient-dense and low in energy density).

A wide range of factors, other than genetic, play a role in the development of chronic disease and its contribution to DALES:

- food;
- physical activity;
- inflammatory processes;

**TABLE 1**

The leading and most disadvantaged disability adjusted life expectancies [Disability Adjusted Life Expectancies (DALES)] (19).

Top 10		Bottom 10	
Member state	DALE (years)	Member state	DALE (years)
Japan	74.5	Ethiopia	33.5
Australia	73.2	Mali	33.1
France	73.1	Zimbabwe	32.9
Sweden	73.0	Rwanda	32.8
Spain	72.8	Uganda	32.7
Italy	72.7	Botswana	32.3
Greece	72.5	Zambia	30.3
Switzerland	72.5	Malawi	29.4
Monaco	72.4	Niger	29.1
Andorra	72.3	Sierra Leone	25.9

- substance abuse (tobacco, alcohol, medication);
- social factors;
- economic factors.

The role of physical activity (both aerobic and strength-training) (22, 23, 24) is of crucial importance to public health as it:

- allows adequate and appropriate food and nutritive substance intakes, without over-fatness;
- discourages substance abuse (like smoking and alcohol);
- encourages social activity;
- enhances CNS function (cognition and mood);
- helps maintain reserve capacity (cardio-respiratory, locomotor);
- reduces certain neoplastic disease processes (colon cancer, breast cancer, prostate cancer);
- provides eco-system contact with, amongst other benefits, engagement with nature, and appreciation of sustainability.

For these and other reasons, regular physical activity increases survival and compresses morbidity towards the end of longer lives (25).

The growing interest in inflammatory processes in chronic disease, for which CRP is an indicator (10, 11, 26, 27) raises the prospect that food with antiinflammatory properties (containing, for example n-3 fatty acids, salicylates and the rosmarinic acid family of compounds in, respectively, fish and flaxseed, certain fruit, and culinary herbs) (28, 29) may be an option in chronic disease prevention (30).

Marmot has identified a sense of personal control (31, 32) as of importance in protection against chronic disease. More broadly, social activity (33) and social networks (34, 35) are consequential.

The Food Habits in Later Life (FHILL) study of the IUNS points to the ongoing importance of food culture, social activity and physical activity, along with substance abuse in later life (36).

#### *The sources of chronic disease - eco-nutritional disease*

The problem with the term “chronic disease” is that it says nothing about aetiology or pathogenesis.

When considering the major importance of food (its variety and the requirement for biodiversity), movement (in safe, pleasurable and sustainable precincts) and the required “environmental buffer zones” to minimise the risk of known and emerging transmissible pathogens, the logic of describing chronic disease as “eco-nutritional disease” becomes apparent (37, 38). Even dependence on substances like tobacco and alcohol is less likely where the environment itself provides fulfilling and less stressful experiences (37).

#### *Public health policy (PHP)*

In the formulation of PHP, there are a number of considerations:

- that there be a focus on community development and this includes:
  - a) education programmes,
  - b) health programmes,
  - c) economic initiatives,
  - d) environmental strategies.

A persuasive example of these considerations would be education (traditional and formal) about the value of food (and plant medicinals) and physical activity (including gardening) to contribute to health programmes in ways more cost-effective than patented drugs, and offering sustainable environments;

- that there be targets for PHP which would favour community development (Table 2);
- eco-nutrition can provide a framework for PHP. Here the dynamic of “Health  $\Leftrightarrow$  Environment” is operative and encourages a sustainable food supply for physically active people;
- newer technologies have much to offer PHP. They include:
  - a) bio-technology,
  - b) food technology,
  - c) information technology,
  - d) biomedical engineering.

#### *A PHP re-format for sustainable community development*

The key elements of future PHP, leading to successful ageing, will be that it:

- takes account of antecedent generations;
- starts at conception;
- requires healthy environments;

**TABLE 2**  
Public health policy targets related to community development.

Community development	Target
In education	Maternal literacy
In health	Culture and beliefs Physical activity Social activity
Economic	Governance Democracy
Environmental	Sustainable food supply Safe and healthy precincts and accommodation

- recognises that women are pivotal in regard to their economic status, literacy and health;
- includes the whole community;
- takes a whole-of-life and whole community approach to chronic or eco-disease so that sustainable solutions may be found for well-being, health and survival.

