

The best of two worlds: how the Greenland Board of Nutrition has handled conflicting evidence about diet and health

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The traditional diet in Greenland consists to a large extent of meat and organs of seal and other marine mammals, which is polluted by POPs and mercury. These substances are present in the blood of Greenlanders in concentrations well above international guidelines, and as these contaminants are suspected of having negative impacts on health, some action should be taken. On the other hand, traditional food is also an important source of health promoting micronutrients that are not provided by imported food in sufficient quantities, for example vitamin D, long chain n-3 fatty acids, and selenium, not to mention the traditional diet's function as a social glue that is perceived as important for Inuit identity in Greenland. The proportion of the total diet that comes from marine mammals is on a constant decrease, and especially children and young adults consume rather little seal and whale. The traditional food items are consequently being replaced by imported food, and among the imported food items several rather unhealthy items are popular, that is carbonated soft drinks with sugar, sweets, chips and farmed (red) meat with a high content of saturated fat. Together with a decrease in physical activity, this dietary transition has resulted in a severe epidemic of overweight and diabetes. In giving advice to the public, the Greenland Board of Nutrition was therefore faced with the challenge to retain the benefits of the traditional diet while minimizing the contaminant exposure, and at the same time to counteract the effects of poor quality imported food. The Board tried to balance the known and suspected positive and negative aspects of the total diet in relation not only to physical health but to general wellbeing, and decided on 10 simple recommendations. As the consumption of traditional food becomes less prominent and as the consumption of food rich in empty calories increases, the guidelines are continuously revised and updated.

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The Greenland Board of Nutrition was re-established in 1997 with the purpose of collecting and documenting information about diet and health and to assist the government with establishing strategic plans for diet and nutrition. One of its original tasks was to balance information to the public about contaminants in the traditional marine diet against general information about a healthy and nutritious diet but the focus has recently shifted towards managing the threatening epidemic of obesity and diabetes. Consequently, in a 2009 revision of its mission the subject area now includes physical activity as well as diet. An added challenge is the perception of the traditional diet as an

important social and cultural glue that binds the Inuit community together.

Material and methods

The overview of the history and actions of the Greenland Board of Nutrition is based on material published by the board including public recommendations and yearly reports and also on the personal experience of one of the authors (GM), who has been chair of the Board since its start in 2004. The data for the analyses of diet and contaminants come from a countrywide population survey in 2005–2009. In brief, a total of 2,971 adult inhabitants (aged 18+) were interviewed, 2,834 Inuit and

137 Danes. Eight towns (population 1,150–14,700) and 10 villages (population 100–425) in Greenland (25% of all communities) were selected as study areas to represent different community sizes and geographical locations. From these 18 communities a random population sample was drawn from the central population register. Pregnant women, persons not born in Greenland or Denmark, and persons who had moved out of the study area were excluded from the sample. Ethnicity as Greenlander or Dane was determined at enrolment in agreement by the interviewer and the participant. The participation rate was 68% for Inuit and 39% for Danes. In addition to the interview, clinical testing and sampling of biological media were conducted. A full description of the study methods is available elsewhere (1). Because of the few Danish participants and their low participation rate, the dietary analyses were restricted to Greenlanders who anyway make up 90% of the population.

Information on diet was obtained by an interviewer administered food frequency questionnaire (FFQ) with portion sizes. Information was obtained from 2,926 of the 2,932 Inuit participants (99.8%). The FFQ was developed from information obtained through a 24 h dietary recall (2). Questions were asked about 67 food items including 23 local and 44 imported items. The numbers of servings per day, week, month or year and, for local food items, the length of the harvesting season were recorded. Portion sizes were estimated from photos of 4 different serving sizes. Consumed weights (g per day) were calculated as portions per day * portion size (* length of season if applicable). Missing information on portion size was substituted by gender specific medians; for individual dietary items portion size was missing in 1.0% of cases (range 0.2–5.5%). Missing information on season was substituted by medians; for individual dietary items information on season was missing in 27% cases (range 14% for frozen blubber to 52% for walrus). The intake of energy, macronutrients, and certain micronutrients and contaminants was calculated from published concentrations (3–6; Greenland Board of Nutrition unpublished analyses). Individuals reporting an average daily intake of less than 3350/2100 kJ (men/women) or more than 17,000/15,000 kJ ($n = 300$; 10.6%) were excluded from the analyses (7). Whole blood mercury and lipid adjusted POPs in serum were analysed at the human toxicology laboratory of the Institut National de Santé Publique du Québec (INSPQ) (8,9).

