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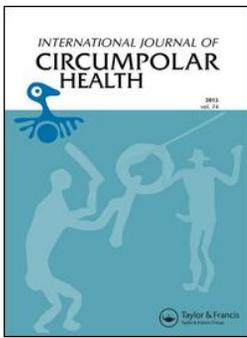
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Translational research to reduce *trans*-fat intakes in Northern Québec (Nunavik) Inuit communities: a success story?

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Following our results, based on population studies conducted in Greenland and Northern Canada, that Nunavik Inuit were thrice as highly exposed to dietary *trans*-fat as were Greenlandic Inuit, and that the biological levels found in Nunavik were already associated with deleterious blood lipid profiles, we decided to engage in translational activities. Our goal was to support Inuit communities in the practical implementation of a reduction of the *trans*-fat content of food sold in Nunavik. We carried out a preliminary feasibility study in Kuujuaq and participated in several meetings. This translational phase involved an Inuk leader, an Inuk student, a southern student, a southern nutritionist and a southern researcher in the framework of a public health project. In the present article, we recount the different phases of the process, from research implementation to results dissemination and institutional commitment to implement a primary prevention program of reduction in *trans*-fat exposure in Nunavik. This is the occasion to draw broader conclusions on the factors that could either act in favour of or, on the contrary, would likely compromise the implementation of primary prevention interventions dealing with food and nutrition in the Arctic. Finally, we share some reflections on future translational activities dealing with *trans*-fat as well as other junk food issues. The analytical framework we propose integrates a range of factors, from geo-climatic to socio-economic, ethno-cultural, and even political, that we think should be examined while identifying and building preventive recommendations and strategies related to the Northern diet.

Keywords: *trans-fat; translational research; intervention; Inuit diet*

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The Inuit dietary transition

The “westernization” of the diets experienced by Inuit populations typically manifests in a decrease in the contribution of subsistence foods to daily energy intakes (EI) as compared to store-bought foods, and its declension in terms of macro- and micro-nutrients intakes. In Northern Québec (Nunavik) communities, on which we base our reflection, the 2004 Inuit Health Survey reported that 84% of EI were provided by store-bought foods the day before the survey (1). The contribution of “traditional”, locally harvested foods was then lower than reported in 1992 (16% vs. 21%). It was also lower among young adults as compared to elders (18–29 years: 10.8% vs. 50 years and more: 28.3%). While local foods contributed respectively 40 and 18% of protein and fat

intakes, 99% of carbohydrates came from store-bought foods. Noticeably, the food group which contributed the most to energy intakes (36%) included many manufactured, low nutritional quality items, in particular sweet beverages (12.4%). Finally, shortening and margarine, potential sources of *trans*-fatty acids, contributed to 3.3% of EI and as much as 11.8% of total lipid intakes.

A focus on trans-fatty acids and their health implications

The latter observation, coupled with known constraints over the Northern food supply, had us hypothesize that Canadian Inuit could be exposed to processed food containing large amounts of industrially produced *trans*-fatty acids (IP-TFA), artificial TFA produced through

partial hydrogenation of vegetable oils. IP-TFA present practical qualities such as long shelf-life and low rancidity which are valuable to the food supply of remote communities. They are present in many highly processed food of low nutritional quality largely available on the Canadian food market in general, and typically found in Nunavik stores. Low amounts of *trans*-fatty acids are associated with increased risk of cardio-vascular disease (2) and some types of cancers including breast (3), colon (4) and non-aggressive prostate tumours (5). The international scientific community thus recommends keeping the consumption of artificial *trans*-fat as low as reasonably achievable and adopting food policies to regulate the legal content of processed food and fats. Our own research findings showed that Nunavik Inuit participating in the 2004 Health Survey experienced biological levels of TFA thrice as high as those found in Greenlandic Inuit (Fig. 1) (6). We also found that this difference was not rooted in dietary behaviours but in food policy: a maximum content in IP-TFA was legally imposed in Denmark and Greenland in 2003, while mandatory labelling of the *trans*-fat content of manufactured food was adopted in Canada in 2005. Furthermore, observed levels were already associated with deleterious blood lipid profiles in Nunavik Inuit men (7), pointing out the necessity for preventive measures in that population. We thus engaged in translational activities with community leaders and regional health professionals in order to reduce artificial *trans*-fat intakes in the Nunavik population.

