

Introduction

- The Intergovernmental Panel on Climate Change, Fourth Assessment Report states that regional climate change is affecting natural and human environments primarily through the effects of warming temperatures.
- Of concern are the effects of climate-related change and variability on human health. Indigenous Peoples residing in the Arctic region are particularly vulnerable as a result of their reliance on natural resources for sustenance.
- There is evidence that climate-related change and variability is affecting traditional food harvesting and thus may impact the nutrition of Indigenous Peoples.
- Research activities that describe the biological, socio-cultural, and environmental attributes of nutrition are necessary to develop programs and policies that meet and protect the welfare of Indigenous Peoples in a changing climate.

Methods and perspective

- This review is based on published literature accessible via the internet from peer reviewed journals, government reports, and international organizations.
- The search was conducted using the key words “climate change,” “nutrition,” “health,” “Indigenous Peoples,” and “Arctic.”
- This review utilizes an ecosystem approach to human health, also known as Ecohealth, to analyze the results and discuss the potential of ecosystem management to improve human health that is consistent with the New Nutrition Project (fig. 1).

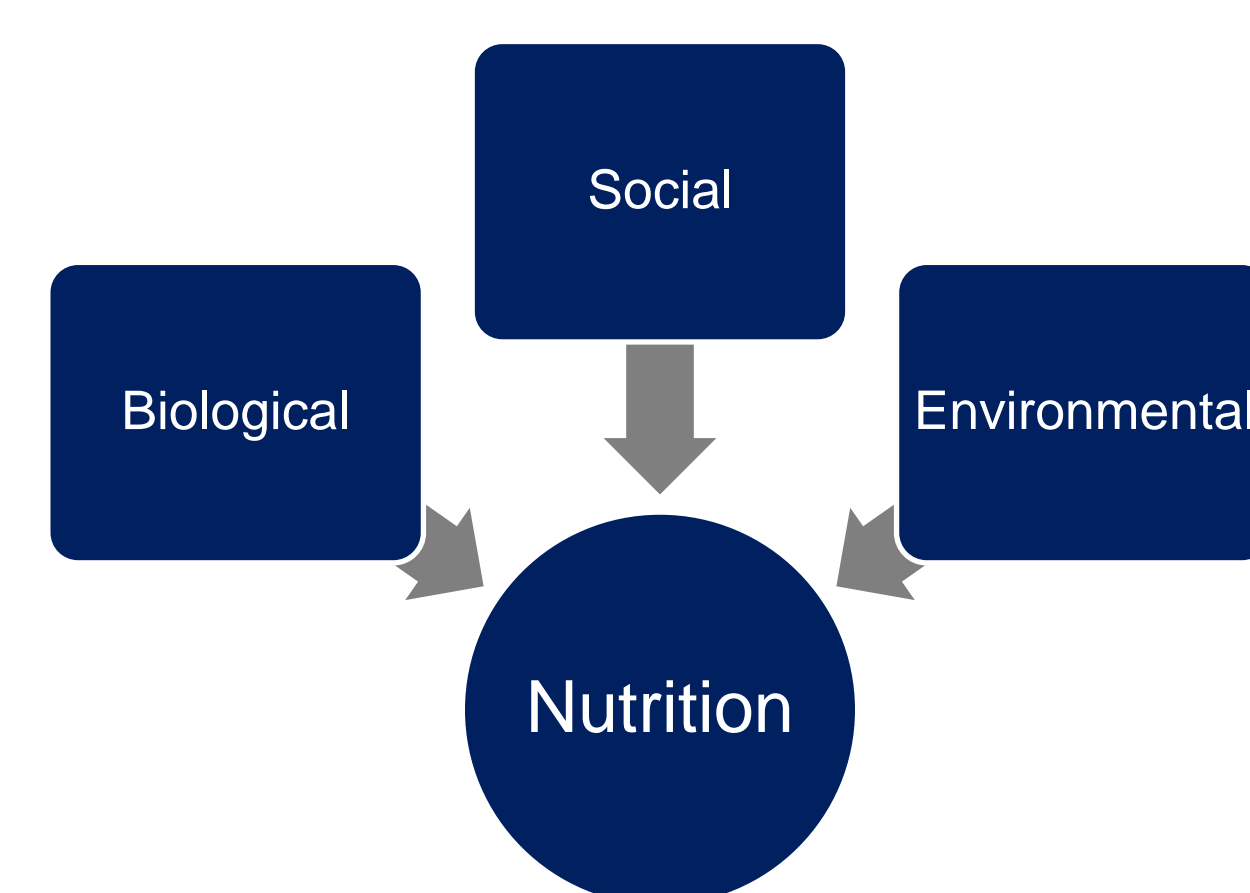


Figure 1. Illustration of the biological, social, and environmental dimensions of nutrition science necessary to meet the challenges and opportunities of the twenty-first century as proposed by The Giessen Declaration and The New Nutrition Science Project .

Results

- The Arctic Climate Impact Assessment sectioned the Arctic region into four sub-regions based on the similarities in climate.
- Sub-region IV includes the Central and Eastern Canadian Arctic and Western Greenland – its climate change impacts on nutrition and related health outcomes are presented below.

Table 1. Impacts on the environmental dimension of nutrition

| Observed | Potential |
|---|--|
