FIRST NATIONS FOOD, NUTRITION & ENVIRONMENT STUDY

Results from Manitoba 2010

University of Northern British Columbia | Université de Montréal | Assembly of First Nations 2012

“ HEALTHY ENVIRONMENT AND
HEALTHY FOODS FOR
HEALTHY FIRST NATIONS ”

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Forward from the AFN National Chief

In today's world we are constantly being made aware of the increasing use of chemicals, some of which are considered dangerous to our health and the environment. This study was initiated due to concerns having been made by First Nations about the safety of traditional foods being harvested. While similar studies have been conducted for the general Canadian population, the First Nations Food, Nutrition and Environment Study (FNFNES) represents the first time a Total Diet Study and sampling for environmental contaminants in traditional foods have been conducted on a national scale for First Nations living on reserve.

The FNFNES began as a resolution passed by the Chiefs-in-Assembly in Halifax, 2007. Since data collection began in 2008 in British Columbia (BC), the study has maintained interest and momentum as implementation moves across Canada. Although the FNFNES is considered an equal partnership between researchers at the University of Northern BC, Université de Montréal and the Assembly of First Nations (AFN), it is a participatory project that involves First Nation communities in all aspects including the field work, site selection for surface water sampling and choosing which traditional foods will be tested. To build capacity, Community Research Assistants are recruited and trained to carry out the surveys and to collect samples, and community based data custodians are trained to analyze and use the collected data for the benefit of their community. It has been the interest and commitment of participating First Nation communities and individuals which has truly led this study.

The integral involvement of First Nations in this landmark study has meant that First Nations' questions and concerns are being addressed regarding nutrition, safety of traditional foods, drinking water quality and exposure to mercury. These have included concerns on the safety and benefits of traditional foods versus market foods, food security and diet quality issues. Thanks to studies such as the FNFNES, First Nations' concerns regarding our health and environment are now being researched with our involvement in a culturally appropriate and respectful manner. It is now up to us to take these results to all First Nations communities, to ensure that our people are informed and prepared to advocate for action to address the concerns raised in this report.

This report presents the results for the FNFNES for Manitoba. It is the second regional report of this 10 year, nationally scoped study, and has highlighted some of the same challenges that were identified in the BC Regional Report which has already been published. The work done in Manitoba has provided further proof of the scope and scale of problems we as First Nations have long been aware of in our communities such as food security and dietary issues resulting from reduced access to traditional foods. This study has also sought to include emerging areas of concern such as pharmaceuticals in surface water, chemical contaminants for which guideline levels have not yet been set and the impact of climate change. The information contained within this report will serve as an important baseline for future studies.

I hope that this report will serve as a catalyst to spur action in First Nation communities in order to address food security issues, improve nutrition, increase access to traditional foods, raise awareness about chemical contaminants, and finally to deal with infrastructure problems associated with access to safe drinking water.

Thank you, first and foremost, to all First Nations who participated in this study, the Community Research Assistants, Community Coordinators, Nutrition Research Coordinators and all others for their significant contributions to this study and regional report. The AFN is pleased to be a part of this study and we look forward to Health Canada's continued commitment to addressing First Nations' environmental and nutritional concerns by supporting research projects that are conducted in full partnership with First Nations.

Shawn A-in-chut Atleo
National Chief
Assembly of First Nations

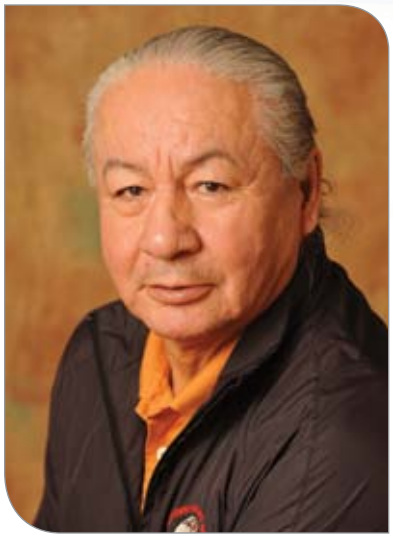
Forward from the Manitoba Regional Chief

It is my pleasure to introduce the FNFNES Regional Report for Manitoba. Manitoba was the second region selected to participate in this nationally-scoped research study. Overall our communities have been enthusiastic about this project and were interested to learn more about their traditional foods, nutrition and environment.