What kind of intervention should be favoured?

This led us to discuss two intervention strategies with local partners. The first option was to follow the Danish

and Greenlandic authorities which imposed a maximum content for *trans*-fat in food products in 2003. Yet, only the federal and provincial governments have the legal right to pass such a regulation in Canada. So far, the Canadian government strategy adopted in 2005 is to rely on mandatory labelling of the *trans*-fat food content. The second option discussed was thus to act directly at the territorial level through dissemination of research results to Inuit and health institutions in Nunavik. Two main options, not mutually exclusive, were possible: educating people to make informed choices, and changing the food environment upstream. On the one hand, the development of social marketing campaigns about *trans*-fat free products and the reading of food labelling, and on the other hand, a regional call for a collective effort to lower the *trans*-fat content of food sold in Nunavik stores.

Material and methods

This translational research was structured around 3 types of activities.

- (a) Dissemination of public health research: Research results about *trans*-fat intakes and their health correlates in the Nunavik population were presented to the Nunavik Nutrition and Health Committee (NNHC), a local advisory body. This was the occasion to raise awareness about the necessity of primary prevention interventions and to strengthen collaboration between university, local and institutional partners.
- (b) Documentation of intervention options and discussion of their relevance to the Nunavik situation: Primary prevention strategies directed to the

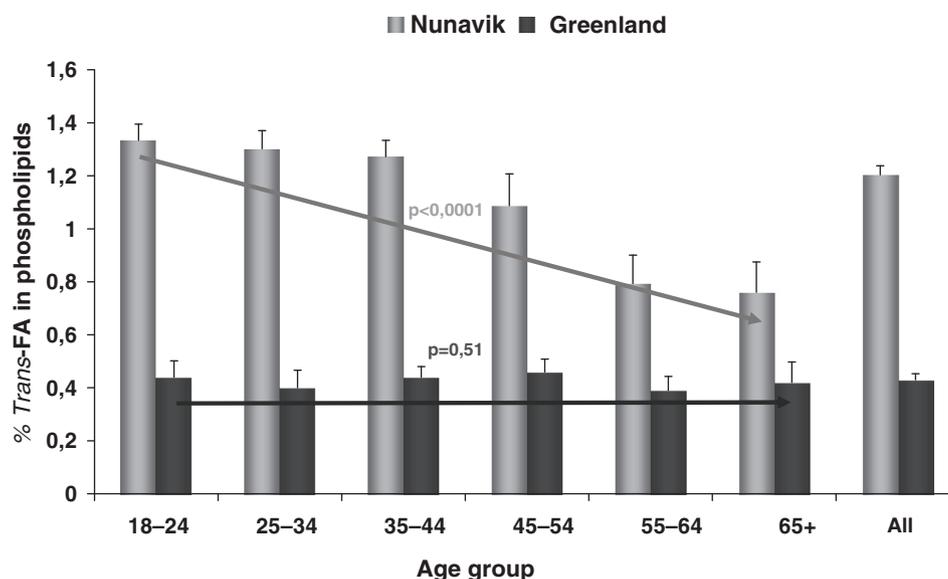


Fig. 1. Relative proportion of *trans*-fatty acids in red blood cell membrane phospholipids according to age group in Inuit populations living in Nunavik (Canada) and Greenland (Denmark). Adapted from Counil et al. 2008.

modification of dietary behaviours were reviewed and the specificity of the Northern context was discussed with local partners.

- (c) Feasibility study of a reduction in the *trans*-fat content of Nunavik store-bought-food: Finally, a market-based study of the TFA content of food was performed based on the list of foods sold in Kuujuaq in 2007, as well as a field study in Kuujuaq (largest village, Ungava Bay) and Akulivik (small village, Hudson Bay) dedicated to compare price and availability and to interview stakeholders.

In the following sections, we present the arguments and results which led to the adoption of a *trans*-fat reduction process in Nunavik store-bought-foods in 2009.

Results

Education and environment in the shaping of healthy dietary behaviours

The Canadian “labelling” strategy is an incentive measure that will probably progressively lead to a shift from wide use of artificial *trans*-fat to better quality fats in the Canadian food supply, as already evidenced by recent Health Canada assessments (8). Yet, the even success of such a strategy at the population level implies that three conditions be gathered: first, that *trans*-fat free products be widely available on the market; second, that they are sold at an affordable price; third, that the “consumers” are able to engage in informed reading of food labels.