Contemporary diet in Greenland

The traditional diet in Greenland consists predominantly of meat and organs of seal and other marine mammals, which is rich in protein, long chain n-3 fatty acids and micronutrients but polluted by Persistent Organic

Pollutants (POPs) and heavy metals, in particular mercury (10). These substances are present in the blood and organs of Greenlanders in concentrations well above international guidelines (Fig. 1). POPs and mercury are suspected of having several toxic effects, especially on the developing foetus (10,11) and the adult cardiovascular system (10) even in very small doses. The international guideline of concern for mercury is 20 µg/L (WHO) while the US EPA has decided on a lower concentration of 5.8 µg/L (12). In Greenland, 78% of the adult Inuit population and 66% of women of childbearing age exceeded the US limit. On the other hand, traditional food is also an important source of health promoting micronutrients that may not be provided by imported food in sufficient quantities, for example vitamin D, long chain n-3 fatty acids, and selenium (13).

The imported food items are similar to food items sold in Denmark and the western world in general. In the larger towns in Greenland the available imported food is varied and includes fresh fruit and vegetables throughout the year. With decreasing community size and increasing remoteness the availability and variation decreases, and fresh products give way to food with a long shelf life such as frozen goods, cabbage, potatoes etc. Nutritious food is expensive which goes for both traditional and imported food.

The proportion of the total diet that comes from marine mammals is on a constant decrease, and especially children and young adults consume rather little seal and whale. Among the 18–24-year-old Inuit in 2005–2009, traditional food items made up 12.8% of the diet compared with 28.3% among the 60+ year old ($p < 0.001$). The traditional food items are consequently being replaced by imported food, and among the imported food items several rather unhealthy items are popular, that is sweetened soft drinks, sweets, chips and

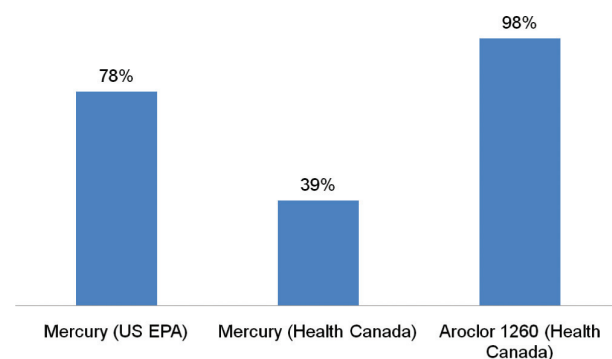


Fig. 1. Percent of participants in a countrywide survey of adult Inuit in Greenland who exceed the guideline levels of concern for mercury (5.8 µg/L according to US EPA; 20 µg/L according to Health Canada) and PCB expressed as Aroclor 1260 (5 µg/L w/w according to Health Canada). $N = 2807$ (mercury) and 313 (Aroclor 1260).

farmed (red) meat with a high content of saturated fat (Fig. 2). It is reasonable to assume that this dietary transition along with decreased physical activity is causally related to the pronounced increase of overweight and diabetes during the last 15 years (14,15).

It is the contamination of the traditional food and its positive nutritious value and social importance, and the negative health effects of much of the popular, cheap and widely available imported food that sets the stage for the recommendations of the Greenland Board of Nutrition along with the existing secular trend in dietary patterns and diet related disease.

The Greenland Board of Nutrition

The Greenland Board of Nutrition was established by the Ministry of Health (of the Greenland Government). Its 8 members represent various official stakeholders including the health care services, the school of nutrition and the chief veterinarian, and a few private organizations. Its mission includes to:

- Document associations between diet, physical activity and health.
- Propose political targets and strategies for diet and physical activity.
- Assist in disseminating information and recommendations to the public.
- Initiate cooperation with relevant international partners.

- Indicate research needs regarding health related, cultural and economic aspects of the diet in Greenland.
- Give special priority to children and families.

Over the years, the Greenland Board of Nutrition has given advice to the Government about a variety of diet related issues. The work of the Board closely follows the overall government preventive strategy as outlined in "Inuuneritta" – the Public Health Programme for Greenland. The Board and its members arrange courses in nutrition and participates in meetings in international for such as the AMAP Human Health Assessment Group.

A major challenge for the Board of Nutrition is to advise the community about the intake of marine mammals. There is no shortage of scientists in environmental health who point to the potential negative effects on health of the mercury and POPs in the meat, organs and blubber of seals and whales, and the press is willing to convey the alarming message to the public. On the other hand, as long as the alternative to eating seal is an increased consumption of imported food of poor nutritional quality, an advice of decreasing or discontinuing consumption of marine mammals would probably lead to decreased overall health. Furthermore, the advice must be simple in order to be understood, and it must not antagonize social and cultural norms in order to be followed.