This study was carried out in full partnership with the AFN and included First Nations at the community level through all stages. First Nations had the opportunity to provide input into the methodology of the study, where and which samples would be taken and even an opportunity to comment on the final drafts of their report – a discussion of which is contained within this regional report.

This report has raised some serious issues in our communities which we as First Nations are not unaware of. It is good to have this data that was collected in a scientifically rigorous manner in order to back up what we have been saying for years. According to this report, food security, diabetes and body weight are major issues, certain nutrients are not consumed in sufficient amounts, pharmaceuticals are being found in the surface water in our communities, and chemical contaminants are being found in our traditional foods. There are also positives. Trace metals in tap water were not found to be of concern despite the recommendation for further monitoring, traditional foods were found to be safe to eat and contributed to better nutrition and exposure to mercury was not found to be of major concern in the communities surveyed.

Multiple barriers to accessing traditional foods were identified which consequently have negative impacts upon nutrition, food security and our traditional way of life. Identifying these barriers through studies such as this one will help our communities come up with their own solutions. Improving access to traditional foods will benefit not only food security, but also the nutritional and cultural health of our communities. First Nations rely on access to traditional foods for many of our teachings, for maintaining our culture, to provide healing in our communities and of course, for a balanced, healthy meal. This study will allow us to advocate for policies and changes that will reduce barriers at the regional level in order to promote healthy First Nations.



These results on a regional level provide us with important baseline information that can be used in the future to monitor how changes in the environment may impact the safety of our traditional foods and water sources. This will be especially useful as climate change and increased exploration, development and extraction of natural resources takes place on our traditional lands. With this baseline data we can now propose and design programs and further research that will effectively build upon the results this report.

I look forward to reviewing these results and hope that First Nations in Manitoba will use this information to chart a way forward for healthier communities. Thanks to all First Nations who were involved in this research, from the participants to the community coordinators, we now have this important report that will benefit First Nations across Manitoba.

Bill Traverse
Regional Chief, Manitoba
Assembly of First Nations

PRINCIPAL INVESTIGATORS

Laurie Chan, Ph.D.
Professor and BC Leadership Chair
School of Health Sciences
University of Northern British Columbia

Olivier Receveur, Ph.D., M.P.H., Dt. P.
Professor, Department of Nutrition, Faculty of Medicine
Université de Montréal

Donald Sharp, Dr.P.H.
Former A/Director, Environmental Stewardship Unit
Assembly of First Nations

CO-INVESTIGATORS

Harold Schwartz, Ph.D.
Manager, Chemical Safety of Traditional Foods
Primary Health Care and Public Health Directorate
First Nations and Inuit Health Branch
Health Canada

Constantine Tikhonov MD, MHA
A/Director, Environmental Health Research Division
Primary Health Care and Public Health Directorate
First Nations and Inuit Health Branch
Health Canada

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Barb Hobson
Laura Kakegamic
Daphne Kent
Abby Klyne
Lois Levasseur
Helen McKinney
Shirley McLeod
Betty Ann Merrick
Cathy Merrick
Jason Miller
Cheryl Moosetail
Shirley Moosetail
Donnie Mousseau
Shirley Nepinak
Carmen Racette
Gaylene Roulette
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CONTRIBUTORS

National Project Coordinator:
Judy Mitchell, M.Sc.

FNFNES Steering Committee – ex-officio members:
Debra Nkusi, B.Sc.
Brenda McIntyre, M.H.Sc.

Lead Nutrition Research Coordinator:
Karen Fediuk, M.Sc., R.D.

