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A Systematic Review of Literature on Dietary Transition- Causes and Consequences in the Indigenous Populations of The Arctic

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A Systematic Review of Literature on Dietary Transition- Causes and Consequences in the Indigenous Populations of The Arctic

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ABSTRACT

Background: The traditional diet in the Arctic Indigenous populations have undergone a significant transition. The Arctic Monitoring and Assessment Programme (AMAP) has been looking into this dietary transition happening in the circumpolar earth for more than 20 years from now and explained them through the studies focusing on changes in Arctic biodiversity, human health, and natural environment. But there has not been any chapter explicitly focusing on the transition of the food, diet, and nutritional status in the populations living in the Arctic. Indigenous communities are the majority living in these demographics, and their traditional food habits have gone through a drastic change and hence affecting their health and lifestyle. This study has focused on exploring the changes or transition in traditional food habits, diet, and nutrition while identifying the causes and consequences to these changes in the indigenous communities living in the Arctic regions through a systematic review of literature of the existing valid evidence.

Methods: The study has been conducted through a systematic literature review including 91 literature (journals, books, reports, national surveys, articles, and unpublished manuscripts from regional health experts and researchers) related to the topics Arctic indigenous food, diet, nutrition, dietary transition, and traditional indigenous diet. Additional 5 literature was added to formalize the method for the study. The relevant non-English pieces of literature were excluded at first. Still, some of them have been included as the regional and native experts from AMAP HHAG helped the study team with the English translation. The literature that did not match the study objectives and keywords were excluded from the study. The references for the study have been organized using Endnote 9X. For wording, citation and referencing APA 6th format has been followed.

Results: A pattern of changes has been found in all indigenous and native populations residing in the Arctic regions (Greenland, Scandinavia, Arctic Russia, Arctic Alaska, Arctic Canada) caused by rapid globalization, gradual climate change, and inclusion of western diet. Traditional diet was found more popular among the older generations than that was found in the younger generations in the Arctic indigenous communities. It is found that the dietary changes have

increased adverse health effects such as the increased prevalence of T2D, obesity, dental caries and other metabolic diseases. On the positive side, these changes found beneficial in terms of nutrient intake, as more vegetables have been included recently within the daily dietary composition. However, the traditional diet is still considered as an integral part of the indigenous cultures and traditions by all the Arctic indigenous populations. Rising concern regarding food insecurity also has been found in the North American Arctic territories (Alaska and Canada) and Arctic Russia which has been reported as one of the causes for the changes in the traditional diet, besides other mentioned causes.

Conclusion: A similarity has been observed in dietary change patterns among all the Arctic indigenous populations, which has both positive and negative consequences in terms of populations' health. Similarity has also been noted in terms of causes among the populations. Globalization, climate change, and inclusion of western diet have been found as the common causes for the overall traditional dietary patterns of the indigenous communities went and still going through the transition. A rising concern in terms of food insecurity has also been found mainly in Arctic Canada, Arctic Alaska, and Arctic Russia.

Keywords: Arctic traditional diet, Dietary Transition in the Arctic, Nutrition, Arctic Indigenous Populations, Food Insecurity in Northern or Arctic Canada, Arctic Alaska, North and North-Western Russia, Northern Norway, Sweden, Finland, Greenland.

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ABBREVIATIONS

AMAP	Arctic Monitoring and Assessment Programme
CACAR	Canadian Arctic Contaminants Assessment Report
CF	Country Food(s)
FFQ	Food Frequency Questionnaire
HHAG	Human Health Assessment Group
HALDI	Hälsa och Levnadsvilkor i Jokkmokks Kommun (Health and Living Conditions in Jokkmokk Municipality)
MOM	Maternal Organics Monitoring
NWT	North West Territories
NU	Nunavut
OH	Organohalogen (s)
RDA	Recommended Daily Allowance
T2DM	Type-2 Diabetes Mellitus
POP	Persistent Organic Pollutant
PCB	Polychlorinated Biphenyl
WHO	World Health Organization
YKD	Yukon-Kuskokwim Delta

GLOSSARIES

Dietary Transition	Changes in the traditional dietary habit(s)
Denmark proper	The southernmost of the Scandinavian countries consists of a peninsula, Jutland, and an archipelago of 443 named islands. (Source: Wikipedia and Statistics Denmark)
Indigenous Population	The population or community that live within, or are attached to, geographically distinct traditional habitats or ancestral territories, and who identify themselves as being part of a distinct cultural group, descended from groups present in the area before modern states were created and current borders defined. They generally maintain cultural and social identities, and social, economic, cultural and political institutions, separate from the mainstream or dominant society or culture. (Source: WHO)
Macronutrient	Essential nutrients such as; Carbohydrate, Protein, and Fat
Micronutrient	Essential nutrients such as; vitamins and minerals
N15	The stable marine isotope of nitrogen
Neoliberalism	A modified form of liberalism tending to favour free-market capitalism
Subsistence Diet	The basic or essential diet consisted of locally harvested foods
Traditional Diet	A diet consisted of locally harvested foods that are also considered an integral part of a distinct culture, ethnicity or social group
Western Diet	A diet consisted of foods from western regions
Imported Food	A food which is not locally harvested and is imported from other region (s) or country(s)

1. INTRODUCTION

The Arctic consists of parts or all the territories of eight nations of the world including Canada, The United States (Alaska), Russia, Denmark (The Faroe Islands and Greenland), Sweden, Norway, Finland and Iceland. (Hassol, 2004; AMAP, 1998) They are also the homeland of many indigenous populations, along with distinct subgroups and communities. (Hassol, 2004) In these parts or territories, indigenous people make roughly 10% of the total Arctic population. (Hassol, 2004) However, in the in Canada, half and Greenland majority of the Arctic population are indigenous residents. (Hassol, 2004) Among these indigenous communities, especially in the Arctic parts of Canada, Alaska and Russia, traditional foods were considered as the primary sources of nutrition for an extended period. (AMAP, 2009; Sheehy et al., 2013) Therefore, it can be said that in a way, traditional food sources used to play a crucial role in these people's diet and nutritional status. The traditional food sources were mostly marine mammals, fish, and birds, which were the primary sources of the essential macro and micronutrients for these indigenous communities. (AMAP 2009) The traditional food sources are rich in n-3 fatty acids, fat-soluble vitamins, and essential minerals (i.e. Zinc, Iron, Iodine, Calcium, etc.). (AMAP 2003, 2009) But, these food sources are also being considered as the potential sources of human exposure to food contaminants. (AMAP, 1998, 2003, 2009) Since the adverse effects of the food contaminants gradually were considered to outweigh the positive health effects of the traditional food consumption, the conventional food consumption has been reduced considerably among the Arctic indigenous people, and imported foods became the two major sources of essential nutrients. (AMAP, 2003, 2009) As the food sources have changed considerably in the indigenous community, it influenced the change in nutritional quality, density, and security of their diets. (AMAP, 2009) Moreover, diseases like; food-borne botulism and trichinosis, are associated with the way the meats from traditional food sources, are being cooked. Such consequences are also causing the current food insecurity among people of Arctic Canada, which is creating an increased prevalence of overweight and obesity as well. (AMAP, 2003, 2009; Sheehy et al., 2013)

According to AMAP Human Health in Arctic report 2009, imported foods started to become more popular among the indigenous populations by the turn of millennia. Gradually the diet consisted of imported foods replaced a significant portion of the diet consisted of traditional foods in these populations. (AMAP, 2009) An exception to this pattern is being observed in the northernmost parts of Russia. (AMAP, 2009) In these parts, the use of local foods has increased in some indigenous populations, after the change of socio-economic status and deterioration of farming and livestock system after the disintegration of former Soviet Russia. (AMAP, 2003, 2009) The higher consumption of imported foods is being observed within the young people of the indigenous community, especially in Alaska, Yukon, and Canadian Inuit, young people tend to eat more imported foods than subsistence or traditional foods. (AMAP, 2003, 2009) Children in the Inuit communities of these demographics get most of their dietary energy from sweet and fatty store-bought foods. (AMAP, 2009, 2015) There is a prediction that this change in the dietary habit in the young population will gradually change the future dietary habits in the population because as the population will grow older, their acquired dietary habit will eventually replace the need for the traditional diet. (AMAP, 2009) It also reflects that the traditional dietary energy sources are going to be changed in the long run in proportion to the changing dietary habit among the young population. In Arctic Canada, an average of 22% dietary energy comes from traditional foods in the indigenous communities. (AMAP, 2009) But even this percentage tends to change as the children in these communities are consuming more fish than traditional foods like marine mammals. (AMAP, 2003, 2009, 2015) In the southern part of Greenland and Northwestern part of Alaska, it has been observed that the contribution of local food is less than it is in Canadian Inuit. (AMAP, 2009) Local food consumption has been reduced by approximately 50% in the Inuit community of Greenland over the last 30 years. (AMAP, 2009) Even the proportion of community-level intake of local foods has decreased among adults and currently, it ranges from 11% to 20%. (AMAP, 2009)

Most of the indigenous women in Alaska, Greenland, and Arctic Canada consume proportionally less traditional food than men. (AMAP, 2003, 2009) There is a positive association between traditional food consumption rate and different living environments. The

proximity of settlements to coast or river can be one of the good examples for such cases. (AMAP, 2003, 2009) But this rate varies with seasons, and it has been observed, in these regions imported food is being consumed more by the children above the elementary school level. (AMAP, 2009) Alcohol consumption has not been considered while measuring the dietary energy consumption in men, which implicates the actual energy intake from traditional food is ever lower than the measured value. (AMAP, 2009)

In the AMAP studies on human health in the Arctic, from the year 1998, 2002, 2009, and 2015, a lot has been described regarding the dietary habits, traditional and imported foods in terms of their nutritional values, change in food consumption rates and the levels of food contamination. Several studies, such as cohort and dietary studies underlying the assessment of populations' health in the Arctic, have been done by different Arctic regions as well. (AMAP, 2015) Nevertheless, there are still significant knowledge gaps in understanding the dietary transition in the Arctic and its consequences on different indigenous populations of these demographics that need to be filled.

In the past few decades, significant changes have been observed in the dietary habits among the Arctic indigenous populations. In the previous studies from Arctic Monitoring and Assessment Program (AMAP) reports from 1998 to 2015, a lot has been described regarding the dietary habits of the indigenous populations of the Arctic and how imported food is becoming popular over traditional foods in these populations. Even so, not much has been done to represent, dietary changes over time and its consequences in different populations of the Arctic. Studying the dietary transition and its consequences on populations are very crucial to find out the nutritional status of those populations. It is also necessary to find out the diet suitable for those specific populations while considering the social, cultural, economic, and environmental status. As there is a knowledge gap in dietary transition and its consequences on human health nutrition in the Arctic populations, the aim of this present study is set to *analyze the existing literature and evidence through a systematic review to explore the dietary transition in the Arctic indigenous populations.*

The following objectives are being set for this study to analyze the existing literature for exploring the dietary transition for the indigenous populations of the Arctic,

1. explore the traditional diet of the Arctic populations
2. describe the dietary transition over time from previous reports of AMAP and other relevant references
3. describe the emerging alternative diet
4. describe the consequences of this dietary transition on nutritional status
5. identify and describe the causes of this transition
6. identify and discuss the knowledge and information gap (s) by analyzing the results of the literature review

2. Methods

2.1. Eligibility Criteria

The study reviewed the literature with valid evidence(s) showing; the dietary pattern in the indigenous communities of the Arctic, changes in dietary habits, and effects of dietary change on the nutritional status in these populations were considered as the critical data during the literature search process. The chapters concerning food habits, diet, food contaminants and nutrition from AMAP report on human health, from the year 1998, 2002, 2009, and 2015 have been reviewed to find the underlying data concerning food, diet, nutritional data, and changes in diet pattern involving Arctic indigenous communities. Primarily 148 literature sources, articles, and reports were selected for the study, among which, 91 of them were selected for the systematic literature review, and 5 of them were selected for structuring the study method (total selected 96 literature, out of 148). Although the plan was only to search the English literature, the researchers conducting the study also included non-English literature to ensure the

validity of the collected information from the literature written in native languages specifically for the native communities.

2.2. Information Sources

Information and data have been collected from journals, articles, newspapers, and unpublished manuscripts of the researchers involved in AMAP Human Health in the Arctic group. Most of the data and information are collected from the electronic sources, AMAP official webpage, Oria, PubMed, Medline, Medline Plus, Research Gate, Google Scholar, BMJ and JSTOR. Since the study has been done in collaboration with AMAP Human Health Assessment Group (AMAP HHAG), some data and information for the study have been collected and included from the data and manuscripts provided by the experts and researchers involved in the AMAP HHAG.

2.3. Search Strategy

Data and information for this study searched for the keywords, food, diet, and nutrition in various Arctic indigenous populations. The data and information search are conducted individually for individual Arctic communities in different demographics of the circumpolar north, in the cases when the food, diet and nutritional information were not much in detail in generalized literature sources for Arctic populations. The electronic databases were searched using the MeSH terms 'Food', 'Nutrition', 'Diet', as well as 'Transition in Diet and Nutrition', always in conjunction with the term 'Arctic indigenous population' or 'indigenous population of the circumpolar north'. For better search results 'AND' and 'OR' were used to specify the correlation between the MeSH keywords.

2.4. Data Management

All the collected data and information during the study were kept in a secure Google Drive Folder as document files and shared only with the concerning researchers. Collected data and information are only editable by the concerned research group members. This master thesis has been developed in collaboration with writers of the chapter on Dietary transition, which will be included in the next AMAP-report from HHAG. Thus, provided information from the experts from different Arctic countries involved in the chapter have been included in this thesis and the writer of this thesis provided data for the report chapter. The data and information for the study are managed and stored as unpublished manuscripts and a combined unpublished report.

2.5. Data Collection process

Data has been collected through online search engines, Google Scholar Search, Pubmed Search, Google Search, AMAP Scientific Report Online Archive, National and International databases dedicated for Arctic Indigenous data, field trips, and by directly contacting the Arctic researchers via e-mail. Referencing and citations have been done using EndNote 9X in APA 6th format.