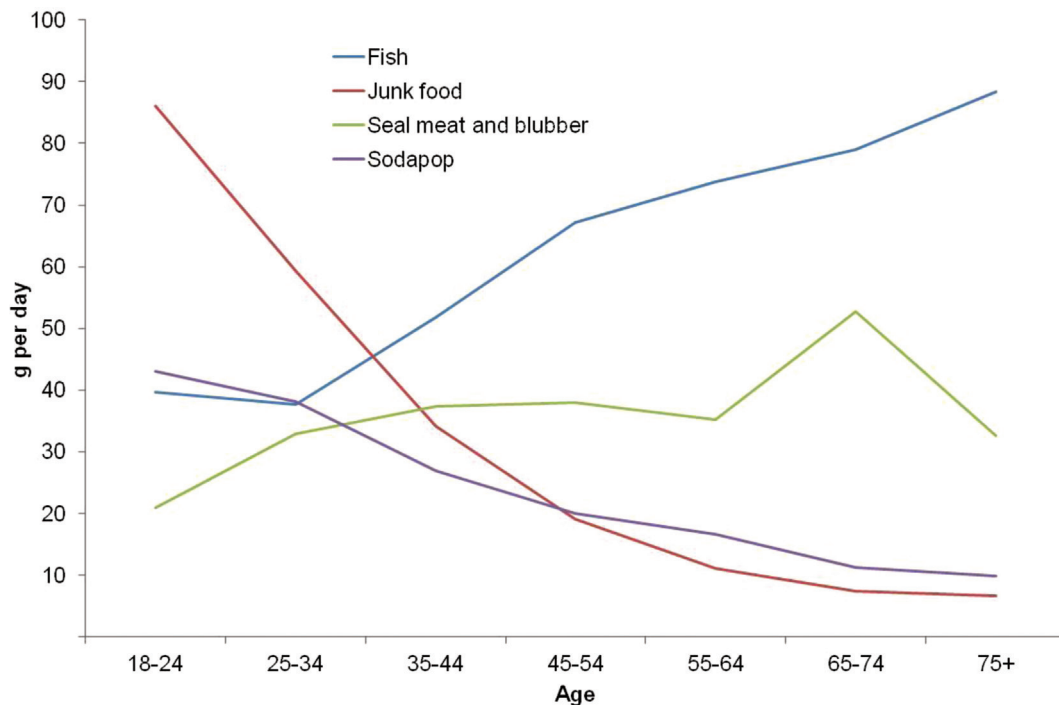


Fig. 2. Daily consumption of seal meat and blubber (g per day), fish (g per day), junk food (g per day) and sodapop (10 g per day) by age in a countrywide survey of 2534 adult Inuit in Greenland.

Table I. Dietary advice to the general population in Greenland

Basic advice	Elaboration and specific advice
Eat varied	The first and most important advice.
Eat local food; often fish	Follow the seasons and change between marine and terrestrial animals. Eat local berries and vegetables. Use fish spread and canned fish for lunch.
Eat fruit and vegetables daily	Bring a piece of fruit or vegetable to your place of work or school. Make it a rule always to have vegetables with your hot meal. Frozen fruit and vegetables are as good as fresh ones.
Eat whole grains daily, often potatoes, rice or pasta	Dark rye bread gives more satiety than white bread. Coarse crispbread is also good for you. Switch between rice, pasta and potatoes for your hot meal.
Consider the fat you eat	Reduce fat intake: scrape the butter or margarine off the bread. Choose low fat varieties of milk, cheese, meat and cold cuts. Use vegetable margarine or vegetable fat for cooking and baking.
Eat less sugar, candy, chips and cakes	Drink coffee and tea without or with less sugar. Fruit and bread gives more satiety than candy, chips and cakes. Eat candy and chips only once a week.
Drink water – drink less fruit syrup and soda pop	Enjoy the fresh cold water from the brook or the tap. Fruit syrup and soda pop contain a lot of sugar and are recommended only for special occasions.
Eat frequently but not a lot	Eat 3 main meals per day. Breakfast is the best way to start the day. Eat also small meals during the day, for instance a piece of fruit or vegetable, crispbread or dried fish.
Be physically active at least 1 h per day	Being physically active can be walking or bicycling to work, going hunting, cleaning the house, doing sports, playing ball and many other things.
Think about what you eat	Good dietary habits begin with shopping. Shop healthy. Cook together with your children. Make dinner a daily family event.

Dietary advice in Greenland

The dietary advice to the general adult population is presented in 10 simple recommendations (Table I). Pregnant and nursing women are encouraged to continue eating traditional food but should avoid or reduce consumption of older seals, toothed whales, seabirds, and polar bear which have high concentrations of contaminants. They are instead recommended to substitute these foods with lean fish and terrestrial mammals. Children and young people should follow the same general advice as pregnant women and all should follow the ten recommendations.

Discussion

In comparison with many other dietary recommendations those of the Greenland Board of Nutrition are simple. Instead of giving detailed advice on how many servings of each food group people in different stages of life should eat, they focus on very general guidelines and include both recommendations on physical activity and on the social aspects of preparing and eating meals. The recommendations are continuously revised and updated as new scientific evidence makes this necessary, for example when it was realised that obesity played a greater role for public health than the exposure to contaminants. In 2007, the Board of Nutrition commissioned an evaluation of an information campaign about the dietary recommendations; among the results of the study was that 43% of the sample knew about the campaign, mostly from TV and a folder, and that the most known recommendations were about eating

fruit and vegetables and about eating traditional food. It is not known to what extent people in Greenland follow the advice.

Conflict of interest and funding

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