Nutrition Research Coordinators:
Angela Grigg, B.Sc.
Anita Mundt, B.Sc. (HNS)
Michelle Turnbull, M.Sc.CH., R.D., CDE.
Joan Rew, B.H. Ecol, R.D.

Regional Coordinator:
Laverne Gervais, M.A.

Data Analysts:
Amy Ing, M.Sc.
Ying Lu, M.Sc.

Communications Coordinator, Assembly of First Nations
Andrew Black, M.Sc.

Head, FNIHB Laboratory:
Yuri Romachine, Ph.D.

Health Canada Project Analysts:
Alexis Gagnon, B.Sc.
Sarah Kettel, M.E.S.
Carole Nault, BCS, B.Math.
Daniel Biggs, B.A.
Marc Paquette

Statistics Canada Statisticians:
Jean Dumais, M.Sc.
Isabelle Michaud, M.Sc.
Craig Seko

UNBC Research Staff:
Leana Garraway, B.A.
Riannon Ball, B.Sc.
Kristin Turnbull, B.H.Sc.
Owen Law

Université de Montréal Research Staff:
Karine Pelletier, M.Sc, Dt.P.

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ACRONYMNS AND ABBREVIATIONS

The following acronyms and abbreviations are used in this report:

AFN:	Assembly of First Nations
AO:	Aesthetic Objective
BMI:	Body Mass Index
BW:	Body weight
CCHS:	Canadian Community Health Survey
CIHR:	Canadian Institutes of Health Research
CWS:	Community Water System
DDE:	Dichlorodiphenyldichloroethylene
EHO:	Environmental Health Officer
FFQ:	Food Frequency Questionnaire
FN:	First Nation
FNFNES:	First Nations Food, Nutrition and Environment Study
FNIHB:	First Nations and Inuit Health Branch (Health Canada)
FS:	Food Security
HCBs:	Hexachlorobenzene
HH:	Household
IR:	Indian Reservation
IQR:	Interquartile range
MAC:	Maximum acceptable concentration
Max:	Maximum or highest value
Min:	Minimum or lowest value
mM:	Molar Concentration-one thousandth of a mole
n:	Number of participants surveyed or number of food, water or hair samples analyzed
PAH:	Polycyclic aromatic hydrocarbons
PBDE:	Polybrominateddiphenyl ethers
PCB:	Polychlorinated biphenyls
PFC:	Perfluorinated compounds
PI:	Principal Investigator
POP:	Persistent Organic Pollutant
PPCP:	Pharmaceuticals and personal care products
PPM:	Parts per million
PSU:	Primary Sampling Unit
PWS:	Public Water System
SE:	Standard error (see Glossary)
SHL:	Socio/Health/Lifestyle Questionnaire
SSU:	Secondary Sampling Unit
TDI/PTDI:	Tolerable Daily Intake/Provisional Tolerable Daily Intake
TDS:	Total Diet Studies
TF:	Traditional food
TSU:	Tertiary Sampling Unit
TWS:	Trucked Water System
TPWS:	Trucked Public Water System
USDA:	United States Department of Agriculture

GLOSSARY

The following are definitions or illustrations of terms used in this report:

Aesthetic objective: The level of substances in drinking water or characteristics of drinking water (such taste, odour, or colour) that can affect its acceptance by consumers. Aesthetic objective levels are below levels considered to be harmful to health.

Arithmetic mean: See mean.

Average: See mean.

Background level: The level of chemical (or other substances) that are normally found in the environment.

Biometric mean: See mean.

Body burden: This refers to the total amount of any chemicals currently present in the human body at any given time. Some chemicals only stay present in the body for a short period of time while others remain within the body for 50 years or more.

Body Mass Index (BMI): Calculated by dividing the weight (in kilograms) by the square of the height (in metres), this index is used to define normal weight (when between 18.5-24.9), overweight (25-29.9) and obesity (30 and over). Overweight and obesity are degrees of excess body weight carrying increasing risks of developing health problems such as diabetes and heart disease.

Bootstrapping: A computer-based statistical method used to estimate a statistical parameter (e.g. standard error) by random sampling with replacement from the original dataset.