Yet another condition to ensure “informed consumer choices” is that better quality products are actually available, at an affordable price. In some Nunavik villages, the diversity of manufactured food products is limited. Our feasibility study showed that for most food categories, *trans*-fat free products were already locally sold in Kuujuaq, which was not necessarily true in smaller and more remote locations such as Akulivik (Counil et al. 2008, unpublished). Educating without offering alternatives is bound to raise anxiety and is unlikely to create any health benefit.

Clearly, the price of food largely influences the willingness to purchase better quality products, especially among low-income families. In a study conducted in Canada by Ricciuto et al. (9) about margarines, TFA reductions actually appeared to be restricted to higher-priced products, suggesting that “voluntary approaches to reduce population intakes of TFA yields little changes in TFA content of low-cost products, and thus may have limited benefit for lower-income groups, who are at higher risk of heart disease”. Even if better formulated products are not necessarily more costly to manufacture, their potential health properties have been subject to intensive marketing by the food industry and a concurrent rise in price in some instances.

Another limitation stems from the age structure of Northern communities. According to the 2006 census, 39% of Nunavik Inuit were 14 years of age and under, 60% being 24 years of age and under. Nutritional education on the reading of food labels cannot be targeted at younger age groups; it should concentrate on the parents who bring food home and largely shape the food environment for their children. Yet some parents are themselves very young due to the high rate of teenage pregnancy, and Nunavik young adults tend to experience higher biological levels of *trans*-fatty acids than elders (Fig. 1) (6). These are serious limitations to the reduction in *trans*-fat intakes of a large part of the Inuit population based solely on social marketing.

Finally, adequacy of information is crucial since 97% of the Inuit population of Nunavik reported Inuktitut as their mother tongue (Canadian Census 2006), while food labels are written in English and French. There are no words in Inuktitut to designate different types of fats based on their chemical properties such as the English adjectives “saturated”, “unsaturated”, and “*trans*”. Moreover, misunderstanding the differences in the sources of *trans*-fats (natural found in small amount in ruminant meats and dairies vs. artificial found in processed fats and snacks) and their properties could lead to a reduction in the consumption of dairy products in a population already experiencing very low intakes of calcium (Ferland et al., 2011). Hence the need for cautious and culturally-sensitive approaches to the development of information tools that can really be fully understood by Northern people in their home language.

The Nunavik trans-fat reduction intervention

For all the reasons developed above, there were some fears among Inuit representatives and their scientific partners that Northern communities could be the last to benefit from improvements brought by the sole food labelling approach adopted at the federal level. It was thus decided with Inuit and institutional partners that in addition to providing information on *trans*-fat to the Nunavik population, it was also desirable to directly act on the food environment, following the hypothesis that educating is important, while improving access to healthy food is crucial. In that prospect, the Nunavik Regional Board of Health and Social Services (NRBHSS) passed a resolution on the 21st of January, 2009, stating that “the NRBHSS: (a) supports the Nunavik Nutrition and Health Committee in an active process of improving the quality of fat found in the food sold in Nunavik stores; (b) mandates the Public Health Director and the NNHC to work actively on the reduction of the *trans*-fat content of store-bought food in Nunavik, and (c) mandates the Department of Public Health to work with all the food stores in Nunavik in order to create an environment that will promote healthy food choices”.

The involvement of Inuit leader's was very important in the success of the process. One of them, Misses Minnie Grey, Chief Negotiator for the self-Government at Makivik Corporation, has been involved in the area of nutrition and health for many years, and has been instrumental in involving the Inuit both at the community and leadership levels. In collaborating with researchers from Laval University, she became involved in the idea of *trans*-fat reduction in Nunavik, and notably assisted in working with the community as well as in identifying a local high school student to work with the researcher on the feasibility study held in Kuujjuaq in 2007. Working for Makivik Corporation, she solicited the involvement of the corporation's president, Pita Aatami and a letter of support was sent out to the organisations in Nunavik. Following the field research, further meetings were held with regional stakeholders in which information on *trans*-fats was disseminated. Written material and information on regional radio were also used. Public education and information included informing Inuit on the difference between kinds of fat: ursuk (sea mammal fat) vs. shortening and other kinds of *trans*-fats, tunnuk (caribou fat) vs. beef or pork fat. This kind of regional campaign led to the Kativik Regional Government passing a resolution supporting a call to reduce or eventually ban *trans*-fatty products in retailers and find healthier affordable substitutes.