2.6. Selection Process

The literature for the study was selected by the author of this paper and reviewed by two supervisors. During the literature selection process, literature containing Arctic indigenous food, diet, and nutritional aspects were selected and sorted according to their validity, reliability, and the number of citations. To maintain these criteria, the author team selected highly cited literature and gathered some unpublished manuscripts shared by the experts working on Arctic health.

3. Results

The study included the literature describing the traditional diet, existing market foods, traditional and emerging alternative diet, past and present nutritional data, causes of changes in the food habits, and health consequences due to the dietary and nutritional changes in indigenous populations residing in Greenland, Scandinavia (Northern Norway, Sweden and Finland), Arctic Russia, Alaska, Arctic Canada. In addition, the study explored the research aim regarding the knowledge gap in the previous AMAP studies and to contribute knowledge in the upcoming AMAP Report on Human Health in the Arctic 2021 Dietary transition chapter. Hence, the results of this study are to be presented in several sections and subsections. The results have been presented as follows under the Regional sections *Greenland, Scandinavian Sami, Arctic Russia, Alaska, and Arctic Canada*, and study objectives have been presented in sub-sections under each main section.

3.1. Greenland

Greenland has a population of 57,000 people, among which, 88% are Greenlandic Inuit. (*Greenland Population 2020 (Demographics, Maps, Graphs)*, 2020) The population includes mixed persons as well and white European descent, mostly Greenland Danes. Apart from that, thousands of Greenlandic Inuit in Denmark proper. (*Greenland Population 2020 (Demographics, Maps, Graphs)*, 2020) In the Greenlandic (or Kallallisut), the country is called Kalaallit Nunaat, or "land of the Kalaallit," who are the indigenous Greenlandic Inuit people living in the western part of the country. (*Greenland Population 2020 (Demographics, Maps, Graphs)*, 2020)

3.1.1. The traditional diet of Greenlandic Inuit

The traditional diet of Greenland consisted of a variety of meat, fish and marine mammals. In Greenland, the food prepared from Greenlandic ingredients is known as 'kalaalimiq' which means 'a piece of Greenlander'. (Ringgard, 2016; "Greenland," 2020) In Greenland ingredients for traditional foods are collected mostly by hunting and fishing. The most common traditional foods are made from, the fish, such as Greenland halibut, Atlantic cod, Greenlandic cod, arctic char, salmon, lumpfish, redfish, catfish, capelin, meat; such as wildfowl meat (Brünnich's guillemot, common eider, black-legged kittiwake, black guillemot, little auk), seal, whale, caribou, muskox, and hare; and different ingredients derived from plants, such as crowberries and blueberries (autumn), seaweed(winter), Greenland lousewort, roseroot and fireweed leaves (summer). (Deutch, 2007; "Greenland," 2020). The traditional Greenlandic cuisine is 'suaasat' (Greenlandic soup), often prepared from the seal, whale, reindeer, or seabird meat mixed with potatoes, onions, and seasoned with salt and pepper or bay-leaf. The soup is often thickened with rice and water soaking barley. (Walker, 1994; "Greenland," 2020)

3.1.2. The transition of diet

The transition history of dietary habits is well documented for Greenland. Several dietary surveys have been conducted since the year 1953 to measure the proportion of locally harvested food in the regular local diet. Interview based dietary surveys have been conducted at a regular interval since the year 1993 to monitor the changes in the dietary pattern in the population. A survey conducted in the year 1953 noted that, in Greenland, 21% of the total diet of the population living in the towns, was based on locally harvested food. In contrast, the proportion was found 45% in the villages. The food in this category involved locally harvested seal meat, Greenlandic cod, and Greenlandic halibut. According to the population health survey 2005-2010 of Greenland, the proportion of locally harvested food decreased to 17% in towns, and 32% in

the villages. The decrease continued, and in the year 2018, that proportion of decrease was 14% in towns and 21% in villages. (“Greenland,” 2020)

3.1.3. The emerging alternative diet and underlying causes

Greenlandic conventional dietary habits have gone through changes. The modern diet of Greenland is composed of 15% locally harvested food (caribou meat, cod, Greenland halibut, seal meat, muktuk) and 85% food imported from overseas, often from or via Denmark. In the capital and the larger towns, the same choice of food is available as in any major town in Denmark although at a higher price. The ten food groups which contributed the most energy to the contemporary diet of the Inuit in Greenland accounted for 76% of the total energy intake, where several pronounced geographical differences and by age group differences has been observed between men and women, regarding food choice or preference. (Knudsen et al., 2015; Larsen et al., 2019; Terkelsen et al., 2017; “Greenland,” 2020).

The following Table 1 presents the ten food groups that contribute the most energy intake to the contemporary diet of the Greenlandic Inuit population.

Table 1: Contribution of food groups to total intake of energy in Greenland in 2018. Analyses from the Population Health Survey 2018 (Larsen et al., 2019; “Greenland,” 2020). N=2335.

Rank	Food Items	Energy (%)	Cumulated Energy (%)
1	Imported red meat	14.5%	14.5%
2	Refined grain	10.2%	24.7%
3	Whole grain	9.3%	34.0%
4	Soda pop	8.1%	42.2%
5	Dairy, eggs	6.9%	49.1%
6	Fish	6.6%	55.6%
7	Sweets	6.5%	62.2%
8	Fruit	5.3%	67.4%
9	Sugar in the coffee of tea	4.4%	71.8%
10	Potatoes	4.2%	76%

Based on the dietary guidelines of the Greenland Council for Diet and Physical Activity, five measurable indicators for a healthy diet have been developed for the Greenland Public Health Programme (Table 2). These indicators of the frequency of consumption have been measured since 2005-2010, by the same food frequency questionnaire. The data collected

through these questionnaires shows that an increasing proportion of the population consumed vegetables daily as advised by the Council but contrary to the advice of the Council fewer consumed fish and more consumed fruit syrup and soda pop. The consumption of marine mammals and fruit didn't change. Only 15% of the survey participants adhered to 4 or more of the indicators.

Table 2. Dietary advice and indicators of the Greenland Council for Diet and Physical Activity. Population Health Surveys in Greenland 2005-2010 (n=2746) and 2018 (n=2236) (“Greenland,” 2020)

Advice	Indicator	2005-2010 (% intake)	2018 (% intake)	Ratio	Confidence Interval
Eat fruits and vegetables daily	Daily consumption of fruits	37.2	38.8	1.04	0.95, 1.04
	Daily consumption of vegetable	23.9	29.6	1.24	1.11, 1.39
Eat local food, often fish	Eat fish at least once a week	56.0	42.8	0.76	0.71, 0.83
	Eat marine mammals 1-3 times per week	35.9	33.3	0.93	0.84, 1.02
Drink water and drink less fruit syrup and soda pop	Drink fruit syrup and soda pop daily	24.4	43.9	1.80	1.62, 2.00

3.1.4. Consequences to the transition

Transition in diet and food habits in the Arctic indigenous communities have quite a significant effect on their regular dietary and nutritional intake. It's not optimal to only depend on the diet consisting of marine mammals, fish, and berry-based diet, while it's only not recommended to have a diet devoid of these traditional food items also, in the Arctic perspective. It has been observed that the decreased amount of traditional food is being substituted by the increased amount of sugar and saturated fat. In contrast, the intake of the essential omega-3 fatty acid gained from the natural fish oils decreased. (Jeppesen and Bjerregaard, 2012; "Greenland," 2020). One positive side of the change is, the dietary fiber consumption has increased dramatically, and due to less consumption of marine mammals' blood mercury level has decreased. Diseases have not been discovered yet due to the dietary transition. (Bjerregaard and Larsen, 2018; "Greenland," 2020) A gradual increase in obesity is observed since the imported foods are taking place in the market with parallel to traditional foods. (Bjerregaard and Larsen, 2018; "Greenland," 2020). Moreover, the study shows Inuit populations are genetically more prone to cardiovascular disease. ("Greenland," 2020) Hence, increased consumption of fat in the diet is elevating their risk of having the cardiovascular disease at an early age.

In recent times, some new initiatives have been taken to promote the use of Greenlandic foods. Cookery books with the varied Greenlandic recipes and family food programs on television are some of those good examples. All municipalities in the country hold annual food festivals with subsistence food items. An Arctic Food Cluster named NERISA provides accessibility to a network for the people interested in Greenlandic foods. (NERISA, 2019). This food cluster is trying to cater to knowledge regarding the opportunities and challenges in the food sector and tries to promote Greenlandic foods in the local setup. But the cluster is concerned about the barriers that entrepreneurs are facing whenever they try to set up a business. Food legislations in Greenland are quite sophisticated to maintain and henceforth; it makes it challenging to start small-scale food production as well as provide better local food experiences to the tourists visiting the country.

3.2. Scandinavian Sami

The Indigenous community living in the Scandinavia are the Sami people. The Sami population lives mostly in the northernmost Scandinavia, especially in northernmost Norway, Sweden, Finland, and some of the Sami communities live in the Kola Peninsula of Russia. (“Sami,” 2020). All these regions are the traditional homeland for the Sami people. The population is not only limited to the northernmost territories of the Scandinavia but also, they live further south than the Arctic borders of Norway and Sweden, including the entire Scandinavian mountain area and neighboring reindeer grazing lands. (“Sami,” 2020). The estimated size of the Sami population is approximately 80,000. ([https:// sweden.se/society/sami-in-sweden](https://sweden.se/society/sami-in-sweden), accessed September 2019; “Sami,” 2020)

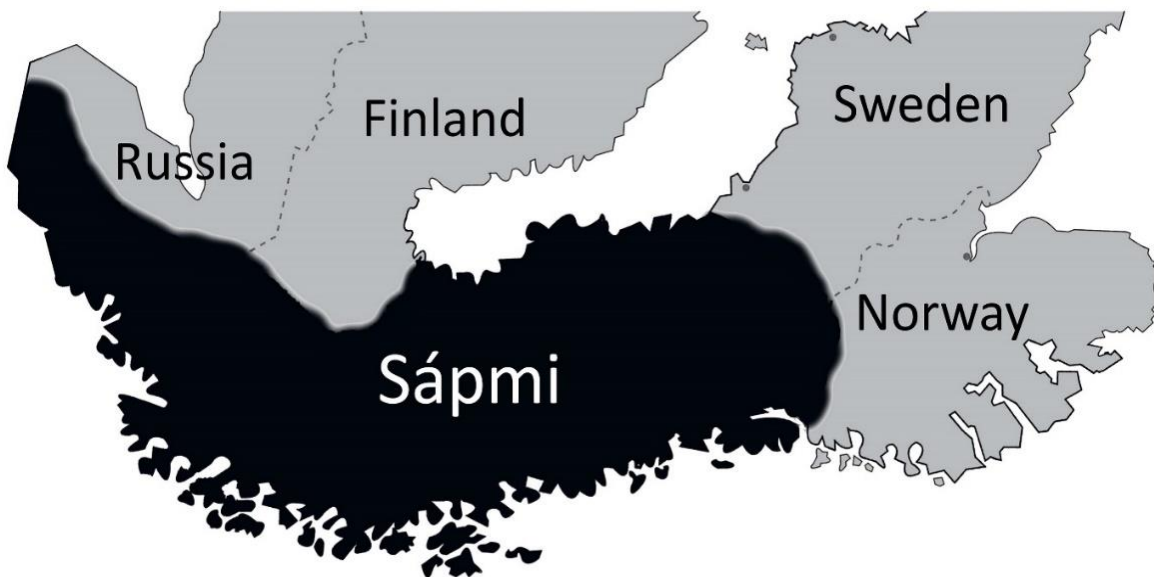


Figure 1: Sápmi, the traditional Sami area is not clearly defined. This figure (Nilsson, 2018) shows an inclusive version, with dashed contours in the inland to stress the uncertainty. © Lena Maria Nilsson.

3.2.1. The traditional diet of the Scandinavian Sami

Traditional Sami diet is rich in protein and fat and contains less carbohydrate in comparison to the westernized Nordic diet model. (Haglin, 1999; “Sami,” 2020) In the old days, Sami people used to collect plant-based food from wild plants, such as berries. They used to preserve and prepare them in such a way that they did not have to add extra refined sugar in berries to consume them after a lengthy preservation time. Drying and water preservation are such techniques for the berries rich in benzoic acid, e.g. cloudberries and lingonberries. (Nilsson, 2018) Sami people prepared their fish by boiling or grilling them while they were fresh. They also preserved fish using drying or fermentation method. (Nilsson, 2018) Meat collected from game animals and reindeer were prepared in a way that maximized the caloric and nutritional value in the traditional meal, and all edible parts were utilized. Drying and freezing techniques varied for preserving the food according to the seasonal variation. (“Sami,” 2020)

3.2.2. Changes in traditional diet and underlying causes

In the present world, when diet and food habits tend to become westernized, Sami diet is still following the traditional trend. According to the studies conducted in Norway and Sweden between the period, 1990-2000 showed dietary data with a higher level of the traditional diet in the local Sami populations compared to the Non-Sami people. (Brustad et al., 2008a, Brustad et al., 2008b, Nilsson et al., 2011, Ross et al., 2009) (Presented in Table 3)

The changes that have been observed in the traditional Sami diet can be described as neoliberal food regime, characterized by globalization, market liberalization, and increased disconnection between the actual domestic food production and food security. (Pechlaner and Otero, 2010, “Sami,” 2020)

Table 3: Elements of a traditional Sami diet in Sápmi 1990-2010. (“Sami,” 2020)

	References	Norway		Sweden		
		Non-Sami	Sami	Non-Sami	Non-herding Sami	Herding Sami
Reindeer meat cluster ¹ (%)	(Brustad, Parr, Melhus, & Lund, 2008)	11	92	NA	NA	NA
Carbohydrate (E%)	(Nilsson et al., 2011)	NA	NA	48	47	43
Protein (E%)	(Nilsson et al., 2011)	NA	NA	14	14	15
Fat (E%)	(Nilsson et al., 2011)	NA	NA	34	34	37

¹Based on a cluster analysis of FFQ data from the SAMINOR study, designed to describe a traditional and local diet of Northernmost Norway

3.2.3. Consequences of dietary transition

At a public health viewpoint, consequences due to the transition in the dietary habit for the Sami communities can be commonly discussed with adverse metabolic health outcomes from the following Table 4.

Table 4 summarizes three measures focusing on obesity, cancer morbidity and all-cause mortality. This summary is the representation of the situation until the year 2004.