## Conclusions

Our genes have not changed significantly in recent generations, but the ways in which they are expressing themselves have changed in profound ways. Whereas macrovascular disease (affecting the large and distributing arteries and their territories - heart, brain, limb, kidneys, eyes, genitalia); obesity; insulin resistance, type 2 diabetes and their complications; certain cancers like lung, breast, prostate, pancreatic, colo-rectal; osteopenia and osteoporosis; musculo-skeletal disease, like osteo-arthritis; neuro-degenerative disease like Alzheimer's; and mood disorders, like depression, were scarcely in evidence 2-3 generations ago, they are now the leading causes of morbidity and mortality in economically advantaged communities, and form part of the "double-burden of disease" (which includes nutrient and other food component deficiencies) in individuals, families and communities worldwide.

There can be a measure of chronicity about these health problems, especially as they may unfold on a background of partly-definable "risk factors", in populations where life expectancy is actually elongating and where there is more opportunity for these problems to express themselves. Their emergence raises fundamental questions about how certain factors which affect our health may act to both advantage and disadvantage, differentially at different life points from conception to grave, and how, increasingly, we must finesse the way we live and pay heed to our environment to achieve optimal health and well-being with longevity. For example, an abundant food supply may provide enough energy intake to spare us from stunting and premature death due to energy malnutrition, but not from obesity and its adverse sequelae later in life. Questions about nutritional status at conception, *in utero*, during growth, through puberty, and in adolescence; the quality, and not just the quantity of the food we eat, as well as eating patterns and the social role of food loom larger than before. Energy balance, predicated on physical activity and muscle mass and strength, and not just energy intake, is more precarious with the advent of sedentariness. And substance abuse - tobacco, alcohol, medication and more - now assumes greater relevance. Moreover, where we live and in what eco-system, how polluted or

intact or resilient it is; how our food is grown, how the animals we eat are fed, how the food is transported, stored, processed and cooked are all important when these factors have time enough to operate, and when the systems are undergoing substantial and rapid change in ways which we may not have understood or have been able to manage in ways conducive to health.

These factors form the basis of an alternative eco-nutritional way of describing chronic disease (39).

## References

1. Wahlqvist ML (2002) Chronic disease prevention: A life-cycle approach which takes account of the environmental impact and opportunities of food, nutrition and public health policies - the rationale for an eco-nutritional disease nomenclature. *Asia Pac J Clin Nutr* 11 (suppl): S759-S762
2. Popkin B, Horton S, Kim S (2001) The nutrition transition and prevention of diet-related chronic diseases in Asia and the Pacific. Asian Development Bank, Manila
3. Kouris-Blazos A, Wahlqvist ML (2002) Food and nutrition policies in the Asia Pacific Region: nutrition in transition. In: *Food and nutrition in Australia*. Allen and Unwin, Sydney, pp 575-598
4. Popkin B (2001) Report on activities in Third Year of the Task Force on the Nutrition Transition. IUNS Nutrition and Transition Committee Report, [www.iuns.org](http://www.iuns.org)
5. Popkin BM (2002) An overview on the nutrition transition and its health implications: The Bellagio meeting. *Publ Health Nutr* 5: 93-103
6. Popkin BM (2002) The shift in stages of the nutrition transition in the developing world differs from past experiences. *Publ Health Nutr* 5: 205-214
7. Misra A, Athiko D, Sharma R, Pandey RM, Khanna N (2002) Non-obese hyperlipidemic Asian northern Indian males have adverse anthropometric profile. *Nutr Metab Cardiovasc Dis* 12: 178-183
8. Dhurandhar NV, Israel BA, Kolesar JM, Mayhew G, Cook ME, Atkinson RL (2001) Transmissibility of adenovirus-induced adiposity in a chicken model. *Int J Obes Relat Metab Disord* 25: 990-996
9. Festa A, D'Agostino R Jr, Williams K, Karter AJ, Mayer-Davis EJ, Tracy RP, Haffner SM (2001) The relation of body fat mass and distribution to markers of chronic inflammation. *Int J Obes Relat Metab Disord* 25: 1407-1415
10. Gurfinkel EP, de la Fuente RL, Mendiz O, Mautner B (2002) Influenza vaccine pilot study in acute coronary syndromes and planned percutaneous coronary interventions: the Flu vaccination acute coronary syndromes (FLUVACS) study. *Circulation* 105: 2143-2147
11. Danesh J, Collins R, Peto R (1997) Chronic infections and coronary heart disease: is there a link? *Lancet* 350: 430-436