Table I reports and summarises the different steps in the whole process, from the uncovering of the *trans*-fat issue in Nunavik (scientific research) to the institutional commitment firstly of Pita Aatami, president of Makivik corporation, then of the NNHC, NRBHSS and Kativik Regional Government (KRG) to actively work toward the reduction of the *trans*-fat content of food sold in Nunavik stores. The process is presently being coordinated by the public health nutritionist at the RBHSS. The main difficulty encountered by the project coordinator is the lack of human resources and competencies to identify products

to be replaced, alternative and affordable *trans*-fat free products, and to train food retailers in the intervention perspective. As mentioned above, several radio programmes have spread information on the different type of fat, including *trans*-fat, and an information leaflet in English and Inuktituk is has been finalised.

In spite of the afore-mentioned advances, many difficulties linked to diverse, overlapping and interacting factors are yet susceptible to stand in the way of a rapid improvement of the content of food eaten in Nunavik with respect to *trans*-fat. Access to country food is quantitatively limited by economic, time, and weather constrains, and people tend to turn to store-bought sources of meat and fat of questionable nutritional quality, ready-to-eat snacks being particularly popular. Practical qualities (low rancidity) and low cost are undoubtedly important determinants of the high IP-TFA content of some pre-packaged pastries, pop-corn, shortening and margarines found in Nunavik stores. Moreover, contradictory messages have been spread on the contamination of local foods, and in particular fatty parts of marine mammals, with persistent organic pollutants, methyl-mercury and other heavy metals, and consequently such negative publicity has influenced food choices over the last 10 years. On the top of that, should Inuit wish to replace margarines and shortening with local sources of fat, they would be faced with the lack of availability of local cooking fats, especially when it comes to cooking inside small, overcrowded houses, with poor ventilation; as would say an Inuk colleague: "imagine the smell of seal oil heat to prepare French fries in a small kitchen!". The cost of living also implies that manufactured alternatives to *trans*-fat products should not result in a rise of food prices, considering the actual over-cost of store-bought foods and lower disposable income in Nunavik as compared to Southern Québec. Finally, the high turnover of workforce among store managers and social and

Table I. Timeline and initiatives taken in Nunavik by Laval University researchers and institutional partners regarding the *trans*-fat issue

Timeline	Initiatives
March 2007	First scientific presentation about exposure to the Nunavik Nutrition and Health Committee (NNHC)
May 2007	Scientific argument sent to Makivik Corporation to support a ban
June 2007	President Pita Aatami calls regional and Inuit organisations for a ban
August–November 2007	Feasibility study of a ban (U Laval, Minnie Grey co-researcher, implication of an Inuk student)
December 2007–March 2008	Presentation at conferences, media coverage (Toronto Star, Nunatsiaq News)
March 2008	Second scientific presentation to NNHC: atherogenic effects and feasibility of a ban; mission in Akulivik (Ungava Bay)
June 2008	Memorandum sent to the NNHC & RBHSS: NNHC takes position
September 2008	First Air & Air Inuit answer positively to NNHC call
November 2008	Meeting with Kativik Regional Government (KRG)
January 2009	The Nunavik RBHSS adopts a resolution about <i>trans</i> -fat
Summer 2009	Kuujjuaq Inn restaurant switch to <i>trans</i> -fat free oil in all its frying

health workers means that actions should be taken as upstream of the food supply organisation as possible.

In the following sections, we will build on the difficulties identified in the *trans*-fat intervention program to identify factors that can play for or against substantial improvement of the food environment, coupled with adequate nutritional education campaigns.

Discussion

Factors susceptible of facilitating primary prevention actions

Three factors seem to act in favour of the implementation of local programmes to improve the food environment in Nunavik.

First of all, the existence of a local advisory body: the Nunavik Nutrition and Health Committee (NNHC) founded in the 90s, which proved efficient in the past such as in drawing researchers' attention on ethical issues in medical research undertaken in Inuit communities, negotiating aims and means of research projects, and translating research results into information and promotional campaigns, as with the ban on lead shots in 1999.

