Original Article

Beyond food and nutrition: How can cities be made healthy?

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Urbanization is one of the predominant demographic trends of the late 20th century, with populations in developing countries moving in ever greater numbers from the rural countryside to cities of all sizes. The nutrition community is logically mostly fixated on issues of intake of foods and determination by nutritional status, and see urbanization and urban populations through that prism. Aside from assorted positive implications for better nutrition and health of urbanization, urban residence can have negative trade-offs including: social deterioration with drugs, crime and homelessness; sedentarism; and chemical, radiation, noise and illumination pollution. Pollution interacts with diet to the extent that there is balancing to be accomplished between the free-radical damage of pollutants and dietary antioxidants. Environmental lead contamination continues to be a problem in Jakarta, Indonesia. Sedentarism and lack of solar exposure in cities has negative implications for bone health, and risks for osteoporosis. Moreover, the processes in rural areas to produce agricultural products for urban populations can produce airborne pollutants that flow to cities, affecting the quality of urban life. Given these considerations, pollution and environmental factors should be added to the alimentary and health-related determinants often placed into the causal models for malnutrition used for planning policy and programs by international agencies.

Key words: acid rain, anemia, antioxidants, bone health, carbon dioxide, environment, free-radical damage, global warming, Indonesia, methane, physical activity, pollution, sanitation, urbanization, water quality.

The assumptions and theme of this meeting are related to chronic or non-communicable disease, and generally the implications of the foods in the diet and the nutritional status they support are the causative or protective factors of interest. The question of interest is whether not only food and nutrition, but also other factors can improve the health of populations. In this situation, the paradigm is that of the urban-dweller in contemporary cities.

Urbanization has been developed as a successful response within social evolution of humankind. The urban system accepted increased complexity but its inhabitants are far more independent from natural phenomena such as climate, soil or weather conditions and live closer to essential facilities (e.g. water, energy, basic need services, communication networks).[1] However, there are trade-off factors of urban residence that limit the benefit of urbanization and may lead to negative consequences for health. These include:

- social deterioration leading to drug abuse, criminality, homelessness;
- lack of physical activity and sedentarism;
- pollution with:
  - inorganic/organic/biological substances
  - radiation
  - excess artificial illumination
  - excess noise.

The increased opportunities in urban life allow individuals more social independence, which may create particular hardships for socially vulnerable groups, notably the very young or old, the ill, the socially stigmatized or the marginalized. Furthermore, the greater social and economic independence of the urban dwellers may lead to a higher risk of social deterioration accompanied with drug abuse, prostitution, homelessness, and criminality.

The pollution factor

Environmental pollution has many faces. Table 1 provides some examples of indirect and direct pollution factors contributing to health deterioration of urban dwellers. According to the statement made by the Asian Development Bank in August 2001, in South Asia alone, every year about 100 000

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Table 1. Examples of indirect and direct pollution factors contributing to health deterioration of urban dwellers

Indirect factors	Direct factors
Global warming	Nitrogen deposition
Ozone layer damage	Organic/heavy metal emission
Acid rain	Indoor air pollution

people die due to air pollution. In particular, the population of large urban conglomerations lives at high health risk of suffering adverse consequences from air pollution. According to the results of a study conducted in São Paulo, Mexico City, Santiago and New York, air pollution from fossil fuels increased death rates in these cities substantially. Figure 1 shows schematically the interactive relationship of chronic diseases to the interaction among the exposure of the population with pollution, episodes of infectious diseases, and food intake. According to this conceptual framework, repeated episodes of infectious diseases[2] and exposure to hazardous pollutants lead to the formation of free radicals which are known to damage cell membranes and DNA. This damage is a trigger for the development of several chronic diseases such as cardiovascular and inflammatory diseases, emphysema, cataracts, and cancer. Environmental pollution plays a very prominent role since the absorbed pollutants lead not only directly to the formation of free radicals but also to the deterioration of immune status, as is the case with chronic intoxications with heavy metals or dioxin, which increases the risk of infectious diseases. As a result, environmental pollution affects rates of chronic diseases both directly and indirectly. Hence, besides inadequate food intake, factors in poor nutritional status include pollution and infectious diseases. However, the formation of free radicals can be reduced or prevented by a diet rich in nutrients (e.g. tocopherols, ascorbic acid, carotenoids, selenium) and non-nutrients (e.g. flavonoids, catechins, phytic acid, polyphenols) antioxidants.