Table 4: Obesity, cancer morbidity and general mortality in Sápmi 1990-2010. Health measures are expressed as 1 = reference group within country, - = lower, + = higher, and 0 = no significant difference compared to reference. (“Sami,” 2020)

	References	Norway		Sweden			Finland	
		Non-Sami	Sami	Non-Sami	Non-herding Sami	Herding Sami	Non-Sami	Sami
Obesity	(Brustad et al., 2008) (Nilsson et al., 2011)							
men		1	-	1	0	0	NA	NA
women		1	+	1	0	0	NA	NA
Cancer	(Hassler, Soininen, Sjolander, & Eero, 2008)							
men		1	-	1	NA	-	1	-
women		1	-	1	NA	0	1	0
Mortality	(Sjolander, 2011; Soininen & Pukkala, 2008)	1	0	1	NA	0	1	0

From the data from Table 4 shows that the data with relation to obesity is contradictory. In the Norwegian Sami women, obesity is perceived to be more frequent than the general population, whereas it is found to be less prevalent among Sami men. (Brustad et al., 2008b, “Sami,” 2020).

Results are found contradictory when it comes to obesity. Obesity is more frequent among Sami women than the Sami men in the general population. (Brustad et al., 2008b; “Sami,” 2020) In the Swedish Sami population, no differences have been observed with regards to obesity between Sami and Non-Sami populations. (Nilsson et al., 2011) In the Norwegian Sami population, cancer morbidity is found lower men and women both, whereas, in the Finish

and Swedish Sami population, this morbidity rate has been found lower only in the men. (Sjolander, 2011; “Sami,” 2020). Moreover, according to the recent data, there have no differences been found in terms of all-cause mortality between the Sami people and the general population of the Sapmi area (“Sami,” 2020, Sjolander, 2011, Soinen and Pukkala, 2008)

3.4. Arctic Russia

The indigenous communities of the North and North-West Russia used to consume locally harvested foods available in the region. They harvested their foods through hunting, fishing, reindeer breeding and gathering. Their diet was known as ‘traditional diet’, which later was named ‘aboriginal diet’ starting from the first wave of subjugation of the Arctic by Europeans. (“Russia,” 2020). However, the indigenous populations of this region still are strongly dependent on their traditional diet, whereas non-indigenous populations eat the traditional diet to a much lesser extent. (“Russia,” 2020). Store-bought or imported foods are consumed more in non-indigenous communities than the indigenous ones. (“Russia,” 2020).

The traditional indigenous diet of the Russian Arctic is developed in a combination of multivariate factors. (AMAP, 2020) These factors are geographic, ethnic, genetic, cultural, lifestyle etc. (“Russia,” 2020) In addition to those, the economic conditions of life, proximity to civilization, transport connection, and many other factors are also found to have a significant influence on the traditions of these populations. However, the population varies in terms of extent and territories. (“Russia,” 2020) Therefore, generalization regarding traditional diet could not have been made for the indigenous populations living in this region. The Russian Arctic is a vast region with 20,000 km coastline, with multiple ethnical groups living in the coastal and inland region, and each of them has their way of gathering and collecting their foods. (“Russia,” 2020)

In the following map, the Arctic indigenous populations are presented. On the map, the residing areas of the indigenous communities for Arctic Russia has been marked with red dots. The dots represent; Chukotka autonomous okrug, Yakutia republic, Nenets autonomous okrug, Arkhangelsk oblast and the Komi Republic. The objectives for this thesis paper have been explored and described based on the indigenous populations living in these demographics to describe the overall dietary transition for the Russian Arctic.

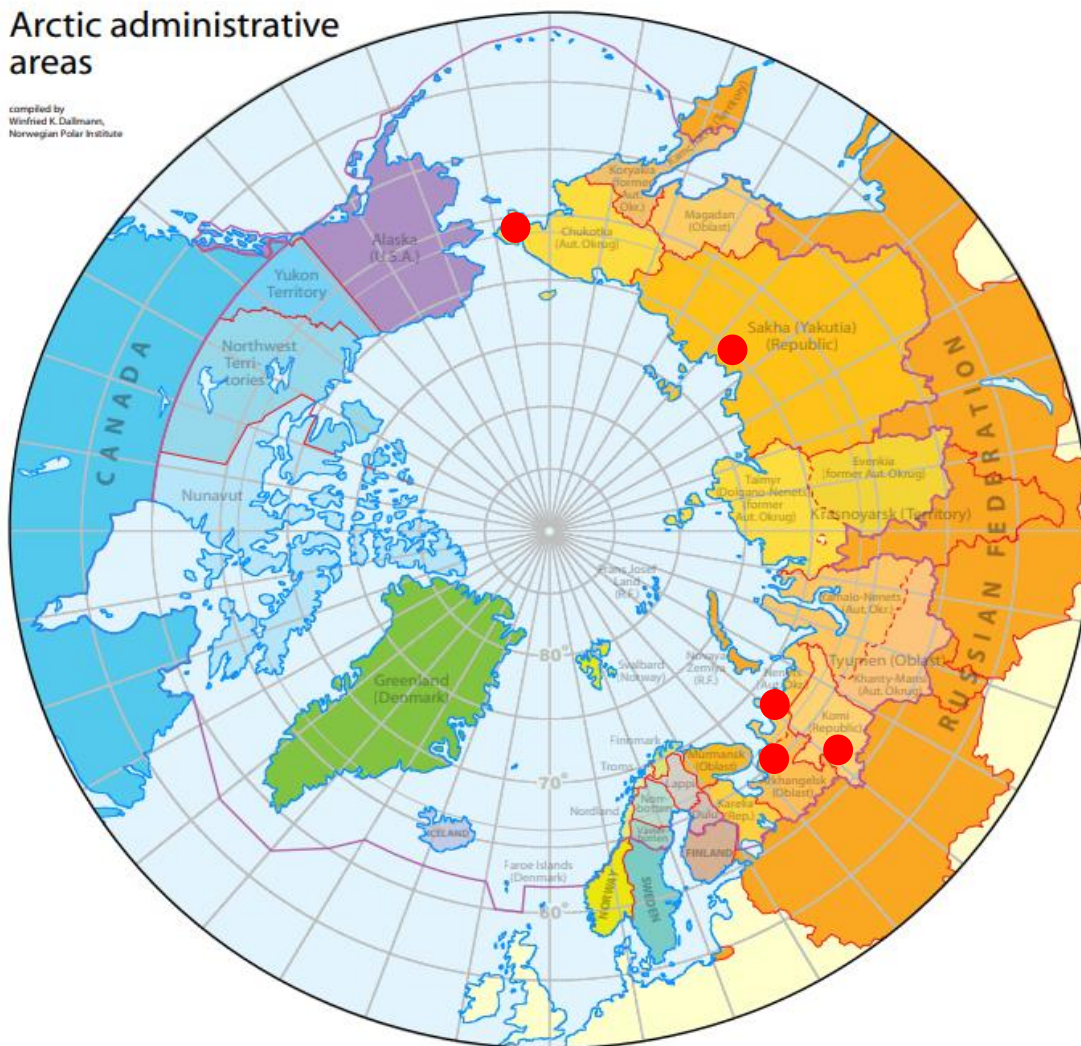


Figure 2: Arctic Administrative Areas. Source: Alexei Dudarev’s Manuscript (Russian Arctic is in Red circles: territories where from the data on Dietary transition was obtained.)

3.4.1. The traditional diet of Arctic Russia

The traditional diet of the Arctic indigenous peoples has developed during centuries through a combination of many factors (geographical, ethnic, genetic, cultural, lifestyle, etc.). Nowadays, the economic conditions of life, proximity to civilization, transport connection, and other factors are also seriously influencing these “traditions” to a different extent in different territories. No generalization regarding the traditional diet could be made for the whole territory of Russian Arctic (20 thousand km of coastline) populated by multiple ethnical groups residing in the coastal and inland regions and characterized by the unique (developed by the tribal generations) patterns of food obtaining skills. (“Russia,” 2020). One good example of the statement can be, the inherited marine mammal hunting process of Chukchi and Eskimo in Chukotka, which is only exclusive in these communities. (Dudarev et al., 2019 I, IV) In contrast, it is not commonly found in many indigenous residents living in the coastal region. Instead, reindeer herding, fishing, berry picking, and mushroom gathering are more common food acquiring processes found in these communities. (“Russia,” 2020) Moreover, it has been observed that cooking habits influence different dietary patterns existing in different communities in the indigenous communities or ethnicities residing in the Russian Arctic. In contrast, the items used in various Arctic indigenous cuisines are different in terms of structure or specific food items used to make these cuisines. (“Russia,” 2020)

3.4.2. The transition in dietary habits and underlying causes

3.4.2.1. Chukotka autonomous okrug (coastal settlements of Chukotka peninsula)

There are few recent studies on dietary habits, and on dietary shifts, in Russian Arctic communities. A follow-up assessment of dietary patterns of indigenous people in the Russian Arctic has been carried out in coastal Chukotka (2016 vs 2001-2002). As for the other Russian

Arctic regions, there are some indirect (collected from statistics) or direct (collected via questionnaires in the field studies) information on dietary shift.

Figure 3. presents amounts of local traditional foods (kg/person/year) from Uelen in the northern part of Chukotka in 2001-2002 (Dudarev et al., 2012) and figure 4 presents the corresponding information from 2016, however from settlements in the southern coastal part of Chukotka (Dudarev et al., 2019).

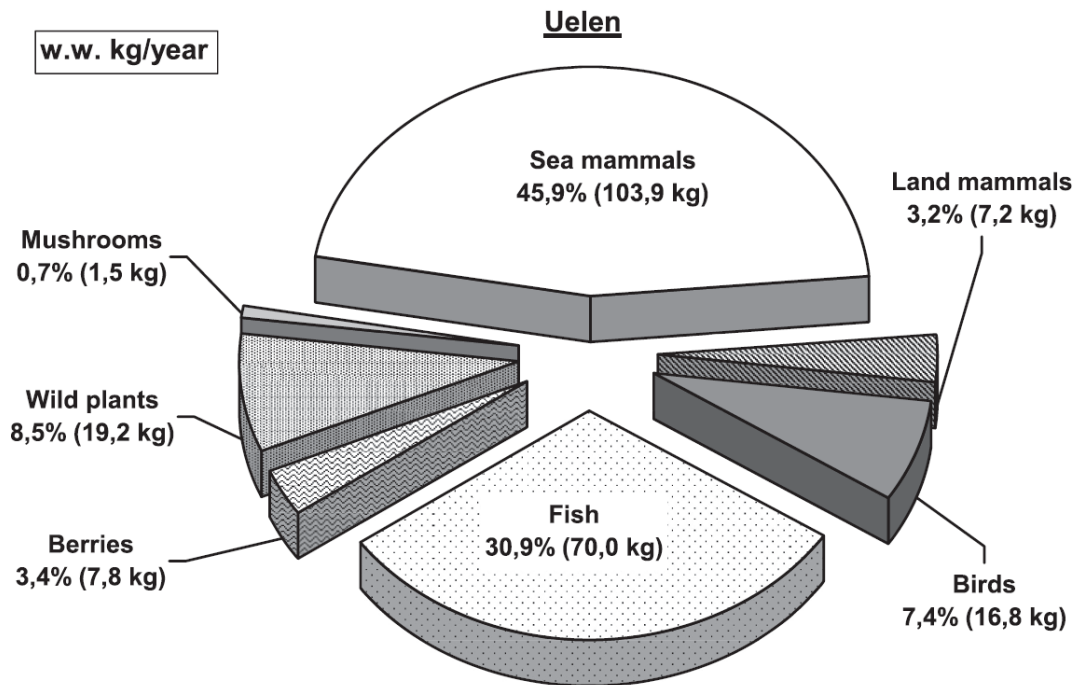


Figure 3. Average annual consumption of local foods (kg/person/year) by coastal indigenous people residing in the settlement Uelen. Questionnaire was carried out in 2001-2002. Figure from the article Dudarev et al, 2012. (“Russia,” 2020)

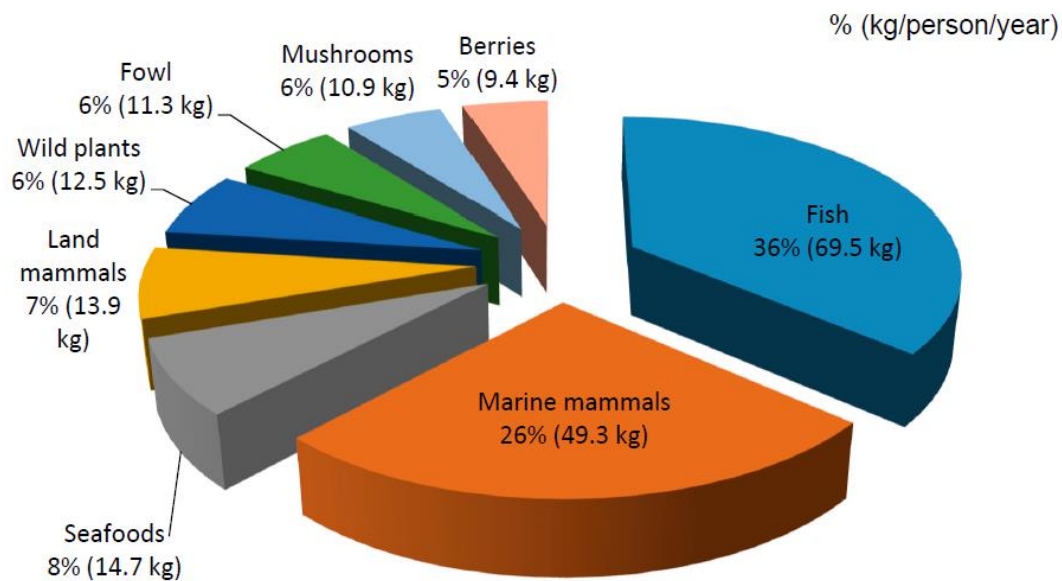


Figure 4. Annual consumption of local foods (kg/person/year) by coastal indigenous people residing in Providensky district of Chukotka (settlements Enmelen, Nunligran and Sireniki). Questionnaire was carried out in March-April 2016. Figure from the article Dudarev et al, 2019. (“Russia,” 2020)

From the collected data from a study conducted in a settlement in the year 2016, local food consumption was found 30 kg less (192 kg/person/year) than the amount of consumption was in between the year 2001 and 2002 (226 kg/person/year). (“Russia,” 2020) Moreover, the amount of sea mammal meat and blubber consumption was found to be 50% less, whereas the amount of fish consumption was similar as in the period 2001-2002. (“Russia,” 2020) However, these data did not mention the reason for these changes, according to the authors of these data mentioned it needs further discussion. In 2001 there was a severe socio-economic crisis due to the collapse of Soviet Union of Russia when locally harvested foods were considered as a reliable food source for nutrition for the Chukotka Villages. (“Russia,” 2020) The authors of these data mentioned, after that period, the availability of store-bought food have increased, despite their availability is still limited. (“Russia,” 2020)

Diet in the Chukotka has changed, and nowadays indigenous residents here eat both Slavic/Eastern European foods and traditional foods as a part of their regular diet. Most of the

families purchase pasta, instant noodle soup, flour, grains, powdered milk, eggs, dehydrated potato, cooking oil, tea and coffee as bulk from the village stores. Evidence shows it is shared here for the families to be cash-poor and unable to buy store-foods for a certain period, henceforth start to rely on locally harvested food. (Dudarev et al., 2019) Things are getting even more difficult as the climate change and unexpected ice formation. (“Russia,” 2020) However, freshly baked bread, such as sourdough and rye bread, are more available in every Chukotka village as there is a municipality managed bakery that has existed since the Soviet period. (“Russia,” 2020)

3.4.2.2. Yakutia (Sakha) Republic

Indigenous and Russian lactating women living in Yakutia rural settlements or Yakutsk city were compared for diet in 2002-2010 (Burtseva et al. 2013). The indigenous women had lower protein intake than the Russian women both in the rural settlements and in Yakutsk city (Table 5).