Secondly, the food retail sector is restricted to two main chains of supermarkets, namely Northern Stores and Fédération des Coopératives du Nord du Québec FCNQ, and one independent shop in Kuujjuaq, limiting the number of stakeholders to be involved.

Thirdly, the simple administrative structure of this region, with a limited number of decision-makers, and most importantly, the strong public health commitment of some Nunavik leaders such as Minnie Grey.

Factors that could compromise primary prevention actions

Factors that are likely to interfere with primary prevention actions are presented synthetically in Table II, some of them further detailed below, namely geo-climatic, socio-economic and ethno-cultural factors.

The specific geography and climate of the territory of Nunavik is related to its location in Arctic Quebec (Canada), north of the 55th parallel. The 14 coastal villages, which are interconnected by skidoo tacks only during the winter, are located very far from Southern urban centres (Montreal–Kuujjuaq: 1,452 km). Transportation of goods from the South and between communities depends on plane for most of the year, except in the short summer and fall periods, when communities can be reached by boat. Moreover, Nunavik climate and weather are subject to extremes. High costs of transportation and maintenance, losses of fresh products due to breakdown and power failure, raise the price of “imported” goods and impact the diversity and quality (freshness, *trans*-fat content) of available processed and other imported food.

In terms of socio-economic environment, three factors contribute to putting Nunavimmiut at risk of budget restriction and financial insecurity: high cost of living, low income and high dependency ratio.

Food represent a considerable portion of Nunavik household budgets (10). In spite of the federal food mail program of transportation subsidies, the average Nunavik price index (NPI) for food, assessed as the price in Kuujjuaq compared to Québec city, was 1.57 in 2006 (11). Manufactured hunting and fishing equipments are also comparatively more expansive in Nunavik than in Québec, which is likely to restrain access to harvesting activities and access to local food among lower income groups.

The “purchasing power”, although never quantified *per se*, is thought to be low. This poses the question of preferential rating of needs in circumstances of budget restriction and financial insecurity, which is a risk factor for food insecurity, a complex reality manifesting at different degrees, from anxiety to hunger. In 2004, nearly 1 person in 4 (24%) indicated that he/she had lacked food during the month before the survey. Hudson Bay communities, jobless and single persons, as well as those living in a crowded household reported more frequently of having faced such lack of food (1). Poverty is thus probably at the heart of many dietary issues, from dietary transition to food insecurity, reported among Inuit communities.

The cost of living also implies high costs for information campaigns in terms of salaries as well as housing, transportation and other mission fees for social and health workers. Finally, and importantly, the high turnover of employees observed in many public services (health, education) as well as private corporations (food stores), compromises perennial implementation of preventive programmes at community level.

From an ethno-cultural standpoint, the recent shift from an economy dominated by hunting to an economy characterised by a mixture of wage labour and subsistence activities has had great impacts on the Inuit “food system” (12).

The traditional Inuit “food system” is based on harvesting local resources, exchanging and sharing them with community members. In terms of nutrients, it is high in protein and fat but low in carbohydrates, with generally sufficient vitamins and minerals through animal blood, bones and offal. Except for bannock, most Inuit food is eaten frozen, raw, or boiled, with very little mixture of ingredients and spices. The notions of meal, mealtime and portion, which are central in the western way of eating, are not part of the “Inuit way”, which may explain the popularity of snacking (12). According to Searles' anthropological research, the health and moral values attributed to different foods according to their classification into ethnic categories (Inuit vs. Qallunaat food,

Table II. Factors susceptible of impeding initiatives directed to the improvement of the Northern food supply