12. SoRelle R (2002) Cardiovascular News. *Circulation* 105: 9081e-9082e
13. SoRelle R (2002) Cardiovascular News. *Circulation* 105: 9067e-9068e
14. Espinola-Klein C, Rupprecht HJ, Blankenberg S, Bickel C, Kopp H, Rippin G, Victor A, Hafner G, Schlumberger W, Meyer J (2002) Impact of infectious burden on extent and long-term prognosis of atherosclerosis. *Circulation* 105: 15-21
15. Ridker PM (2002) On evolutionary biology, inflammation, infection, and the causes of atherosclerosis. *Circulation* 105: 2-4
16. Wu G, Meininger CJ (2000) Arginine nutrition and cardiovascular function. *J Nutr* 130: 2626-2629
17. Welch GN, Loscalzo J (1998) Homocysteine and atherothrombosis. *N Engl J Med* 338: 1042-1450
18. Wahlqvist ML, Wattanapenpaiboon N, Kannar D, Dalais F, Kouris-Blazos A (1998) Phytochemical deficiency disorders: Inadequate intake of protective foods. *Current Therapeutics* July: 53-60.
19. Mathers CD, Sadana R, Salomon JA, Murray CJL, Lopez AD (2001) Healthy life expectancy in 191 countries, 1999. *Lancet* 357: 1685-1691
20. World Health Organization (Member: ML Wahlqvist) (1998) Preparation and use of food-based dietary guidelines. Report of a Joint FAO/WHO Consultation (1995: Nicosia, Cyprus). World Health Organization, Geneva
21. Wahlqvist M, Worsley T, Harvey P, Crotty P, Kouris-Blazos A (1997) Food-based dietary guidelines for the Western Pacific: Nutrition in transition. World Health Organization, Manila.
22. Fiatarone MA, O'Neill EF, Ryan ND, Clements KM, Solares GR, Nelson ME, Roberts SB, Kehayias JJ, Lipsitz LA, Evans WJ (1995) Exercise training and nutritional supplementation for physical frailty in very elderly people. *N Engl J Med* 330: 1769-1775
23. Savage G, Wahlqvist ML, Lee D, Snelson B (2002) Age fit. Pan MacMillan, Sydney.
24. Hills AP, Wahlqvist ML (1994) Exercise and obesity. Smith-Gordon & Co Ltd, London
25. Fries JF (1996) Physical activity, the compression of morbidity, and the health of the elderly. *J R Soc Med* 89: 64-68
26. Bachmaier K, Neu N, de la Maza LM, Pal S, Hessel A, Penninger JM (1999) Chlamydia infections and heart disease linked through antigenic mimicry. *Science* 283: 1335-1339.
27. Libby P, Egan D, Skarlatos S (1997) Roles of infectious agents in atherosclerosis and restenosis: an assessment of the evidence and need for future research. *Circulation* 96: 4095-4103.
28. Shetty K, Labbe RG (1998) Food-borne pathogens, health and role of dietary phytochemicals. *Asia Pac J Clin Nutr* 7: 270-276.
29. Shetty K (1997) Biotechnology to harness the benefits of dietary phenolics; focus on Lamiaceae. *Asia Pac J Clin Nutr* 6: 162-171
30. Steward SH (2002) Alcohol and inflammation: a possible mechanism for protection against ischemic heart disease mortality. *Nutr Metab Cardiovasc Dis* 12: 148-151
31. Levi L, Bartley M, Marmot M, Karasek R, Theorell T, Siegrist J, Peter R, Belkic K, Savic C, Schnall P, Landsbergis P (2000) Stressors at the workplace: theoretical models. *Occup Med* 15: 69-106
32. Marmot M (1999) Importance of the psychosocial environment in epidemiologic studies. *Scand J Work, Environ Health* 25 (suppl 4): 49-53
33. Welin L, Tibblin G, Svardsudd K, Tibblin B, Ander-Peciva S, Larsson B, Wilhelmsen L (1985) Prospective study of social influences on mortality. The study of men born in 1913 and 1923. *Lancet* 1: 915-918
34. Isacson A, Hanson BS, Ranstam J, Rastam L, Isacson SO (1995) Social network, social support and the prevalence of neck and low back pain after retirement. A population study of men born in 1914 in Malmo, Sweden. *Scand J Social Med* 23: 17-22.
35. Hanson BS, Isacson SO, Janzon L, Lindell SE (1989) Social network and social support influence mortality in elderly men. The prospective population study of "Men born in 1914", Malmo, Sweden. *Am J Epidemiol* 130: 100-111.
36. Wahlqvist ML, Darmadi-Blackberry I, Savage GS, Kouris-Blazos A, Trichopoulos D. Age-fitness. How achievable with food? IUNS Conference, Vienna, 26-31 August 2001.
37. Wahlqvist ML, Specht RL (1998) Food variety and biodiversity: Econutrition. *Asia Pac J Clin Nutr* 7: 314-319
38. Scott S, Duncan CJ (2001) Biology of plagues: Evidence from historical populations. Cambridge University Press
39. Wahlqvist ML (2002) Eco-nutritional disease or nutrition and chronic disease. (Foreword). *Asia Pac J Clin Nutr* 11 (suppl): S753-754