Table 5. Daily intake (per person per day) of macronutrients and calories by Indigenous and Russian lactating women living in Yakutia, averaged for 2002-2010 (adapted by Dudarev A. from Burtseva et al, 2013) (“Russia,” 2020)

	Rural settlements		Yakutsk city		RDA*
	Indigenous n=133	Russians n=10	Indigenous n=26	Russians n=28	
Proteins, g	59.8	70.7	53.0	69.9	71
Fats, g	63.2	65.5	59.4	68.3	nd
Carbohydrates, g	257.6	238.3	205.4	233.9	210
Energy, kcal	1819.6	1820.9	1549.1	1824.6	-

* Recommended dietary allowances: Institute of Medicine of the National Academies, Food and Nutrition Board. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (Macronutrients). A Report of the Panel on Macronutrients, Subcommittees on Upper Reference Levels of Nutrients and Interpretation and Uses of Dietary Reference Intakes, and the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. Washington, DC: The National Academies Press; 2005: p. 1357. [cited 12 June, 2013]. Available from: <http://www.nap.edu/openbook.php?isbn=0309085373>

According to the study data, the study team compared the consumption of food items as the proportion of total energy consumption for the lactating women sampled during 2013 and 2016. The proportion was compared between the women from the Yakut indigenous communities and the Russian women living in non-Arctic settlements such as Chokurdakh, Saskylakh, and more urban areas such as Yakutsk city. (“Russia,” 2020) The data represents the diet of lactating mothers in the Arctic rural settlements for both indigenous and Russian communities. The diet was found to consist of a high share of milk, butter, macaroni, low share of sausages, chicken, fowl, and vegetables. The proportion of cookie consumption was found same in both Yakutsk city and non-Arctic rural settlements (2%) in all study groups though

ethnicities were different. In all study groups, sugar consumption was found 4% among indigenous women whereas it was found 2% among Russian women.

Table 6. Structure of food products in the daily diet (% of the total diet) of lactating women in Yakutia, averaged for 2013-2016 studies (unpublished data, questionnaire data processing). Adapted by Dudarev A. from personal communication with Burtseva T. and Chasnyk V. (“Russia,” 2020)

Food	Non-Arctic rural settlements		Arctic* rural settlements		Yakutsk city	
	Indigenous, n=159	Russian, n=38	Indigenous, n=13	Russians, n=6	Indigenous, n=26	Russians, n=28
Milk	36	36	40	45	28	28
Butter	2	1	3	2	1	1
Meat store	5	4	5	4	5	4
Meat wild	1	1	1	2	1	-
Sausages	2	3	1	1	4	4
Chicken and fowl	1	2	1	1	2	3
Fish wild	2	2	2	3	1	3
Bread	7	6	8	6	6	6
Potato	6	7	5	8	6	8
Macaroni	8	9	9	11	6	8
Cereals	10	9	8	4	13	14
Cookies	2	2	2	2	2	1

Food	Non-Arctic rural settlements		Arctic* rural settlements		Yakutsk city	
	Indigenous, n=159	Russian, n=38	Indigenous, n=13	Russians, n=6	Indigenous, n=26	Russians, n=28
Sugar	4	2	4	2	4	2
other	4	9	6	4	3	4
Totally	100%	100%	100%	100%	100%	100%

* Chokurdakh and Saskylakh settlements located above Polar Circle.

3.4.2.3. Nenets autonomous okrug

A recent study has been conducted in a boarding school in Naryan-Mar city to find the daily dietary habits of indigenous children studying and living in the school. From that study, it has been observed foods, especially potato, vegetables, bread, and cookie consumption has increased among these children in the period 2017-2018, compared to the period 2012-2013. In contrast, sugar consumption has decreased by 8%. (Table. 7) (“Russia,” 2020) Also, in 2017-2018, no significant difference was found regarding the consumption of foods between the students in the boarding school and the recommended standards for students in general education schools. (Adapted by Dudarev A from personal communication with Shepeleva O.A. and Dedkova L.S.)

Table 7. Daily diet of indigenous children (11-17 years old) studying and living in the boarding school of Naryan-Mar city, Nenets okrug, 2012-2013 and 2017-2018. (“Russia,” 2020)

Food item	2012-2013, g or ml per person per day	2017-2018, g or ml per person per day	Changes in 5 years, %	Standard*, g or ml per person per day	The difference in consumption 2017-18 from the standard, %
Milk and sour milk	475.2	488	+2.7	480	+1.7
Curd and curd products	56.3	60	+6.6	60	0
Sour cream	9.2	10.3	+12	10	+3
Cheese	11.5	11.5	0	11.8	-2.5
Butter	33.8	35.8	+5.9	35	+2.3
Seed oil	17.5	18.5	+5.7	18	+2.8
Meat (beef)	81.7	77.5	-5.1	78	-0.6
Sausages	21	19.6	-6.7	19.6	0
Chicken	55	52.4	-4.7	53	-1.1
Eggs	40	38.5	-3.8	40	-3.8
Fish	79.7	74.7	- 6.3	77	-3
Potatoes	155	195.8	+26.3	188	+4.1
Vegetables	242.3	330,3	+ 36.3	320	+3.2
Fruits	170.2	186	+ 9.3	185	+0.5
Dried fruits	20	19.8	0	20	-1.0

Food item	2012-2013, g or ml per person per day	2017-2018, g or ml per person per day	Changes in 5 years, %	Standard*, g or ml per person per day	The difference in consumption 2017-18 from the standard, %
Juices	170	200	+17.6	200	0
Bread black	69.7	118	+ 69.3	120	-1.7
Bread white	131.8	191	+ 44.9	200	-4.5
Cereals, beans	50	52.2	+4.4	50	4,4
Macaroni	20	20.1	0	20	+0.5
Cookies	12.3	15	+ 22.0	15	0
Sugar	50	46	- 8.0	45	+2.2

*SanPiN 2.4.5.2409-08 "Sanitary-epidemiological requirements to the nutrition of students in general education schools, institutions of primary and secondary vocational education", 2008.

On the contrary, a study involving the indigenous children studying in the boarding schools in rural settlements of Nenets okrug noted that the increase in consumption of curd, sour cream, cookies, sugar, seed oil, meat, sausages, and chicken among the children, whereas the consumption of milk, dried fruits, macaroni, and fish has significantly decreased. ("Russia," 2020) The difference in food consumption was significantly high in terms of those foods, either was severely high or severely below the recommended standards during the year 2017 and 2018. The 'exceeds' over the standards were observed, mostly in the cases of the consumption of cookies and sugar, and for both. (AMAP, 2020) Both of these 'exceeds' were noted, noted 45% and 35% respectively. ("Russia," 2020) These are alarmingly high ratios. As for the high deficit, it was mostly found in terms of the consumption of fish, vegetables, and fruits.

Table 8. Daily diet of indigenous children (11-17 years old) studying and living in the boarding schools in rural settlements, Nenets okrug, 2012-2013 and 2017-2018. (“Russia,” 2020)

Food item	2012-2013 g or ml per person per day	2017-2018 g or ml per person per day	Changes in 5 years, %	Standard*g or ml per person per day	The difference in consumption 2017-18 from the standard, %
Milk and sour milk	470.3	350.1	- 25.6	480	-37.1
Curd and curd products	11.6	19.7	+ 69.8	60	-77.2
Sour cream	2.9	5	+ 72.4	10	- 50
Cheese	10.7	10.1	- 5.6	11.8	- 14.4
Butter	33	31.4	- 10.8	35	- 10.3
Seed oil	17.5	21.1	+ 20.6	18	+ 17,2
Meat (beef)	90.2	103.5	+ 14.7	78	+ 32.7
Sausages	21.6	25.6	+ 18.5	19.6	+ 30.6
Chicken	42.4	50.6	+ 19.3	53	- 4.5
Eggs	35.2	34.1	- 3.2	40	- 14.7
Fish	68.6	57.2	- 16.6	77	- 25.7
Potatoes	231.3	245.7	+ 6.2	188	+ 30.7
Vegetables	301.9	276.7	+ 8.3	320	- 13.5
Fruits	178.8	156.8	- 12.3	185	- 15.2
Dried fruits	13.7	6.1	- 55.5	20	- 69.5

Food item	2012-2013 g or ml per person per day	2017-2018 g or ml per person per day	Changes in 5 years, %	Standard*g or ml per person per day	The difference in consumption 2017-18 from the standard, %
Juices	197.3	194	- 1.7	200	- 3.0
Bread black	66.4	61.7	- 7.1	120	- 48.6
Bread white	148.5	149.9	+ 0.9	200	- 25.0
Cereals, beans	57.8	59,1	+ 2.2	50	+ 18.2
Macaroni	22.8	18.8	- 17.5	20	- 6.0
Cookies	13.9	21.8	+ 56.8	15	+ 45.3
Sugar	46.5	60.8	+ 30.8	45	+ 35.1

* SanPiN 2.4.5.2409-08 "Sanitary-epidemiological requirements to the nutrition of students in general education schools, institutions of primary and secondary vocational education", 2008

3.4.2.4. Arkhangelsk oblast

During the year 1998 and 2017, the consumption of foods such as meat and meat products, eggs and fruits significantly increased in the people residing in the Arkhangelsk oblast. An increase in vegetable consumption was also observed, whereas the consumption of potatoes slightly decreased. During that period, an increase has also been observed in terms of sugar consumption. In contrast, the consumption rate of bakery and pasta intake remained unchanged.

Also, some food consumption exceeded the recommended standard in the year 2017, where vegetable oil consumption exceeded by 11.7%, consumption of flour products exceeded by 9.4%, and for sugar, it exceeded by 62.5%. The consumption of other foods such as dairy products, vegetable, and fruit was more than 40% less than the recommended value. (Table 9, adapted by Dudarev A. from personal communication with Shepeleva O.A. and Degteva G.N.)

Table 9. Consumption of foods by the general population of Arkhangelsk oblast, 1998-2017

Food items	Average consumption*, kg/person/year			Changes in consumption, 1998-2017	Standard**, kg per person per year	Difference in consumption 2017 from the standard, %
	1998	2010	2017			
Meat products	29	53	64	++	73	-12.3%
Dairy products	126	158	176	+	325	-45.8%
Eggs	138	253	240	++	260	-7.7%
Seed oil	8.5	11.9	13.4	+	12	+11.7%
Potatoes	95	74	69	-	90	-23.4%
Vegetables	57	76	81	+	140	-42.1%
Fruits and berries	18	61	59	+++	100	-41%
Bread, macaroni, flour, cereals, beans	107	109	105	0	96	+9.4%
Sugar	30	39	39	+	24	+62.5%

* Data from the Russian Federal State Statistics Service.

**Order of the Russian Federation Ministry of Health Care, No. 614 from August 19, 2016 “On approval of Recommendations on rational standards of food consumption that meet modern requirements for healthy nutrition”.