Factors identified as threatening food availability and affordability	Consequences on the food supply
Geo-climatic conditions	
<ul style="list-style-type: none"> ■ Isolated from food production and distribution centres ■ Communities isolated from each other ■ Accessible only by plane during winter and spring, by boat in the summer and fall ■ Extreme climatic weather conditions 	<ul style="list-style-type: none"> ■ Cost of transportation (airplane), maintenance and repair ■ Losses of perishable foods ■ Impact on the price of food ■ Need for products with long preservation ■ Irregularity of availability of some products, low quality of fresh products, lack of diversity
Socio-economic inequalities	
<ul style="list-style-type: none"> ■ High price index in Kuujuaq for imported goods compared to the Québec area ■ Low personal disposable income per capita ■ High dependency ratio ■ High costs of health care professionals and health promotion campaigns ■ High turnover of health care professionals, store managers, occasional volunteers 	<ul style="list-style-type: none"> ■ Difficulty of individual and household budget planning, prioritisation of needs and longings ■ Risk of food insecurity ■ Influence on food preferences and food choices ■ Cost and durability of education campaigns, prevention strategies, and programs
Ethno-cultural aspects	
<ul style="list-style-type: none"> ■ Inuit economic and food systems ■ Clash of dietary cultures ■ Few Inuk workers in the health and nutrition sector, few food anthropology in Arctic regions, few fundamental research on Inuit metabolism ■ No local equivalents when wish to promote country food in replacement of SBF ■ Contradictory messages about virtues and vices (benefits and risks) of country foods (nutrients vs. contaminants) 	<ul style="list-style-type: none"> ■ Lack of language-sensitive nutrition information tools ■ Lack of culturally-sensitive dietary recommendations ■ Lack of ethnic-specific dietary recommendations ■ Risk of inconsistencies in dietary recommendations regarding country food
Historical and political roots	
<ul style="list-style-type: none"> ■ Sedentary settlement due to school, trading posts, and other governmental incentives ■ Land claim and local resource management ■ Development of federations selling imported food ■ Insufficient food sovereignty ■ Federal subsidies to food transportation without evaluation of funding use 	<ul style="list-style-type: none"> ■ Uneven and irregular access to country food ■ Right to food violated ■ No direct control on food prices ■ Structural violence

rather than traditional and modern food) is a means of expressing self-identity and power.

From a physiological standpoint, although Inuit food are now included in regional food guides, as exemplified in the Nunavik food guide, they are simply proposed in replacement or in addition to Qallunaat food usually shown in the Canadian Food Guide, without adjustment for potential differential dietary requirements due to environmental factors, as with iron intakes with respect to *Helicobacter pylori* infection (13), or genetic factors, as with calcium intakes with respect to lactose intolerance (14).

Ethno-cultural aspects of food preferences and choices are seldom given enough priority in the elaboration of nutritional education tools. Less so considering that few social and health workers are born Inuit and that

anthropology of food, foodways and body image is not so much developed.

From “dietary transition” to “food insecurity”

Many mechanisms have been operating dynamically in the observed decrease in access to local food, increase in dependency upon imported store-bought food of questionable quality, and high cost as compared to household incomes and dependency ratio (15). Inuit sedentary settlement and increase in life expectancy led to demographic pressure on the land and local resources; schooling and employment restricted the time available for collecting food from the land; the development of Northern stores providing manufactured goods, together with development of airplane transportation and development

of means of communication such as TV and more recently the Internet, led to increased exposure to highly-processed and highly-marketed food; low average disposable income and the current state of regional sovereignty are grounds for financial and food insecurity. These largely politically and historically grounded processes have led to financial insecurity and food insecurity in a large proportion of Inuit households experiencing the dietary and nutritional transition, as the traditional lifestyle becomes further eroded.

Restoring the Inuit “right to food”

Question is: what preventive dietary interventions could work in such a complex context? As we already pointed out, the predominant public health approach to solving health disparities focuses on health promotion to individuals, with the goal of having each person take responsibility for his/her own health. There is no doubt that with lifestyle changes, people can improve their own health. Yet there are obvious limits to how much an individual can and will fulfil socially imposed norms of health behaviour within a constrained environment, in which social marketing is largely out of balance compared to junk food industry budgets spent on advertising soda, candy, snacks and fast foods.

From that perspective, the most plausible answer to the question asked lies in that Inuit communities, as other human groups living in places where they have few alternatives but to survive on low-wage jobs and have limited means of accessing either supermarkets to purchase healthy foods or their own land to collect country foods, should urgently be given back their “right to food”, a right to shape modern Inuit foodways, both culturally meaningful and physiologically adequate, including its land claim dimension. As pointed out by others for Nunavut (Canada) and Jujuy (Argentina) communities (16), even well-intended initiatives directed to the softening of the dietary transition and the alleviation of food insecurity related to financial insecurity may fuel the nutrition transition by ignoring the importance of placing “food sovereignty” at the centre of the discussions.

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