Community Water System: A piped water distribution system with five or more connections that can include any combination of housing units and public access buildings.

Ecozone/culture area: Regions/areas identified based on the distribution patterns of plants, animals, geographical characteristics and climate.

Food security: Physical and economic access by all people to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Household food security can be estimated by a questionnaire.

Guideline value: In Canada, guideline values are set for the protection of environmental and human health. For example, there are guidelines for human tissues (such as blood and hair), animal tissues (fish, mammals and birds), drinking water, recreational water, soil, as well as for the protection of aquatic life. These values are based on the most current scientific data available for the parameter of interest.

Groundwater: Water located beneath the ground surface such as in porous soil spaces and fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water.

Individual Water System: A system serving individual homes that each have their own pressurized water supply (e.g. a well), or is connected to a piped distribution system that has less than five housing units and does not include any public access buildings.

Interquartile range (IQR): A statistical term used to describe the distribution around the median (25% above and below the median).

Maximum Acceptable Concentration (MAC): The concentration or level of a particular substance at which exposure to may cause harmful effects on health.

Mean, arithmetic (average): A statistical term used to describe the value obtained by adding up all the values in a dataset and dividing by the number of observations.

Mean, geometric: To calculate a geometric mean, all observations [i.e. values] are multiplied together, and the nth root of the product is taken, where n is the number of observations. Geometric mean of skewed distribution such as hair mercury concentrations usually produces an estimate which is much closer to the true center of the distribution than would an arithmetic mean.

Median: A statistical term used to describe the middle value obtained when all values in a dataset are placed in numerical order; at most half the observations in a dataset are below the median and at most half are above the median.

Oral Slope Factor: An upper bound, approximating a 95% confidence limit, on the increased cancer risk from a lifetime oral exposure to an agent. This estimate, usually expressed in units of proportion (of a population) affected per mg/kg-day, is generally reserved for use in the low-dose region of the dose-response relationship, that is, for exposures corresponding to risks less than 1 in 100.

Public Water System: A system with less than five connections, but has one or more buildings open to the public.

Surface water: All water situated above-ground (for example, rivers, lakes, ponds, reservoirs, streams, seas).

Standard error (SE): A measure of variation to be expected from sampling strategy, measurement error, and natural variability in the calculated parameter (The parameter can be a percentage or a mean (average) for example).

Tolerable Daily Intake or Provisional Tolerable Daily Intake: is an estimate of the amount of a substance in air, food or drinking water that can be taken in daily over a lifetime without appreciable health risk. TDIs or PTDIs are calculated on the basis of laboratory toxicity data to which uncertainty factors are applied.

Trucked Public Water System: A system that has one or more buildings open to the public and that receives trucked water delivery.

Trucked Water System: A group of individual homes or multi-family buildings with less than five housing units that receives trucked water delivery and do not include public access buildings.

Water treatment plant: The facility that treats water so that it is clean and safe to drink.

Water treatment system: Includes all water delivery components such as the raw water intake, water treatment plant, distribution system, hydrants, etc.

µg/g: micrograms (1 millionth or 1/1,000,000 of a gram) per gram; in the case of the mercury in hair results, this measurement represents the weight of mercury measured per gram of hair. In the food contaminant results, this represents the weight of contaminant per gram of food.

µg/L: micrograms (1 millionth or 1/1,000,000 of a gram) per liter; found in the drinking water results, this measurement represents the weight of trace metals measured per litre of water.

ng/g: nanograms (1 billionth or 1/1,000,000,000 of a gram) per gram; found in the food contaminant results, this measurement represents the weight of a contaminant measured per gram of food.

ppm: Parts per million; a common unit typically used to describe the concentration of contaminants in food or the environment. This is approximately equivalent to one drop of water diluted into 50 liters (roughly the fuel tank capacity of a small car).

ppb: Parts per billion; this is approximately equivalent to one drop of water diluted into 250-55 gallon containers.

pg/kg/day: Picograms (1 trillionth or 1/1,000,000,000,000 of a gram) per kilogram per day; in the food contaminant results, this represents the weight of contaminants per kilogram body weight that is being consumed per day. This value is used for risk assessment.