3.4.2.5. Komi Republic

In a 2001-2015 survey involving the population residing in the Komi Republic, an excess of 15-30% fat consumption than WHO recommendation was found. During that period, protein intake was found consistently lower than the WHO recommendation, which was noted 30%-42% lower on average in 2003. (AMAP, 2020) Similar lower intake was noted in terms of carbohydrate intake, which was almost 25% less than the dietary recommendation provided by the WHO. (“Russia,” 2020) Except for the intake rate measured in the year 2001 and 2004. (Fig. 5) (Adapted by Dudarev A. from personal communication with Bojko E. and Vasilenko T, “Russia,” 2020)

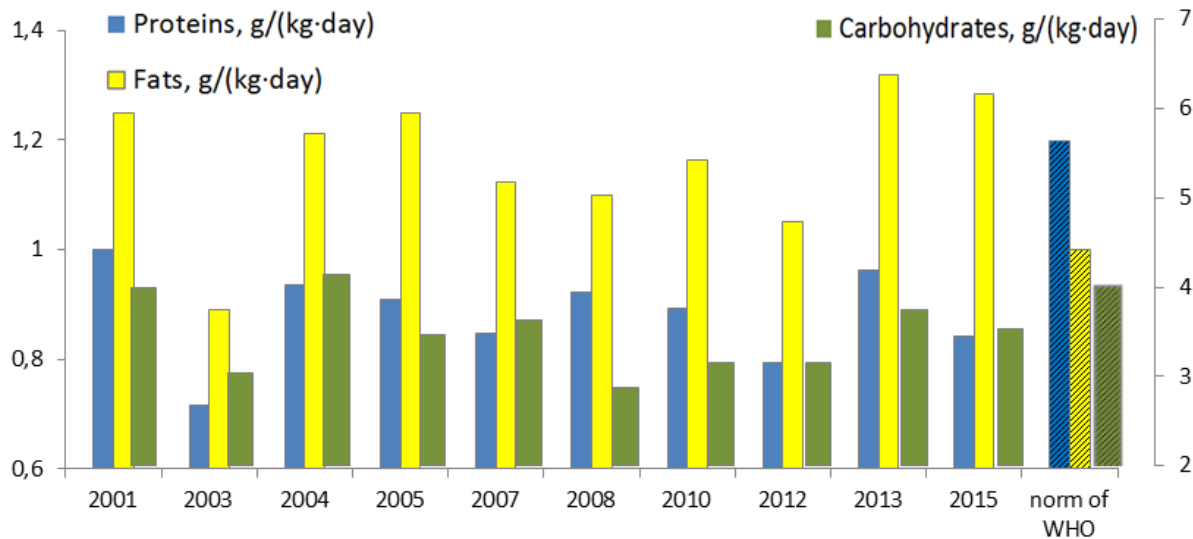


Figure 5. Daily intake of proteins, fats, carbohydrates (g/kg bw/day) in the general population of Komi Republic, 2001-2015 (figure provided by Bojko E. and Vasilenko T). (ref WHO. Diet, nutrition and the prevention of chronic diseases: report of a Joint WHO/FAO Expert Consultation. WHO Technical Report Series, No. 916. Geneva: World Health Organization; 2003)

The existing diet of the Komi Republic inhabitants is limited to essential foods with high calories such as white bread, pasta, confectionery products, and sugar. Less diversity has been observed in this diet pattern. However, an increase in canned foods after intensive technological processing has been observed in this region. (“Russia,” 2020; Bojko, 2019, Personal communication) Regional experts identified this increase as a potential cause for the significant loss of vitamins in the diet for the population. (“Russia,” 2020; Bojko, 2019, Personal communication)

3.4.3. The consequences to the emerging transition in diet

In 20 years of research, the experts and researchers of Arctic Russia found a high spread of hypovitaminosis in the residing populations in the whole European north of Russia. (“Russia,” 2020; Bojko, 2019, personal communication) However, in the indigenous communities like Nenets and Komi, where in general the traditional lifestyle and dietary habits are more in practice, a higher Vitamin D status has been found. (Kozlov, A et al., 2014) In contrast, an increased intake of starch, fat and sugar has also been found in the recent dietary habits of the indigenous populations of Arctic Russia. Experts noted, this increase as a possible leading cause for not only the increased risk of having chronic diseases like diabetes, or cardiovascular diseases, (Petrenya et al., 2011, “Russia,” 2020) but also the increased prevalence of obesity. (Snodgrass et al. 2006, Kozlov et al. 2019, “Russia,” 2020)

3.5. Arctic Alaska

Arctic Alaska or Far North Alaska is a region of the U.S. state of Alaska generally referring to the northern areas on or close to the Arctic Ocean. It commonly includes North Slope Borough, Northwest Arctic Borough, Nome Census Area, and is sometimes taken to include parts of the Yukon-Koyukuk Census Area. Some notable towns there include Prudhoe Bay,

Utqiagvik, Kotzebue, Nome, and Galena. Majority of these communities have no highways and can only be reached by aircraft or snowmobile in good weather. Initially inhabited by various Alaska indigenous groups living off hunting, whaling, or salmon fishing, modern settlement in Arctic Alaska was driven first by discoveries of gold and later by the extraction of petroleum.

3.5.1. The traditional diet of Arctic Alaska

The bowhead whale, walrus, seals, fish, berries, waterfowl, caribou, moose, Arctic hares, have been considered as the traditional foods of the Alaskan indigenous communities. (Caufield, 2000) These foods of the indigenous communities are considered as the country food or local foods, and their integration in the Alaskan indigenous diet is considered as necessary for the people living in the Arctic Alaska region. (Caufield, 2000) However, in the southwestern part of Alaska, the traditional diet consists of various species of Pacific salmon, which are migrating from the coastal rivers to spawn. (ADF&G 2014 Subsistence update; “Alaska,” 2020)

3.5.2. Changes in dietary habits over time

Since the year 1960, extensive health and dietary studies have been conducted to understand the health status, dietary changes, and impacts of the changes in the traditional diet of the Alaskan Native Yupik residents living in the delta between Yukon River and Kuskokwim River. According to those studies, it has been found that the rural Alaska Native diet is gradually transitioning from the traditional seasonal plant and local wildlife-based diet to a mixed diet of imported and local foods. (Heller, 1964; “Alaska,” 2020) In Arctic Alaska, the transportation system is well developed, and even the smallest villages have air transport with regional hub communities, which has increased the availability of processed foods and foods with high sugar content as well as expensive. (“Alaska,” 2020) However, the foods harvested from wildlife are still the essential sources of nutrients and calories for the native communities living in the rural

areas. Data regarding subsistence harvest in Arctic Alaska shows that the urban areas and areas with a high density of population are the lowest in harvesting locally available foods. In contrast, it has been observed that the subsistence harvest is the highest in the remote Alaskan regions with low population density. (“Alaska,” 2020)

Figure 6 and 7. show this information for the 1990s and 2014. For most Alaskan regions, but not all, the amount of subsistence harvest has decreased over time.

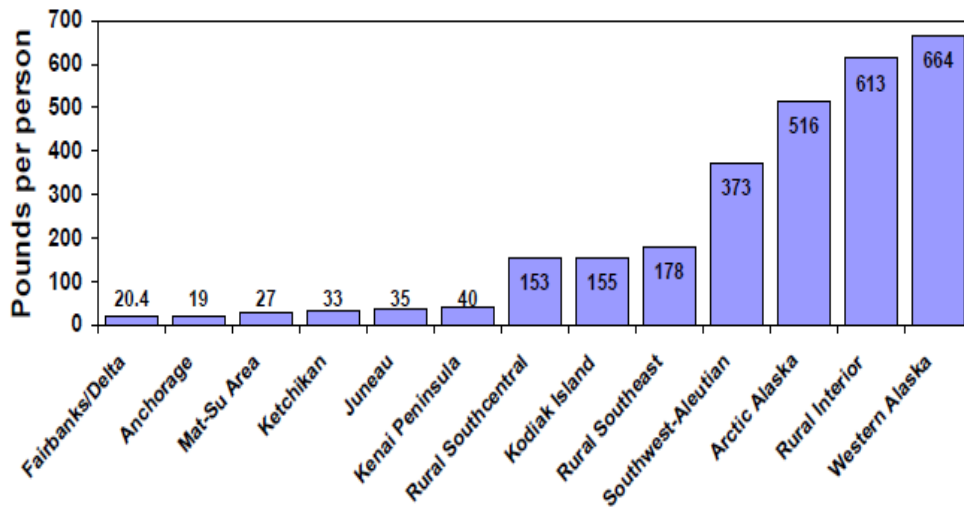


Figure 6. Subsistence food harvest in different Alaskan regions in the 1990s. From Caulfield et al. 2000. (“Alaska,” 2020)

Rural Alaska Subsistence Food Harvest

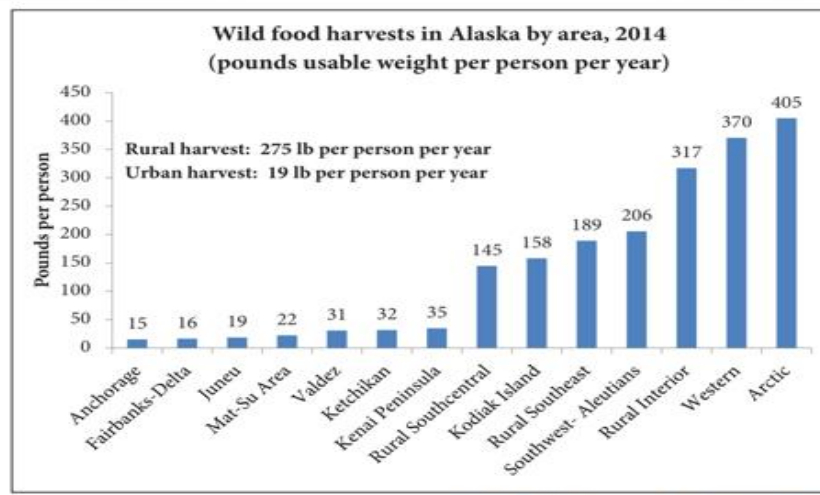


Figure 5

ADFG Subsistence Update 2014

Figure 7. Subsistence food harvest in different Alaskan regions in 2014. From Division of subsistence, Alaska Department of Fish and Game, Anchorage, Alaska. (“Alaska,” 2020)

3.5.3. Consequences of dietary transition

Within the Alaskan populations, the prevalence rate of non-communicable diseases such as obesity, type 2 diabetes (T2DM) and chronic diseases associated with those have increased, where the rates are observed having the matching pattern with the rates within the general population. (IBIS, 2019, “Alaska,” 2020)

As a measure to find the trend of OH (Organohalogen) and Hg (mercury) levels in the bloodstream of mothers and infants in the Yupik population of the Southern Alaska, Maternal Organic Monitoring (MOM) Study was carried on by the YKD Tribal Health Board and the Alaskan Native Tribal Consortium, during the period 1998-2012. (AMAP 1998; AMAP, 2015;

“Alaska,” 2020) From the study, the researchers observed a steady decrease in the levels of maternal OH and Hg. (AMAP, 2015; “Alaska,” 2020)

While the negative health impacts of OH and metals in traditional marine diet continues to be studied, the negative impact of decreased consumption of marine species has only recently begun to be intensively studied.

In the YKD region of southwest Alaska, the decline in traditional food consumption, especially marine species, has resulted in a steady decrease in the blood levels of young Yupik women, of the stable marine isotope of nitrogen, N15, and is part of the explanation for the decrease in exposure to contaminants, and micronutrients, as well. (O’Brien 2017).

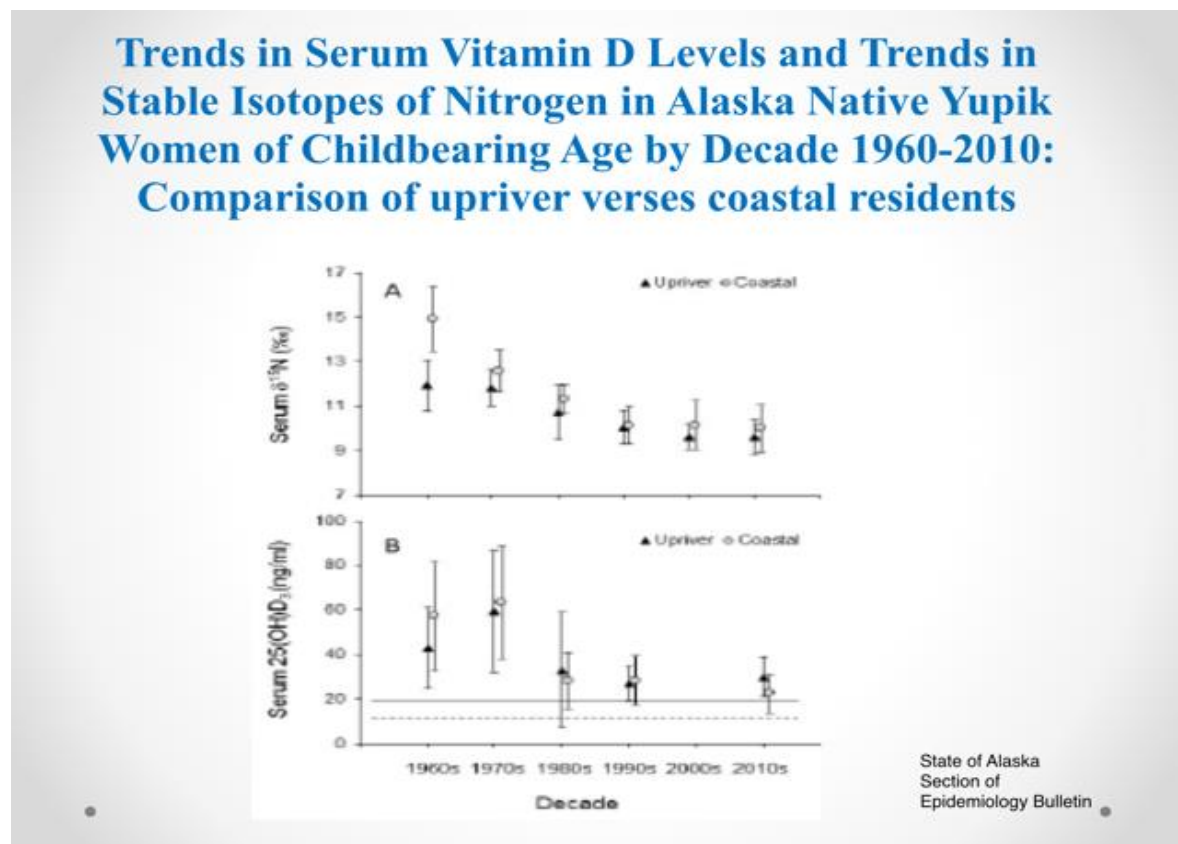


Figure 8. Multi-decade decreases in blood levels of N15 and vitamin D. From O’Brien 2017.