| <ul style="list-style-type: none"> • Modifying atmospheric & oceanic currents → increase contaminants in the Arctic food chain • Warmer waters increase mercury methylation in fish & marine mammals • Change incryosphere* • Change in travel, migration & health of species | <ul style="list-style-type: none"> • Increase vulnerability in small, geographically isolated communities with sparse resources • Expand arable land northward due to longer & warmer growing season |

*Cryosphere: snow, glaciers, permafrost, and rivers, lakes, and sea ice

Table 2. Impacts on the social dimension of nutrition

| Observed | Potential |
|---|---|
| <ul style="list-style-type: none"> • Food insecurity due to reduced access to traditional foods • Compound existing economic barriers in accessing traditional foods • Uneven distribution of the benefits & costs of climate change • Increase advocacy for research, programs & policy <ul style="list-style-type: none"> ○ Inuit Circumpolar Conference ○ Arctic Athabaskan Council ○ Gwich'in Council International | <ul style="list-style-type: none"> • Loss of socio-cultural identity, and spiritual health due to reduced harvesting of traditional foods • Exacerbate political infringement on indigenous peoples' rights |

Table 3. Impacts on the biological dimension of nutrition

| Observed | Potential |
|--|---|
| <ul style="list-style-type: none"> • Excess levels of toxic metals from dietary intake of traditional food (marine & terrestrial species) | <ul style="list-style-type: none"> • Elevate exposure to UV → increase risk of UV - immunosuppression resulting from dietary intake of histidine found in fish • Increase diarrheal & infectious diseases resulting from changes in waterborne & foodborne infective agents • Reduce dietary intake of protein, iron, zinc, vitamin C & fiber due to changes in harvesting traditional foods |

Discussion

- Climate change may exacerbate the loss of physical and spiritual health associated with westernization.
- Indigenous Peoples are experiencing nutrition transitions described as the westernization of traditional diets that results from industrialization, urbanization, economic development and globalization.
- An increased westernization that results in a loss of traditional food harvesting and intake may reduce physical activity and diet quality which increases the risk of chronic disease (fig.2).