EXECUTIVE SUMMARY

In recent years, First Nations have been concerned about the impacts of environmental pollution on the quality and safety of traditionally-harvested foods. However, very little is known about the composition of their diet, nor about the level of contaminants that may be present in traditional foods. This study attempts to fill this gap in knowledge about the diet of First Nations peoples living on reserve, south of the 60th parallel. In addition, baseline information on human and veterinary pharmaceuticals in surface waters are being collected, especially where fish are being harvested or where water is being taken for drinking purposes.

This study, called the First Nations Food, Nutrition and Environment Study (FNFNES) is being implemented region by region across Canada over a 10-year period. Data collection started in 21 on-reserve First Nations communities in British Columbia in 2008-2009. Results from British Columbia are summarized in a report that is available on the FNFNES website (www.fnfnes.ca). In the fall of 2010, data collection was conducted in nine randomly selected on-reserve First Nations communities in Manitoba. This report presents the aggregated results from these nine Manitoba First Nations communities.

The FNFNES includes five components:

1) Household interviews to collect information on dietary patterns, lifestyle and general health status, environmental concerns and food security;
2) Traditional food sampling for chemical contaminant content;
3) Drinking water sampling for trace metals;
4) Hair sampling for exposure to mercury; and
5) Surface water sampling for pharmaceuticals.

This study was guided by the principles of the Canadian Institutes of Health Research Guidelines, "Health Research Involving Aboriginal peoples" and the Tri-Council Policy Statement, "Ethical Conduct for Research Involving Humans". Ethical approval has been granted by the Research Ethics Boards of Health Canada, the University of Northern British Columbia and the Université de Montréal.

Results

Data were collected from nine randomly selected communities in Manitoba. In each community, up to 100 households were randomly selected; one participant per household, aged 19 years and older, living on reserve and who self-identified as First Nation was invited to participate. There were a total of 706 participants (477 women and 229 men). The overall participation rate was 82% for questionnaires and 33.6% for mercury in hair sampling as an indicator for mercury exposure. The average age of the participants was 42 years old for women and 41 years old for men. The median number of people reported to usually live in Manitoba First Nations households was five: 64% were between the ages of 15 and 65, 31% were children less than 15 years of age and 5% were elders (over 65 years of age).

High rates of overweight and obesity were found in both female and male participants. Fifty-eight percent of women were classified as obese compared to 45% for men. Obesity is a strong risk factor for diabetes and heart disease. A total of 23% of participants reported having been told by a health care provider that they had diabetes.

The average amount of traditional food consumed per person, per day was 45g. Traditional food consisted mainly of land mammals (eaten by 86% of participants), fish (83%), wild berries or nuts (68%), wild birds (56%), wild plants (27%), tree foods (2%) and mushrooms (2%). Over 100 different types of food were commonly harvested, with walleye, moose and blueberries being the most popular traditional foods. Almost two-thirds of participants reported that they would like to have more traditional food. However, key household barriers to greater use included the absence of a hunter, a lack of equipment or transportation and lack of time. Other external factors that inhibited access to traditional food were government restrictions and hydro projects. Almost half the participants (48%) reported that moose was less available due to these external factors. Climate change was also perceived by 54% of participants to affect the availability of traditional food.

In terms of overall diet quality, Manitoba First Nations adults do not meet the recommended amounts and types of food in Canada's Food Guide. Manitoba First Nations adults exceed the recommended number of food guide servings for the Meat and Alternatives group. For the other three food groups (Milk and Alternatives, Vegetables and Fruit, and Grain Products),

intakes are lower than recommended, particularly among women. Fibre and many nutrients needed for good health and prevention of disease, including vitamin A, vitamin D, vitamin C, vitamin B6, calcium and magnesium, are at risk of insufficient intake. Current intake of fat, saturated fat and sodium (salt) among Manitoba First Nations adults is higher than recommended. High intakes of fat are linked to obesity and heart disease while evidence links high intakes of sodium to high blood pressure which can lead to heart disease.