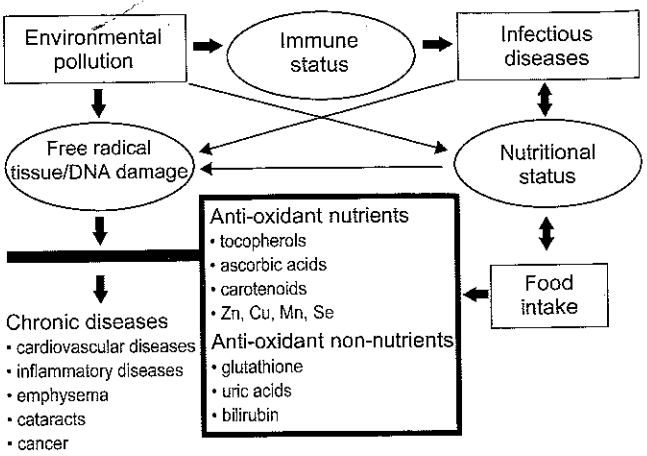

Figure 1. The free radical trap and the anti-oxidant barrier.

The case of the Indonesian capital of Jakarta

The accelerated economic growth during the first half of the 1990s in Indonesia, and in particular in its capital, Jakarta, increased dramatically the establishment of residential, office and manufacturing facilities. However, insufficient investment was made for the control of environmental degradation such as would involve expansion of effective sanitation or garbage collection systems. As the result, between 1989 and 1992, the quality of drinking water in Jakarta decreased and the admission of cases with diarrhea into the hospitals increased. In particular, the water quality was worse and the admission of cases with diarrhea was higher in the lower-income city conglomerations of Jakarta than in the higher-income residential areas. Beyond the microbiological environmental degradation, non-biological (inorganic elemental) pollution is widespread in Jakarta. According to an environmental mapping carried out in 1997, there is a considerable pollution of lead and cadmium in the environment, with one of the mayor lead sources is gasoline since there is still no unleaded gasoline available.[3] As a result, in two each schools from both the richer southern area of Jakarta and the poorer central area, about 20% and 25%, respectively, of the children were found with blood lead levels beyond the limits of safety prescribed by the US Food and Drug Administration recommendations.[4]

In summary, in the metropolitan area of Jakarta, environmental microbiological pollution is one of the major contributing factors for the increase of infectious diseases due to the deprived sanitary facilities and high population density in particular within poor dwellers. However, also non-biological pollutants are widespread, which have negative effects on the immune and nutritional status. The magnitude and severity of environmental pollution is increasing.

Despite the economic growth in the nineties, marginal micronutrient deficiencies were still prevalent in the population of Jakarta.[3] At the same time, overnutrition is increasing in the same population. According to the study of Budiman and Surjadi there were 19.5% overweight fathers and 29.1% overweight mothers in a selected low-income area in Jakarta.[5] Therefore, we can predict that environmental pollution with its consequent infectious diseases will join inadequate nutritional status and Westernising dietary practices as the major factors for a dramatic increase of chronic diseases in the population of Jakarta.

The bone health factor

Life in the cities can be a specific concern for bone health. For most organ systems of the body, except for the skin, oral fossa, and alimentary tract, it is with advancing age that vulnerability for disease and dysfunction sets in. The bony skeleton is a prime example of this principle. What goes wrong with the skeleton is the fracture of the individual bones. This can come about at any age from forceful trauma from a projectile, a heavy blow or collision accident, or in older age, from only a minor fall or even walking across an uneven surface. The consequences are different depending on the site of the fractures. With fractures comes pain (spine,

wrist, hip) disability (wrist, hip) and immobilization (hip). Hip fractures also involve a finite risk of mortality as the bed-ridden older person is at increased risk of respiratory infections and venous thrombosis and embolism from traumatized limbs. With hip fractures also come major expenses within the health care system. Riggs and Melton have projected an annual hip fracture incidence rising to 3 000 000 per year in Asia, Africa, Latin America and the Middle East by the year 2050.[6]

Osteoporosis is a disease of ageing of the bones in which they progressively loose their mineral content and lose the reinforcing strength of their architecture, making them susceptible to fractures with minor trauma. Urbanization is a cocontributory factor to poor bone health in later life. City life is likely to provide lower cumulative sun-exposure through a lifetime. Lesser exposure to solar energy derives from more indoor jobs in urban economies and filtration of sunlight by the layers of smog that often envelope cities. It can be argued that, for skin cancers and cataracts, this lower sun exposure of cities reduces risks compared to rural residents. For bone health, however, this is truly adverse. Adequate vitamin D stores are needed to maximize the mineralization of bone and maintain bony calcification. Generally, it was anticipated that most of the vitamin D for a person's nutritional economy would not come through diet, but through the action of sun.

With indoor pursuits both at home and at work comes a more sedentary lifestyle. Vigorous physical activity is an important conditioner of bone mineralization. Especially beneficial is heavy weight-bearing, which is outside of the pursuits of most urban dwellers, even for labourers, with mechanization in the workplace. Physical labour, sports and recreational dancing, moreover, can provide flexibility and dexterousness that will help avert tripping and falls in later life. Constraints on time and reduction in participation in individual and team sports in favour of television viewing and internet use is setting a pattern of sedentarism for the contemporary urban child and adolescent. Decreased dedication of green areas for parks and recreation and criminality in the streets are additional reasons for reduced physical activity among the poorer segments of the population.