Relationship between westernized lifestyle and risk of chronic disease

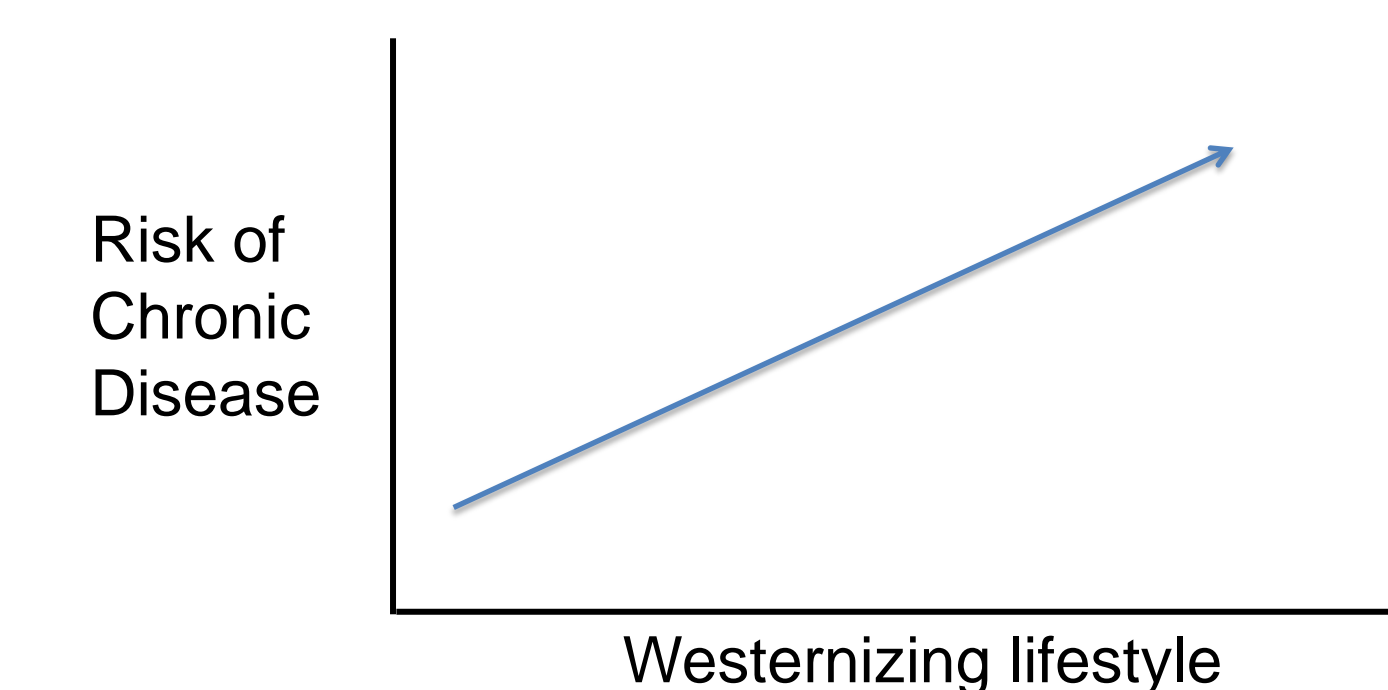


Figure 2. Westernized lifestyle increases the risk of chronic disease (obesity, diabetes, and cardiovascular diseases).

- Across the Canadian Arctic and Greenland, Indigenous Peoples' cultural value in sharing traditional food and knowledge may be protective against these changes.
- Already their collective advocacy via participation in the Arctic Council and past success in reducing contaminants in the Arctic biota demonstrates their international influence that is necessary for climate-related policy and mitigation strategies.
- Measuring the impact of climate change on nutrition and related health outcomes is challenged by a lack of longitudinal data on health and its determinants.
- Thus this analysis made extrapolations from the literature reviewed with particular attention to Indigenous communities' reported observations.



Figure 3. Example of poster used in health education campaign to inform communities about the safety and health benefits of traditional foods in the Northwest Territories of Canada.

Conclusions

- Climate change, with its significant variation in temperature, precipitation, and/or wind that lasts for over a decade is affecting Indigenous Peoples residing in the Arctic region.
- Climate change is projected to affect global food systems and is presently disturbing traditional food systems; thus creating inequitable costs for Indigenous Peoples who rely on both systems.
- An understanding of the biological, social, and environmental dimensions of nutrition will contribute to research, programs and policy that support sustainable food systems and improve human health in a changing climate and environment.