Dietary quality was much improved on days when traditional foods were consumed, as traditional foods are important contributors of protein, iron, zinc, vitamin D and other essential nutrients. When only market food was consumed, intake of saturated fat (the type of fat associated with heart disease) was significantly higher than when traditional food was included in the diet.

Thirty-eight percent of participants reported experiencing household food insecurity; 32% of the households are moderately food insecure and 6% are severely food insecure. Thirty-one percent of households reported that they could not afford to eat a 'balanced meal'. Household food insecurity varies by ecozone; in the Boreal Plains (southern Manitoba), household food insecurity was 21% and rose to 73% in northern communities within the Taiga Shield. The high price of food is a contributing factor to high food insecurity and the subsequent inability to eat a 'balanced meal'. Compared to food prices in Winnipeg, the cost of groceries per week for a family of four ranged from $57 more (southern Manitoba First Nations communities) to $182 more (northern Manitoba First Nations communities). When asked about traditional food security, 40% of participants said that they worried that their household traditional food supplies would run out before they could get more.

In terms of water treatment systems on reserves, each community reported having an operational water treatment plant with two communities having two plants, for a total of 11 plants in use at the time of the study. However, as one small plant was slated to close in the coming year, only 10 water treatment plants were surveyed as part of this study. In 2010, three communities issued boil-water advisories. One community issued three boil-water advisories as a result of broken water mains; the advisories lasted 43, 81 and 91 days.

Nearly all (99%) of participants reported that their households have tap water; 35% of households reported having water storage tanks. Seventy-eight percent of participants reported that they use the tap water for drinking while 93% use it for cooking. One-third of participants said that the smell of chlorine sometimes prevented them from drinking tap water. Tap water testing for metals considered to be harmful for human health found that only one out of 311 samples collected contained lead above the maximum acceptable guideline; tap water was retested and the lead level was found to be below the acceptable guideline. Aluminum, copper, iron, manganese, sodium and zinc were observed to be present at higher than the aesthetic objectives for drinking water in some of the samples tested; these metals are not considered to be of public health concern but can affect smell, taste and colour. An Environmental Health Officer, of the First Nations and Inuit Health Branch (FNIHB) Manitoba region, was asked to resample the tap water or the water treatment plant at the sites where an exceedance was observed. Where there was a chemical exceedance, the householder was informed and letters were sent to the Chief and Council for their information and copied to Health Canada for follow-up action.

Surface water sampling showed the presence of six human pharmaceuticals in one or more communities. No pharmaceutical was found in a concentration of concern to human health.

Mercury was measured in the hair samples collected from 236 participants (33.4% of the 706 participants provided hair samples). The average mercury level of all participants was 0.45 µg/g. Out of the 138 women of childbearing age whose hair was sampled, seven (5.1%) had mercury levels that exceeded the Health Canada's mercury biomonitoring guideline of 2 µg/g in hair proposed for women of childbearing age and children. While these observed levels were not considered high enough to be a health concern to the participant, letters were sent to these women with suggestions on how to reduce their exposure to mercury.

A total of 651 food samples representing 83 different types of traditional foods were collected for contaminant analysis. Results showed typical levels of contaminants found in Canada and there is no safety concern associated with eating traditional food. However, some foods have higher levels of metals because of natural processes and occasional lead contamination from gunshot. As a result, high consumption of game meat may result in an increased risk of lead exposure if the food was high in lead as a result of lead shot contamination. High consumption of fish that have high mercury concentrations may also result in an increased risk of mercury exposure.

Thus far, this study has been a valuable tool in addressing the gaps in knowledge about the total diet, traditional food and levels of environmental contaminants to which First Nations in Manitoba are exposed. It should be noted that this is the first study of this type to be done on a representative cross-country scale. The data collected will serve as a benchmark for future studies to determine if changes in the environment are resulting in an increase or decrease in concentrations of chemicals of concerns and how diet quality will change over time.