According to a study result published in the year 1934, dental problems such as dental caries increased in the YKD infants and young children as the availability of the high sugar-containing snacks and foods became more available in that time. (JDR, 1934; “Alaska,” 2020) In a more recent study, childhood dental disease has been identified as a significant health disparity in the YKD community. (CDC MMWR, 2008; “Alaska,” 2020) Moreover, the increased prevalence of T2DM and obesity has also been reported higher in YKD communities than any other native communities of Arctic Alaska. (“Alaska,” 2020) Clinically apparent vitamin D deficiency has also been reported in a report published in 2015 where this deficiency was mentioned as two times higher now than that was in the early 1990s and 2000s in comparison to US all-races rate. (Singleton, 2015, “Alaska,” 2020)

Furthermore, parallel drop in N15 (a marker of marine protein intake) stable isotope and vitamin D in Yupik women was noted from the year 1960 until the year 1980, which was found stabilizing in the year 1990. (O’Brien, 2017. “Alaska,” 2020) From YKD MOM study cohort-3 recruited between 2009-2012 (156 women averagely aged 26, and 76 new cord blood samples), a significant amount of women entering prenatal care were diagnosed with vitamin D deficiency and an even higher percentage of infants with deficient (<30 ng/ml) and severely deficient (<12 ng/ml) cord blood. (“Alaska,” 2020) In case of dental problems, vitamin D deficient newborns have been observed to have a 2.5 times higher risk to have the dental disease than those who have enough vitamin D levels. (Singleton, 2019; “Alaska,” 2020) A significantly positive correlation was found among the isotope biomarker N15, total blood mercury, total omega-3 fatty acids, and vitamin D levels from the YKD MOM cohort 3 study, where only vitamin D was found to be negatively associated with HbA1c (a marker for blood glucose level). (Comm. and “Alaska,” 2020) The regional experts of Alaska have mentioned that this preliminary finding is being explored further. However, it would indicate a possible association between the risk of increased insulin resistance with vitamin D levels during the time of pregnancy. (Berner et al., 2019, personal communication)

3.6. Arctic Canada

The Canadian Arctic territories consist of Yukon, the Northwest Territories (NWT) and Nunavut (NU). In these territories, approximately 25%, 50% and 85% of the total populations are the indigenous people, respectively (Statistics Canada, 2007a,b,c, 2008). Canadian Aboriginal groups inhabiting these territories include Inuit and Inuvialuit, First Nations (including De'ne') and Me'tis (people of mixed First Nations and European ancestry) (Indian and Northern Affairs Canada, 2000; Statistics Canada, 2007a,b,c, 2008). The highest concentration of Canada's Inuit (49%) resides in Nunavut (Statistics Canada, 2007a, 2008). The Northwest Territories is home to 10% of the country's Inuit, usually described as Inuvialuit (Statistics Canada, 2007a, 2008). It is mentioned that Inuit and Inuvialuit will be distinguished in times if possible. Even though they cannot be distinguished, it is to be mentioned that the term Inuit includes Inuvialuit (Indian and Northern Affairs Canada, 2000). The land, water, and wildlife are the foundation of Northern culture and spirituality (Takano, 2005).

3.6.2. The traditional diet of Arctic Canada

By tradition, the Inuit people in NU and Inuvialuit in the NWT were used to be nomadic hunter-gatherers. Their subsistence or traditional diets consisted of a diverse range of largely protein-based foods, such as; caribou, Arctic hare, seal, fish, ptarmigan, goose, berries, which they could gather locally. (Draper, 1977; Kuhnlein et al., 2001). In the Inuit community, the subsistence foods have long been considered as the basis of their age-old cultural tradition. (Sharma, 2010) It has also been found that the food sharing systems in the Inuit community of the Canadian Arctic have defined their identity through creating and reinforcing social bonds and ensuring the survival of the extended family and community members (Sharma 2010; Condon et al., 1995; Collings et al., 1998).

3.6.3. Changes in dietary habits over time

In Arctic Canada, the traditional diet is going through a gradual transition, even though it is considered as an important part of the social and cultural systems of the indigenous populations of this region, where a significant decline has been reported in traditional food consumption over time. (Van Oostdam, J, 2019; “Canada,” 2020) This is an evident dietary transition with a decline in the consumption of country foods including a limited amount of consumed local species and noted from the review of the NCP (Canadian Northern Contaminants Program) and the AMAP 1990-2017 assessments. (Van Oostdam, J, 2019; “Canada,” 2020)



Figure 9. Description of Canadian territories from Statistics Canada. (“Canada,” 2020)

The Canadian Arctic has its assessment report named CACAR (Canadian Arctic Contaminants Assessment Report). According to the CACAR published in the year 1997, it is noted that the daily intake of traditional food was 82 to 562 grams/person/day, varied by age, gender, ethnicity, and location of the community. The amount of country food intake was noted higher in the older age groups and more remote communities. It has also been noted that, even though the country or traditional foods consisted only 10-40% of the total energy intake of the entire diet, they played a significant role in providing necessary micro and macronutrients (e.g., protein, iron, omega-3 fatty acids, vitamin A, and calcium) for the local communities. (CACAR, 1997; Van Oostdam, J, 2019; “Canada,” 2020) Another assessment through early work on radio-caesium exposures in Baker lake indicates, in 1989, the caribou consumption was one-fourth of that noted in the year 1967. (Van Oostdam, J, 2019; “Canada,” 2020)

A report from the AMAP 2009 on Arctic Canada indicates, country food items consist 11-30% of the total diet of Arctic Canada (AMAP, 2009, Van Oostdam, J, 2019; AMAP, 2020). From the report, it has also been indicated the major dietary shifts observed in larger communities before the year 1950 than it was observed in rural communities. In contrast, the consumption rate of the country foods in the 1970s maintained a higher trend.

In the Northwest Territories in Canada, a human biomonitoring project funded by the Northern Contaminants program research put an effort to provide knowledge on country food consumption in Dene communities of the Sahtú and Dehcho regions of the Northwest Territories of Canada during the period 2015-2017. The project utilized an FFQ survey and a 24 hours dietary recall survey, where a total of 44% (n= 237, 65% from Dehcho and 35% from Sahtú) of the total participants completed the FFQ survey. In this survey, 48.5% and 51.5% were men and women, respectively. (Van Oostdam, J, 2019; AMAP, 2020) This research project has been able to present an overall country food intake data in the last 25 years.

Table 10. Energy and nutrient intake on days with and without consumption of country food (CF) in 1994 and in 2016-2018. (“Canada,” 2020)

Dene/Métis	Adults			
	CINE (1994) ¹ Dehcho and Sahtu regions		Mackenzie Valley Study (2016-2018) ² Dehcho and Sahtu regions	
<u>Nutrients (average)</u>	With CF (N=661)	Without CF (N=346)	With CF (N=35)	Without CF (N=65)
Energy (kcal)	2261	2085	2144	1959
Carbohydrate (E%)	35	47	39	44
Protein (E%)	31	20	25	17
Fat (E%)	34	39	37	40

CF=Country Food; In these two regions of the Northwest Territories, country food consists of harvested food from the land and waterways, primarily large land animals (e.g., moose, caribou) and fish, along with birds, small land animals (e.g., rabbit, beaver), berries, and plants.

CINE=Centre for Indigenous Peoples’ Nutrition and Environment

¹Kuhnlein & Receveur 2007

²Skinner et al. 2020

3.6.4. The causes behind the dietary transition

It has been seen from the previous section that the traditional food habits in the Arctic Canada region have decreased. According to a recent study published in 2019, climate-related changes on various aspects of the country food systems, including the changes in the accessibility, availability, and condition has been identified as the causes for the decline in the country food consumption in the Inuit community. (Nancarrow, 2008; Wesche, 2010; Kenny et al., 2019) Moreover, in Northern Canada food insecurity due to the state of inadequate access to

enough, safe/nutritious and culturally preferred foods and other inadequacies regarding country foods is becoming a growing concern for the indigenous community like Inuit. (Kenny et al., 2019). In the AMAP 2015, Canada reported on dietary changes and possible contaminant exposures related to decreasing availability of country foods such as caribou (AMAP 2015).

Another reason for the decreased country food consumption can be, the bioaccumulation of contaminants such as POPs and Mercury in the country foods (i.e. marine mammals, freshwater fish), as these country foods, have been identified as a potential source contaminant by the regional researchers (Van Oostdam, J, 2019; “Canada,” 2020). In CACAR 2009, data has been presented on contaminant trends and dietary change in the Canadian Arctic. CACAR 2017 presented data in to present how human contaminant concentrations in Inuit and Dene/Métis peoples could be correlated with theoretical human exposure models (Binnington et al., 2016a; 2016b, Van Oostdam, J, 2019; “Canada,” 2020). These assessments based on theoretical dietary change presented short term dietary changes for contaminants with long half-lives (e.g. PCB, Mercury, etc.) have no significant effect in changing body burdens due to contaminants. Instead, it allowed some significant increase in various essential nutrients for the human body. Therefore, researchers have stated that there is a possibility of overestimation by the country food frequency questionnaires regarding the dietary exposures in terms of country food and their contaminant load.

3.6.5. Consequences of dietary transition

In the indigenous population of Arctic Canada, obesity and other metabolic diseases are rising which resembles the trends found in other Arctic indigenous populations from other Arctic regions (Bjerregaard, 2004; Galloway, 2010; Reeds et al., 2016). Health inequalities have found higher between Aboriginal and non-Aboriginal people with evident shorter life expectancy, increased rates of chronic disease (Gittelsohn et al., 1998; Veenstra et al., 2009; Van Oostdam, J, 2019; “Canada,” 2020), increased fracture rates (Leslie et al., 2004, Van Oostdam, J, 2019;

“Canada,” 2020) as well as increased prevalence of rickets in the Aboriginal communities. (Ward, 2007, Van Oostdam, J, 2019; “Canada,” 2020). Moreover, the prevalence of 25-hydroxy vitamin D deficiency has been found ranging from 13.9% to 76% among the indigenous populations living in Canada during summer, where mean intake for vitamin D was found below estimated required average in all age groups (Fares, 2016; Van Oostdam, J, 2019; “Canada,” 2020). On the other hand, the increase in height has been noted among the Canadian Inuit children (Roth, 2008; Van Oostdam, J, 2019; “Canada,” 2020), which can be considered as a positive side of the ongoing dietary transition.

A survey involving 2095 Inuit adults in 2007-2008 revealed that, even though country foods contributed 6.4-19.6% of the total energy intake, these foods provided 23-52% of the total protein also. The same survey also presented that, those country foods even provided a large proportion of many other essential micronutrients such as 73% of vitamin D, 50-80% of vitamin B12, and 28-54% of iron. (Van Oostdam, J, 2019; “Canada,” 2020) Market foods such as sweetened beverages added sugar and bread contributed to approximately 20% of the total energy intake, whereas in terms of nutrients they did not contribute much (Kenny et al., 2018; Van Oostdam, J, 2019; “Canada,” 2020)

4. DISCUSSION

The systematic literature review of this study indicates a similarity with regards to traditional diet among the different Arctic indigenous populations. Traditional food based on animal sources, consumption of fish, the meat of sea mammals and their blubber (meat and blubber of whale, walrus and seal) have been a common tradition among all the indigenous populations living in the Greenland, Alaska, and some indigenous populations of Arctic Russia (Chukchi and Eskimos). In the indigenous communities of Scandinavia (Sami), and Arctic Russia (except Chukchi and Eskimos) the traditional diet consisted mostly of reindeer meat, and fish. Hunting and gathering have always been an essential part of acquiring foods from the

traditional and local food sources for Arctic indigenous communities and helped them to survive through generations. Meat from different game birds used to be a part of traditional food in the indigenous communities living in Arctic Canada, Alaska, and have game animals like the Arctic hares. In terms of the plant-based regular diet, commonly different types of locally harvested berries are or used to be consumed according to their availability in the region. However, in some areas, indigenous populations also used to consume other plant-based food too. For example, in Arctic Russia, indigenous communities used to consume mushrooms and wild plants.

Although traditional foods used to be an integral part of these indigenous communities, as the time passed by, majority of these dietary traditions has changed and at some extent replaced by the imported foods from other regions. According to the literature included in the study, it has been widely observed that the indigenous diets in the Arctic regions have gone through different changes or transitions through several decades. In Greenland, it has been found that 85% of the total diet of the population now consists of imported foods, whereas only 15% of the total intake consists of traditional food sources. It is noted from the study data, 76% of the total dietary energy in modern Greenlandic Inuit communities comes from imported red meat, refined grain, whole grain, soda pop, dairy, eggs, fish, sweets, fruit, sugar in the coffee or tea, and potatoes. In contrast, fish only contributes 6.6% of it. (Knudsen et al., 2015; Larsen et al., 2019; Terkelsen et al., 2017, Bjerregaard, 2019, personal communication) When searching for the transition involving the Scandinavian Indigenous Sami populations, it has been found that the community has been able to maintain their dietary tradition through harvesting foods from local resources. However, the amount of traditional food consumption has also reduced as imported foods have been introduced. In Arctic Russia, the dietary transition in terms of conventional foods followed decreasing pattern in the indigenous populations living in Chukotka Peninsula, Arkhangelsk oblast, Yakutia or Sakha republic, Nenets autonomous okrug, and Komi republic. In all these communities overall the consumption of imported foods, such as macaroni, pasta, sugar and sweetened products has increased compared to the consumption of traditional foods (walrus, fish, seal, game animals etc.) used to be several years back.

However, overall intake in terms of vegetables has increased in all the communities of this region. It indicates an improvement in terms of Alaskan indigenous nutrition. In Arctic Alaska, the traditional diet is still popular among the indigenous native communities (Yupik), despite the increase of the imported foods from outside regions. However, the traditional food sources are more popular among the indigenous natives living in the rural part of Arctic Alaska. It has been noted that the overall amount of local harvest is 256 lb/person/year (Rural produce 275 lb/person/year, and urban harvest 19 lb/person/year) more than the indigenous natives living in the towns. (ADFG subsistence update 2014; “Alaska,” 2020) Even so, due to growing food insecurity in the Arctic Alaska, traditional food sources are getting scarcer. Therefore, the overall traditional harvest is decreasing day by day. As for Arctic Canada, a decline in traditional food intake has been found. From CACAR report it is seen that in 1997 the traditional food intake ranged from 82 to 562 grams/person/day, which contributed 10-40% of the energy intake for the indigenous residents in Arctic Canada. Even though traditional foods were the leading sources for macro and micronutrient for the indigenous community of the region, later a decrease in consumption has been reported by the regional experts and researchers. Caribou intake among the indigenous populations in the area also reduced since 1967, and since that year, one-fourth reduction of Caribou consumption was noted in the year 1989. (Van Oostdam, J, 2019; “Canada,” 2020)

When the study searched for the causes behind these dietary transitions among all these indigenous populations of the Arctic regions, it is noted that gradual climate change, globalization and westernization of the society were the common cause which worked as driving force towards changed dietary habits. In the regions where whale, sea fish and sea bird consumption used to be a popular tradition (e.g. Greenland and Arctic Canada), the increased presence of hazardous environmental contaminations and POPs in these food sources is noted. That is one of the main reasons that the alternative diet is emerging within the indigenous communities in these regions. Some of them, such as indigenous communities from Arctic Canada and Arctic Alaska also facing growing food insecurity in the areas, which is also creating

a necessity towards switching to alternative diets apart from the common causes of transition. (Van Oostdam, J, 2019; “Canada,” 2020)

It is indeed true that the Arctic indigenous diet is changing, and these changes have changed the age-old indigenous culture and tradition of food, the consequences to these changes are noted to have both positive and negative effects. Indeed, the prevalence of non-communicable diseases such as T2D, cardiovascular disease, and obesity has increased as these communities acquired western food habits beside their traditional diet. Even the conditions like Dental Caries has also increased due to increased sugar and sugary product consumption. But, an increase in vegetable (excellent source for vitamin, minerals, and fiber) intake also has been noted at the same. That is a positive effect of adapting western diet. The study data suggests the consequences of the dietary transition can be regulated through careful food choices.