The final bone-damaging exposure of a non-dietary origin is tobacco smoking. In traditional societies, smoking rates are generally higher in urban populations than in the countryside.

Extra-urban influences on health in the city

The presently described issues of acute and chronic diseases for city-dwellers have a basis in exposures that arise within the cities, themselves. Local, informed and concerted actions could, theoretically, empower the populace to alleviate the environmental hazards and behavioural constrains. Residents of urban areas and their health, however, are subject to adverse influences from phenomena originate far away form the cities in which they live.

The respiratory health of Singapore and Kuala Lumpur, two major metropolises on the Malay Peninsula have been damaged in recent years by the smoky fumes of forest fires burning mainly in Sumatra and Kalimantan, islands of the Indonesian archipelago. There, land-clearing (slash and burn) agricultural practices among rural Indonesian peasants was the root cause of the smog and impure air for Singaporean and Malaysian city-dwellers to the north.

For some time satellite images have identified areas of high pollution.[7] However, more recent images have shown that polluted air moves. In the case of tracked carbon monoxide (CO) at a height of about 5 kilometers, the earth's northern hemisphere showed much more CO than the south. The new data indicate, however, that pollution moves on a global scale. About half of all CO emissions is of human origin, and much of this is created in large fires. The lesson learned is that no country escapes from the wrong-doings of others. High concentration of CO originating in Central America or China will, a couple of weeks later, appear in Africa and the United States, respectively.

Another anthropomorphic pollutant is methane.[8] Atmospheric methane has doubled over the past 200 years, and its smothering potency is over 20 times that of carbon dioxide (CO_2). Recent evidence holds that methane (CH_4) is second only to CO_2 in creating a warming greenhouse effect. Methane may even have been responsible for a sudden warming of the Earth by 7°C about 55 million years ago. As most methane is produced biologically, the gas is sometimes associated with bathroom humor. The largest abundance released by the US, however, is created when anaerobic bacteria break down carbon-based garbage in landfills. However, the good news is that methane is much easier to control than CO_2. Therefore, a more effective way to help our planet than trying to restrict your own methane emissions would be to encourage efficient landfill gas management.

Conclusions

Environmental pollution is a major contributing factor for a dramatic increase of non-communicable diseases particularly in urban areas. However, despite its crucial role, little attention has been paid to the importance of nutritional status on its causal and effectual relationship to environmental contaminants.

With respect to the 1997 WCRF report, *Food, Nutrition and Prevention of Cancer: A Global Perspective*,[9] which is the subject of discussion of three of the working-groups of this workshop, a selected number of the goals and guidelines are beyond the nutritive aspects of foods. These include the general no-tolerance proscription of any tobacco consumption as well as the prescriptions to maintain a constant and adequate body weight and for an individual to have a 1.75 physical activity level (total activity 75% above basal metabolism) and for the use of refrigeration for perishable foods, the non-charring of cooked foods, storage of grains so as to avoid mycotoxins, and the limiting of exposures to food additives and pesticide residues. Urban residence implies a different relationship to most of these factors than agrarian life in the countryside. Smoking and urban life has been covered above. The urban constraints on physical activity

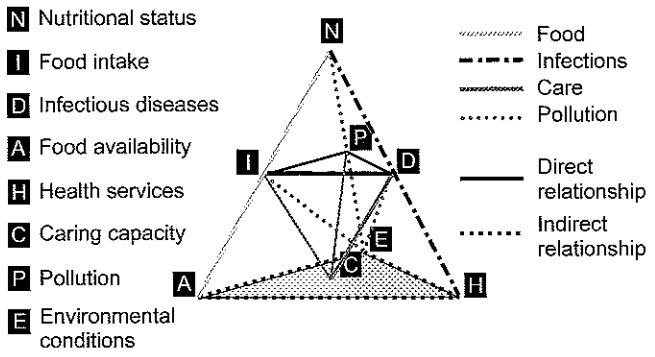

Figure 2. Framework of nutritional status.

make both weight maintenance and protective physical activity levels more difficult. Availability of an electrical current to run refrigeration and indeed to refrigerators themselves is greater in the cities, but economic and cultural factors may curtail their widespread use. Open flame cooking may change to that of gas burners, electrical coils or even microwave energy, for a positive effect on charring, but net flesh consumption may rise in urban life. Ironically, the decisions related to how the grains for the city have been processed and stored and the chemicals added to the food supply may be taken in the cities, applied at the source of production in the countryside, and never even be perceptible for the urban consumer.

In conclusion as shown in figure 2, a third component in the nutrition framework. According to this model, environmental pollution has a direct pathway to nutritional status, which requires high attention in the development and implementation of nutrition policies and strategies.

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