INTRODUCTION

In Canada, there remain significant health disparities between First Nations and the non-Aboriginal population. First Nations continue to experience a lower life expectancy (Health Canada, 2010) and higher rates of chronic and infectious disease and mental health issues (Health Canada, 2005). Regional studies in Manitoba and British Columbia reveal that infant mortality rates among First Nations infants are two times higher than the rate for the regional non-Aboriginal population (Health Canada, 2010). Obesity, diabetes and cardiovascular disease have reached epidemic levels (Young, 1994) (Belanger-Ducharme, et al., 2005) (Ayach, et al., 2010). Ailments are further exacerbated by poverty, poor quality diet, food insecurity, erosion of a traditional lifestyle and social instability (Kuhnlein, et al., 1996) (Willows, 2005) (Power, 2008). Well-being is determined by multiple factors including diet and lifestyle, environmental health, genetics, household stability and socio-economic status, among other factors (Frohlich, et al., 2006) (Marmot, 2005).

Traditional food is nutritionally, culturally, and economically important for First Nation Peoples. Traditional foods are often more nutrient dense compared to market food replacements. As First Nations communities decrease the proportion of traditional foods in their diet, there is a risk of decrease in the nutritional quality of the diet and rise in nutrition related health problems such as anemia, heart disease, obesity, osteoporosis, cancer, infections, diabetes and tooth decay (Kuhnlein, et al., 1996). First Nations communities are experiencing a dietary transition away from traditional foods in the diet that could be attributed to a multitude of factors including acculturation and loss of time for harvesting activities, declining traditional food access and availability, environmental pollution and climate change (Kuhnlein, et al., 1996).

Increasing industrialization in the last century has led to various degrees of pollution in all ecosystems. Due to the subsistence lifestyle and traditional diet, First Nations are particularly at risk to environmental contaminant exposure. First Nations communities from different geographical areas in Canada face their own unique environmental problems due to the nature of the point sources of environmental pollution and the degree to which their diet is obtained from the local environment. It has been suggested that major health problems (e.g. cancer, diabetes, low infant weight) may be related to the amount of chemical contaminants in the environment (Hectors, et al., 2011) (Lee, et al., 2011) (Li, et al., 2006) (Institute of Medicine, 2007). There are also concerns of new or unknown health issues associated with the consumption of food contaminated with chemicals that have not been fully characterized. However, the risks and benefits of traditional food must be better understood before recommendations can be made. Unfortunately, both the nutritional composition of the average diet of most First Nations and the levels of contaminants in their traditional foods have been largely unknown.

Current knowledge has advanced to a point where we are starting to understand the influences that food toxicants, environmental contaminants and nutritional imbalances have in contributing to or causing a range of human health conditions including; cancer, kidney and liver dysfunction, hormonal imbalance, immune system suppression, musculoskeletal disease, birth defects, premature births, impeded nervous and sensory system development, reproductive disorders, mental health problems, cardiovascular diseases, genito-urinary disease, old-age dementia and learning disabilities.

Toxicants in food can occur naturally or can enter during processing or through environmental contamination. Toxicants can be 'natural' or 'manufactured'. For example, some mushrooms produce toxins that can be harmful to human health. In another example, shellfish can be contaminated by microorganisms containing saxitoxin, often as a result of a 'red tide' algal bloom. Saxitoxin is not harmful to shellfish but it can cause fatal paralytic shellfish poisoning in humans. Toxic metals such as arsenic, cadmium, lead and mercury are found naturally in soil and rocks. However, they can also be emitted as a waste product (pollutant) of human activities such as mining and forestry and accumulate in animals and plants in high enough amounts that are harmful to the human consumers. The burning of wood and fossil fuels can release toxic chemicals such as polycyclic aromatic hydrocarbons (PAHs) and dioxins and furans into the environment. Man-made (anthropogenic) chemicals such as PCBs (derived from industrial activities), PBDEs and PFCs (used in consumer products) and organochlorine and organophosphorous pesticides (used in agriculture and forestry) can also enter into the food system.