Literature

- ACIA. (2004). *Impacts of a Warming Arctic: Arctic Climate Impact Assessment*. Cambridge, UK: Cambridge University Press.
- Beauman, C., Cannon, G., Elmadfa, I., Glasauer, P., Hoffman, I., & Keller, M., et al. (2005). The Giessen declaration. *Public Health Nutrition*, 8(6A): 673-694.
- Cannon, G., & Leitzmann, C. (2005). The new nutrition science project. *Public Health Nutrition*, 8(6A): 783-6.
- Chan, H.M., Fedruk, K., Hamilton, S., Rostas, L., Coughney, A., Kuhnlein, H., et al. (2006). Food security in Nunavut, Canada: Barriers and recommendations. *International Journal of Circumpolar Health*, 65(5): 416-428.
- Confalonieri, U., Menne, B., Akhtar, R., Ebi, K.L., Hauguey, M., Kovats, R.S., et al. (2007). Human health. In Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J., Hanson, C.E. (Eds) *Climate Change 2007: Impacts, Adaptations and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (pp.391-431)* Cambridge, UK: Cambridge University Press
- Dammen, S., Eide, W.B., & Kuhnlein, H.V. (2008). Indigenous peoples' nutrition transition in a right to food perspective. *Food Policy*, 33: 135-155.
- DePlaen, R., & Kilelu, C. (2004). From multiple voices to a common language: Ecosystem approaches to human health as an emerging paradigm. *EcoHealth*, 1(2): 8-15.
- Deutch, B., Dyerberg, J., Pedersen, H.S., Aschlum, E., & Hansen, J.C. (2007). Traditional and modern Greenlandic food: Dietary composition, nutrients and contaminants. *Science of the Total Environment*, 384(1-3): 106-119.
- Furgal, C., & Prowse, T.D. (2008). Northern Canada; in *From Impacts to Adaptation: Canada in a Changing Climate*, 2007; edited by D.S. Lemmen, F.J. Warren, J. Lacroix, & E. Bush; Government of Canada, Ottawa, ON, pp. 57 – 118.
- Furgal, C., & Seguin, J. (2006) Climate change, health, and vulnerability in Canadian northern Aboriginal communities. *Environmental Health Perspectives*, 114(12):1964-1970
- Guyot, M., Dickson, C., Paci, C., Furgal, C., & Chan, H.M. (2006). Local observations of climate change and impacts on traditional food security in two northern Aboriginal communities. *International Journal of Circumpolar Health*, 65(5): 403-415.
- Hamilton, L., Lyster, P., & Otterstad, O. (2000). Social change, ecology and climate change in 20th century Greenland. *Climate Change*, 47: 193-211.
- Johansen, P., Muir, D., Asmund, G., & Riget, F. (2004). *Contaminants in Traditional Greenland Diet*. National Environmental Research Institute, Denmark. 74pp-NERT Technical Report No. 492.
- Kuhnlein, H.V., Receveur, O., Soueida, R., & Egeland, G.M. (2004). Arctic indigenous peoples experience the nutrition transition with changing dietary patterns and obesity. *The Journal of Nutrition*, 124:1447-1453.
- NCP (2003) *Highlights of the Canadian Arctic Contaminants Assessment Report II*. Minister of Public Works and Government Services Canada, Ottawa, ON.
- Noonan, F.P., & De Fabo, E.C. (1999). UV-B radiation: a health risk in the Arctic? *Polar Research*, 18(2): 361-366.
- Van Oostdam, J., Donaldson, S.G., Feeley, M., Arnold, D., Ayotte, P., Bondy, G., et al. (2005). Human health implications of environmental contaminants in Arctic Canada: A review. *Science of the Total Environment*, 351 (Special Issue):165-246.

For further information

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