4.1. Knowledge gaps and suggested further studies

In addition to exploring dietary transition and its causes and consequences involving the Arctic indigenous communities, the study also tried to encompass the existing knowledge gaps in the dietary existing dietary data through careful review of the selected literature. While exploring the results, it has been found that knowledge gaps in the nutritional data differed from nation to nation within the Arctic regions. In Greenland, the dietary data is noted as well explored at the national level. Still, it lacks information when it comes to food and diet-based studies in terms of demographic, geographic and social subgroups of the population. Moreover, there is still much to do regarding the economic aspects of diet and qualitative studies of the reasons for dietary choices. Questions on food insecurity have recently been added to the health interview surveys and to be analyzed in the future. In the Sami populations from Scandinavian (Finland, Norway, and Sweden) countries, it is noted that the dietary data involving Norwegian Sami community is well explored and followed up in regular basis through SAMINOR study. The Swedish and Finnish dietary data involving Sami population have not been continued since the year 1996.

Therefore, it seems data requires updates through well-structured dietary studies with follow up in Sweden and Finland involving the resident Sami communities. However, it has also been reported by a regional expert in Sami diet that, a study named HALDI has been launched in Sweden to explore the unexplored data concerning Sami residents in collaboration with SAMINOR study to fulfil these diet-based knowledge gaps. (“Sami,” 2020) As for Arctic Russia, although it is one of the most significant Arctic territories, only a few reviews on dietary patterns and dietary shift during the last 10-20 years have been carried out. The same is right about studies on assessment and monitoring of environmental contaminants in traditional foods in Arctic Russia. Extensive new studies are needed in the “unexplored” territories, as well as follow-up studies in the previously examined regions, for monitoring of the dietary changes, particularly concerning the influence of climate change, industrialization consequences and other processes going on in the Arctic. And finally, in Alaska and Arctic Canada, Alaskan dietary data involving indigenous communities are noted well explored in terms of quantifying the amount of local harvest in a different part of the region. In contrast, the Canadian data is indicated very well studied overall. Even so, Alaskan dietary data still have knowledge gaps concerning the adverse effect of the contaminants in the indigenous populations, and the Canadian data lacks information concerning food acceptability and affordability through a structured qualitative Food Choice-based questionnaire.

4.2. Strengths and Limitations

This study has covered the emerging dietary transition trend in the indigenous populations residing in all the Arctic regions. The study is a systematic review of the literature with extensive data on a traditional diet, emerging dietary transition, causes and consequences of the transition. The study team tried to collect and compile all the data concerning these topics in a systematic manner, as a single publishable paper. The study has been done in collaboration with the AMAP HHAG regional experts and researchers, who communicated the data and statements (personally or through their manuscripts) requested by the study team. The study team included these communicated data and information in this systematic review of the literature study, which has

increased the strength of the study, in terms of data and information validity and reliability. Apart from opinions, suggestions, and manuscripts from the regional experts and researchers, the study team selected and sorted literature by their peer review, citations, and relevance to the study aim. The study team tried to verify all the study data connected to the upcoming Dietary transition chapter of AMAP 2021 report by sending them for national reviews and AMAP HHAG team review. The feedback and corrections from the national reviews and AMAP HHAG team, helped the team to increase the source validity and marginalize the risk of unexpected plagiarism. The study has presented extended results collected from all the sources that have been included in the study to avoid publication bias.

However, the study mostly focused on available English literature and at some extent literature available in Scandinavian languages (mostly Norwegian, Danish, and Swedish), even though there are many literature and evidence available in native languages published by different Arctic regions. So, the study may have possible language bias. However, to avoid such bias, the study team tried their best to communicate with regional experts. They have helped the study team to transcribe data from their native language to English, which helped the study team to marginalize language bias to some extent.

5. CONCLUSION

The diet in the Arctic is changing. Although the traditional food sources used to be the major sources of energy and nutrients for the indigenous populations, currently the people from the Arctic indigenous communities are adapting the alternative diet. The gradual climate change, mass globalization, and increasing popularity of the western diet are acting as the root driving force towards this dietary transition which has created the necessity for the indigenous people of these regions to accept imported foods besides their subsistence dietary habits. Moreover, food insecurity is becoming a growing concern. The risk of T2D, cardiovascular diseases, obesity, and dental carries has increased through the past decades among indigenous communities. For the

positive effect of this change, vegetable consumption has increased in several indigenous communities of these regions due to the adaptation of the western diet, which indicates an improvement in terms of nutrition, as vegetables are the excellent sources of macro and micronutrients. Therefore, it can be stated that the dietary effects of the transition or changes can be manageable through following dietary guidelines and careful food choices. However, data and information gaps have been identified for several Arctic regions concerning the effects of dietary transition in the indigenous populations' health and their lifestyle as well as their food choices and affordability. For better understanding and to provide better dietary guidelines, further extensive studies, including qualitative food frequency questionnaires can be used by the regional and local experts and researchers.

REFERENCES

Diabetes and Obesity Prevalence. Retrieved from <http://ibis.alaska.gov/>

AMAP. (1998). In *AMAP Assessment Report: Arctic Pollution Issues* (pp. 820). Oslo, Norway.

AMAP, 2003. *AMAP Assessment 2002: Human Health in the Arctic*. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. xiv+137 pp.. (2020).

AMAP, 2009. *AMAP Assessment 2009: Human Health in the Arctic*. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. xiv+254 pp.

AMAP, 2015. *AMAP Assessment 2015: Human Health in the Arctic*. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. vii + 165 pp.

AMAP. (2020). *AMAP, 2021. chapter on dietary transition* Unpublished report draft, Arctic Monitoring and Assessment Programme, Oslo, Norway.

Alaska. (2020). *AMAP, 2021. chapter on dietary transition* Unpublished report draft, Arctic Monitoring and Assessment Programme, Oslo, Norway.

Anderson, I., Robson, B., Connolly, M., Al-Yaman, F., Bjertness, E., King, A., . . . Yap, L. (2016). Indigenous and tribal peoples' health (The Lancet–Lowitja Institute Global Collaboration): a population study. *The Lancet*, 388(10040), 131-157. doi:10.1016/s0140-6736(16)00345-7

Berner, J. (2008). Health Transitions in Arctic Populations. In T. Young & P. Bjerregard (Eds.), (pp. 53-70): University of Toronto Press.

- Berner, J., & ANTHC (2019). [Institute of Medicine: Dietary reference intake for calcium and vitamin D].
- BERTELS, E. (1937). Grønlandsk medicinsk statistik og nosografi, II–Sundhedsvilkaarene I Grønland [Greenland medical history and nosography. II. Health conditions in Greenland. In Danish]. *Medd. om Grønland*. 117 (2): 1, 248.
- Binnington MJ, Curren MS, Quinn CL, Armitage JM, Arnot JA, Chan HM, et al. Mechanistic polychlorinated biphenyl exposure modeling of mothers in the Canadian Arctic: The challenge of reliably establishing dietary composition. *Environ Int*. 2016a;92-93:256-68.
- Binnington MJ, Curren MS, Chan HM *et al.* (2016b) Balancing the benefits and costs of 1134 traditional food substitution by indigenous Arctic women of childbearing age: Impacts on persistent organic pollutant, mercury, and nutrient intakes. *Environ Int* 94, 554-566.
- Bischoff-Ferrari, H. A. (2014). Optimal Serum 25-Hydroxyvitamin D Levels for Multiple Health Outcomes. In *Sunlight, Vitamin D and Skin Cancer* (pp. 500-525): Springer New York.
- Bjerregaard, P., Kue Young, T., Dewailly, E., & Ebbesson, S. O. (2004). Indigenous health in the Arctic: an overview of the circumpolar Inuit population. *Scandinavian Journal of Public Health*, 32(5), 390-395.
- Bjerregaard, P., Kue Young, T., Dewailly, E., & Ebbesson, S. O. E. (2004). Review Article: Indigenous health in the Arctic: an overview of the circumpolar Inuit population. *Scandinavian Journal of Public Health*, 32(5), 390-395.
doi:10.1080/14034940410028398
- Bjerregaard, P., & Larsen, C. V. L. (2018). Three lifestyle-related issues of major significance for public health among the Inuit in contemporary Greenland: a review of adverse childhood conditions, obesity, and smoking in a period of social transition. *Public Health Reviews*, 39(1). doi:10.1186/s40985-018-0085-8

- Brustad, M., Hansen, K. L., Broderstad, A. R., Hansen, S., & Melhus, M. (2014). A population based study on health and living conditions in areas with mixed Sami and Norwegian settlements – the SAMINOR 2 questionnaire study. *International Journal of Circumpolar Health*, 73(1), 23147. doi:10.3402/ijch.v73.23147
- Brustad, M., Parr, C. L., Melhus, M., & Lund, E. (2008). Childhood diet in relation to Sámi and Norwegian ethnicity in northern and mid-Norway – the SAMINOR study. *Public Health Nutrition*, 11(2), 168-175. doi:10.1017/s1368980007000432
- Brustad, M., Parr, C. L., Melhus, M., & Lund, E. (2008). Dietary patterns in the population living in the Sami core areas of Norway - The SAMINOR study. *Int J Circumpolar Health*, 67(1), 82-96. Retrieved from <Go to ISI>://WOS:000254724500009
- Brustad, M., Parr, C. L., Melhus, M., & Lund, E. (2008). Dietary patterns in the population living in the Sami core areas of Norway—the SAMINOR study. *International Journal of Circumpolar Health*, 67(1), 84-98. doi:10.3402/ijch.v67i1.18240
- Burtseva, T., Solodkova, I., Savvina, M., Dranaeva, G., Shadrin, V., Avrusin, S., . . . Chasnyk, V. (2013). Dietary intakes of energy and macronutrients by lactating women of different ethnic groups living in Yakutia. *International Journal of Circumpolar Health*, 72(1), 21519. doi:10.3402/ijch.v72i0.21519
- CACAR Jensen J, Adare K, Shearer R. (1997). Canadian Arctic Contaminants Assessment Report (CACAR). Department of Indian Affairs and Northern Development, Ottawa, Ontario, Canada.
- CACAR. Van Oostdam, J., S. Donaldson, M. Feeley and N. Tremblay (eds.), 2003. Canadian Arctic Contaminants Assessment Report II (CACAR II) Northern Contaminants program. Department of Indian Affairs and Northern Development, Ottawa, Ontario, Canada.

CACAR. Van Oostdam, J., S. Donaldson, M. Feeley and C. Tikhonov (eds.), 2009. Canadian Arctic Contaminants and Health Assessment Report (CACAR III): Human Health 2009. Department of Indian Affairs and Northern Development, Ottawa, Ontario, Canada.

CACAR 2017 Curren, M. et al. Canadian Arctic Contaminants and Health Assessment Report (CACAR IV): Human Health Assessment Caulfield, R. A. (2000). *Food security in Arctic Alaska: a preliminary assessment*: GÉTIC, Université Laval.

Canada. (2020). *AMAP, 2021. chapter on dietary transition* Unpublished report draft, Arctic Monitoring and Assessment Programme, Oslo, Norway.

Condon, R. G., Collings, P., & Wenzel, G. (1995). The Best Part of Life : Subsistence Hunting, Ethnicity, and Economic Adaptation among Young Adult Inuit Males. *ARCTIC*, 48(1). doi:10.14430/arctic1222

Control, C. f. D., & Prevention. (2011). Dental caries in rural Alaska Native children--Alaska, 2008. *MMWR. Morbidity and Mortality Weekly Report*, 60(37), 1275.

Draper, H. H. (1977). The Aboriginal Eskimo Diet in Modern Perspective. *American Anthropologist*, 79(2), 309-316. doi:10.1525/aa.1977.79.2.02a00070

Danmark i Tal 2010 [Denmark in Numbers 2010] (Rep.). (n.d.). Statistics Denmark.

Dudarev, A., Yamin-Pasternak, S., Pasternak, I., & Chupakhin, IV. (2019). Traditional Diet and Environmental Contaminants in Coastal Chukotka IV: Recommended Intake Criteria. *International Journal of Environmental Research and Public Health*, 16(5), 696. doi:10.3390/ijerph16050696

Dudarev, A. A. (2012). Dietary exposure to persistent organic pollutants and metals among Inuit and Chukchi in Russian Arctic Chukotka. *International Journal of Circumpolar Health*, 71(1), 18592. doi:10.3402/ijch.v71i0.18592

- Dudarev, A. A., Yamin-Pasternak, S., Pasternak, I., & Chupakhin, V. S. (2019). Traditional Diet and Environmental Contaminants in Coastal Chukotka I: Study Design and Dietary Patterns. *International Journal of Environmental Research and Public Health*, 16(5), 702. doi:10.3390/ijerph16050702
- El Hayek Fares, J., & Weiler, H. A. (2016). Implications of the nutrition transition for vitamin D intake and status in Aboriginal groups in the Canadian Arctic. *Nutrition Reviews*, 74(9), 571-583. doi:10.1093/nutrit/nuw020
- Fillion, M., Laird, B., Douglas, V., Van Pelt, L., Archie, D., & Chan, H. M. (2014). Development of a strategic plan for food security and safety in the Inuvialuit Settlement Region, Canada. *International Journal of Circumpolar Health*, 73(1), 25091. doi:10.3402/ijch.v73.25091
- Galloway, T., Young, T. K., & Egeland, G. M. (2010). Emerging obesity among preschool-aged Canadian Inuit children: results from the Nunavut Inuit Child Health Survey. *International Journal of Circumpolar Health*, 69(2), 151-157. doi:10.3402/ijch.v69i2.17437
- Gittelsohn, J., Wolever, T. M. S., Harris, S. B., Harris-Giraldo, R., Hanley, A. J. G., & Zinman, B. (1998). Specific Patterns of Food Consumption and Preparation Are Associated with Diabetes and Obesity in a Native Canadian Community. *The Journal of Nutrition*, 128(3), 541-547. doi:10.1093/jn/128.3.541
- Greenland Population 2020 (Live). (n.d.). Retrieved March 10, 2020, from <https://worldpopulationreview.com/countries/greenland-population/>
- Greenland (2020). *AMAP, 2021. chapter on dietary transition* Unpublished report draft, Arctic Monitoring and Assessment Programme, Oslo, Norway.

Hansen, J. C., Reiersen, L.-O., & Wilson, S. (2002). Arctic Monitoring and Assessment Programme (AMAP); strategy and results with focus on the human health assessment under the second phase of AMAP, 1998–2003. *International Journal of Circumpolar Health*, 61(4), 300-318. doi:10.3402/ijch.v61i4.17478

Hassler, S., Soininen, L., Sjölander, P., & Eero, P. (2008). Cancer among the Sami—a review on the Norwegian, Swedish and Finnish Sami populations. *Int J Circumpolar Health*, 67(5), 421-432. doi:10.3402/ijch.v67i5.18351

Hassler, S., Soininen, L., Sjölander, P., & Pukkala, E. (2008). Cancer among the Sami—a review on the Norwegian, Swedish and Finnish Sami populations. *International Journal of Circumpolar Health*, 67(5), 421-432. doi:10.3402/ijch.v67i5.18351

Hassol, S. (2004). *Impacts of a warming Arctic-Arctic climate impact assessment*: Cambridge University Press.

Heller, C. A., & Scott, E. M. (1967). *The Alaska dietary survey, 1956-1961* (Vol. 2): US Department of Health, Education, and Welfare, Nutrition and Metabolic

Håglin, L. (1988). The food and nutrient intake of a Swedish Saami population. *Arctic medical research*, 47, 139-144.

Håglin, L. (1991). Nutrient intake among Saami people today compared with an old, traditional Saami diet. *Arctic medical research*, 741-746.

Håglin, L. (1999). The nutrient density of present-day and traditional diets and their health aspects: the Sami-and lumberjack families living in rural areas of Northern Sweden. *International Journal of Circumpolar Health*, 58(1), 30-43.

Indigenous populations. (2010, December 07). Retrieved May 30, 2020, from https://www.who.int/topics/health_services_indigenous/en/

Jeppesen, C., & Bjerregaard, P. (2012). Consumption of traditional food and adherence to nutrition recommendations in Greenland. *Scandinavian Journal of Public Health, 40*(5), 475-481. doi:10.1177/1403494812454467

ITK. An Inuit-Specific Approach for the Canadian Food Policy. Ottawa, ON: Inuit Tapiriit Kanatami; 2017 pp. 1-40

Kenny, T.-A., Hu, X. F., Kuhnlein, H. V., Wesche, S. D., & Chan, H. M. (2018). Dietary sources of energy and nutrients in the contemporary diet of Inuit adults: results from the 2007–08 Inuit Health Survey. *Public Health Nutrition, 21*(7), 1319-1331. doi:10.1017/s1368980017003810

Kenny, T.-A., Wesche, S. D., Fillion, M., MacLean, J., & Chan, H. M. (2018). Supporting Inuit food security: A synthesis of initiatives in the Inuvialuit Settlement Region, Northwest Territories. *Canadian Food Studies / La Revue canadienne des études sur l'alimentation, 5*(2), 73-110. doi:10.15353/cfs-rcea.v5i2.213

Knudsen, A.-K. S., Long, M., Pedersen, H. S., & Bonefeld-Jørgensen, E. C. (2015). Lifestyle, reproductive factors and food intake in Greenlandic pregnant women: The ACCEPT sub-study. *International Journal of Circumpolar Health, 74*(1), 29469. doi:10.3402/ijch.v74.29469

Kozlov, A. (2019). Carbohydrate-related nutritional and genetic risks of obesity for indigenous northerners. *Voprosy pitaniia, 88*(1), 5-16.

Kozlov, A., Khabarova, Y., Vershubsky, G., Ateeva, Y., & Ryzhaenkov, V. (2014). Vitamin D status of northern indigenous people of Russia leading traditional and “modernized” way of life. *International Journal of Circumpolar Health, 73*(1), 26038. doi:10.3402/ijch.v73.26038

Krummel, E.-M., & Gilman, A. Risk Communication: 4.2.2 and 4.2.3. In *AMAP Assessment 2015: Human Health in the Arctic* (pp. 115-116). Oslo, Norway: Arctic Monitoring and Assessment Programme (AMAP).

- Kuhnlein, H. V., Receveur, O., & Chan, H. (2001). Traditional food systems research with Canadian Indigenous Peoples. *International Journal of Circumpolar Health*, 60(2), 112-122.
- 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*, 134(6), 1447-1453. doi:10.1093/jn/134.6.1447
- Larsen, C. V. L., Hansen, C. B., Ingemann, C., Jørgensen, M. E., Olesen, I., Sørensen, I., . . . Bjerregaard, P. (2019). Befolkningsundersøgelsen i Grønland 2018. Levevilkår, livsstil og helbred: Oversigt over indikatorer for folkesundhed.
- Leslie, W. D. (2004). Fracture risk among First Nations people: a retrospective matched cohort study. *Canadian Medical Association Journal*, 171(8), 869-873. doi:10.1503/cmaj.1031624
- NERISA. (2019). Retrieved from <http://en.business.gl/>
- Nilsson, L. M. (2018). Food, Nutrition, and Health in Sápmi. In *Nutritional and Health Aspects of Food in Nordic Countries* (pp. 179-195): Elsevier.
- Nilsson, L. M., Dahlgren, L., Johansson, I., Brustad, M., Sjölander, P., & Guelpen, B. V. (2011). Diet and lifestyle of the Sami of southern Lapland in the 1930s–1950s and today. *International Journal of Circumpolar Health*, 70(3), 301-318. doi:10.3402/ijch.v70i3.17831
- Nilsson, L. M., Dahlgren, L., Johansson, I., Brustad, M., Sjölander, P., & Van Guelpen, B. (2011). Diet and lifestyle of the Sami of southern Lapland in the 1930s - 1950s and today. *International Journal of Circumpolar Health*, 70(3), 301-318. Retrieved from <http://www.circumpolarhealthjournal.net/index.php/ijch/article/view/17831>
<http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-51135>

- O'Brien, D. M., Thummel, K. E., Bulkow, L. R., Wang, Z., Corbin, B., Klejka, J., . . . Singleton, R. (2016). Declines in traditional marine food intake and vitamin D levels from the 1960s to present in young Alaska Native women. *Public Health Nutrition*, 20(10), 1738-1745. doi:10.1017/s1368980016001853
- Pechlaner, G., & Otero, G. (2010). The Neoliberal Food Regime: Neoregulation and the New Division of Labor in North America. *Rural Sociology*, 75(2), 179-208. doi:10.1111/j.1549-0831.2009.00006.x
- Petrenya, N., Dobrodeeva, L., Brustad, M., Bichkaeva, F., Menshikova, E., Lutfaliev, G., . . . Odland, J. Ø. (2011). Fish consumption and socio-economic factors among residents of Arkhangelsk city and the rural Nenets autonomous area. *International Journal of Circumpolar Health*, 70(1), 46-58. doi:10.3402/ijch.v70i1.17798
- Price, W. A. (1934). Relation of nutrition to dental caries among Eskimos and Indians in Alaska and Northern Canada. *Journal of Dental Research*, 14, 227-229.
- Reeds, J., Mansuri, S., Mamakeesick, M., Harris, S. B., Zinman, B., Gittelsohn, J., . . . Hanley, A. (2016). Dietary Patterns and Type 2 Diabetes Mellitus in a First Nations Community. *Canadian Journal of Diabetes*, 40(4), 304-310. doi:10.1016/j.jcjd.2016.05.001
- Ross, A. B., Johansson, Å., Vavruch-Nilsson, V., Hassler, S., Sjölander, P., Edin-Liljegren, A., & Gyllensten, U. (2009). Adherence to a traditional lifestyle affects food and nutrient intake among modern Swedish sami. *International Journal of Circumpolar Health*, 68(4), 372-385. doi:10.3402/ijch.v68i4.17371
- Roth, H. J., Schmidt-Gayk, H., Weber, H., & Niederau, C. (2008). Accuracy and clinical implications of seven 25-hydroxyvitamin D methods compared with liquid chromatography–tandem mass spectrometry as a reference. *Annals of Clinical Biochemistry*, 45(2), 153-159. doi:10.1258/acb.2007.007091
- Russia. (2020). *AMAP, 2021. chapter on dietary transition* Unpublished report draft, Arctic Monitoring and Assessment Programme, Oslo, Norway.

- Sami. (2020). *AMAP, 2021. chapter on dietary transition* Unpublished report draft, Arctic Monitoring and Assessment Programme, Oslo, Norway.
- Sharma, S. (2010). Assessing diet and lifestyle in the Canadian Arctic Inuit and Inuvialuit to inform a nutrition and physical activity intervention programme. *Journal of Human Nutrition and Dietetics*, 23, 5-17.
- Singleton, R., Day, G., Thomas, T., Schroth, R., Klejka, J., Lenaker, D., & Berner, J. (2019). Association of Maternal Vitamin D Deficiency with Early Childhood Caries. *Journal of Dental Research*, 98(5), 549-555. doi:10.1177/0022034519834518
- Singleton, R., Lescher, R., Gessner, B. D., Benson, M., Bulkow, L., Rosenfeld, J., . . . Tiesinga, J. (2015). Rickets and vitamin D deficiency in Alaska native children. *Journal of Pediatric Endocrinology and Metabolism*, 28(7-8). doi:10.1515/jpem-2014-0446
- Sjolander, P. (2011). What is known about the health and living conditions of the indigenous people of northern Scandinavia, the Sami? *Glob Health Action*, 4. doi:10.3402/gha.v4i0.8457
- Sjölander, P. (2011). What is known about the health and living conditions of the indigenous people of northern Scandinavia, the Sami? *Global Health Action*, 4(1), 8457. doi:10.3402/gha.v4i0.8457
- Snodgrass, J. J., Leonard, W. R., Sorensen, M. V., Tarskaia, L. A., Alekseev, V. P., & Krivoschapkin, V. (2006). The Emergence of Obesity among Indigenous Siberians. *Journal of PHYSIOLOGICAL ANTHROPOLOGY*, 25(1), 75-84. doi:10.2114/jpa2.25.75
- Soininen, L., & Pukkala, E. (2008). Mortality of the Sami in Northern Finland 1979-2005. *Int J Circumpolar Health*, 67(1), 43-55. Retrieved from <Go to ISI>://WOS:000254724500006

- Soininen, L., & Pukkala, E. (2008). Mortality of the Sami in northern Finland 1979–2005. *International Journal of Circumpolar Health*, 67(1), 45-57. doi:10.3402/ijch.v67i1.18227
- St-Germain, A.-A. F., Galloway, T., & Tarasuk, V. (2019). Food insecurity in Nunavut following the introduction of Nutrition North Canada. *Canadian Medical Association Journal*, 191(20), E552-E558. doi:10.1503/cmaj.181617
- Takano, T. (2005). Connections with the land. *Ethnography*, 6(4), 463-486. doi:10.1177/1466138105062472
- Terkelsen, A. S., Long, M., Hounsgaard, L., & Bonefeld-Jørgensen, E. C. (2017). Reproductive factors, lifestyle and dietary habits among pregnant women in Greenland: The ACCEPT sub-study 2013–2015. *Scandinavian Journal of Public Health*, 46(2), 252-261. doi:10.1177/1403494817714188
- Uhl, E. (1955). Nogle undersøgelser af grønlandske levnedsmidler og kostforhold. *Beretninger vedrørende Grønland* [Some Studies of Dietary Issues in Greenland. In Danish], 3.
- Van Oostdam, J. (2019) *Dietary summary measures in Human Contaminant studies relevant to the Northern Contaminants Program and Arctic Monitoring and Assessment Program* Unpublished manuscript, Human Health Assessment Group plus global and Arctic human contaminant monitoring evaluation, Health Canada.
- Veenstra, G. (2009). Racialized identity and health in Canada: Results from a nationally representative survey. *Social Science & Medicine*, 69(4), 538-542. doi:10.1016/j.socscimed.2009.06.009
- Ward, L. M., Gaboury, I., Ladhani, M., & Zlotkin, S. (2007). Vitamin D-deficiency rickets among children in Canada. *Canadian Medical Association Journal*, 177(2), 161-166. doi:10.1503/cmaj.061377

Wikipedia contributors. (2020, June 9). Denmark. In *Wikipedia, The Free Encyclopedia*. Retrieved 14:22, June 12, 2020, from <https://en.wikipedia.org/w/index.php?title=Denmark&oldid=961688235>

Zukewich, N. (2008). Inuit Children Under Six Years Old *Statistics Canada*. Retrieved from <https://www150.statcan.gc.ca/n1/en/catalogue/89-634-X2008004>

References (Used for Formalizing the Study Method):

Ioannidis J. P. (2005). Why most published research findings are false. *PLoS medicine*, 2(8), e124.

Higgins JPT, Green S (editors). Chapter 4: Guide to the contents of a Cochrane protocol and review. In: Higgins JPT, Green S (editors). *Cochrane Handbook for Systematic Reviews of Intervention*. Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Available from www.cochrane-handbook.org.

Shamseer, L., Moher, D., Clarke, M., Gherzi, D., Liberati, A., Petticrew, M., . . . Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *Bmj*, 349.

LibGuides: APA Style Guide: Book with No Author. (n.d.). Retrieved June 09, 2020, from <https://irsc.libguides.com/apa/bookwithnoauthorreferenceexample>

Wikipedia contributors. (2019, January 12). Publication bias. In *Wikipedia, The Free Encyclopedia*. Retrieved 16:50, March 8, 2019, from https://en.wikipedia.org/w/index.php?title=Publication_bias&oldid=877980487