About 8,400,000 chemical substances are commercially available and 240,000 are reported to be inventoried/regulated chemicals. Combined with pesticides, food additives, drugs and cosmetics, there are as many as 100,000 chemicals that have been registered for use in commerce in the United States over the past 30 years, and numbers are similar in the EU and Japan (Muir, et al., 2006). Some of these organic chemicals, such as some pesticides, PCBs

and dioxins, as well as organic lead and mercury, have physical and chemical characteristics that allow them to resist degradation and persist in the environment, to be transported globally via air and water currents and to bioaccumulate and biomagnify along biological food chains. These persistent organic pollutants (POPs) are of particular concern in aquatic environments as the aquatic food chains are usually longer than the terrestrial food chains resulting in higher bioaccumulative factors found in the top predators. Where these chemicals are present in fish, they will also accumulate in water fowl and marine mammals that consume them, eventually reaching humans. Fact sheets of the contaminants measured in this study can be found in Appendix A.

In the last few years, concern has also been raised about pharmaceuticals and personal care products (PPCPs) in the environment (Treadgold, et al., 2012). Some of these compounds, including human pharmaceuticals and veterinary drugs, are excreted intact or in conjugated form in urine and feces. These PPCPs have also been found in sewage treatment effluent and surface waters.

Health authorities usually employ four complementary approaches to assess and characterize risk and develop programs meant to minimize the potential health impact of toxic chemicals:

1. Monitor foods for compliance with national and international food safety regulatory standards. In Canada, this function is the responsibility of the Canadian Food Inspection Agency.
2. Conduct targeted surveys to identify and eliminate sources of high-priority toxicants (contaminants of public health concern), such as lead, dioxins and pesticides, from foods.
3. Estimate the actual consumption of chemicals in the diet by population at risk, and compare these intakes with toxicological reference points, such as the acceptable daily intake (ADI) or provisional tolerable weekly intake (PTWI). Health Canada runs a Total Diet Study every five years.
4. Conduct biomonitoring projects by measuring the chemical concentrations in blood, urine and breast milk collected from the target population as indicators of exposure. The Canadian Health Measures Survey, a bio-monitoring project, started in 2007.

Canada is one of the global leaders in conducting Total Diet Studies. The first Total Diet Study of the Canadian general population was conducted between 1969 and 1973. The second ran from 1976 to 1978, the third from 1985 to 1988, the fourth from 1992 to 1999, and the fifth from 2000 to 2004 and the most recent one started in 2005. Results of the first five studies have been published in the scientific literature and are used provincially and nationally for assessing exposure to contaminants through market food. These studies have focused only on store-bought foods that are available to the general Canadian population. Therefore, although they have provided valuable information on the safety of the general urban diet, their findings are not applicable to First Nations who continue to rely to a large extent on traditionally-harvested foods. A similar situation exists for the evaluation of dietary nutritional quality with the 2004 Canadian Community Health Survey (Health Canada, 2004), which has not involved First Nation peoples living on reserve.

There have been a number of dietary studies conducted in First Nations communities since the 1970s. They provide a general understanding of the types of foods consumed by some First Nations on reserves. However, these studies were conducted at different times and by different research teams that have employed different investigative tools to address a variety of research objectives. Therefore, the data are not easily comparable. Relatively more comprehensive information is available for the Aboriginal communities in the three northern territories. With the funding support from the Northern Contaminant Program, three comprehensive dietary surveys were conducted in the Yukon, the Northwest Territories and Nunavut in the 1990's providing information on the diets, the nutritional value of foods eaten and the food pathways of exposure to environmental chemicals (Kuhnlein, et al., 2001). Diets have been shown consistently to be of greater nutritional quality when traditional food is consumed compared to when only market food is consumed. Furthermore, the nutritional, as well as cultural, benefits of traditional food repeatedly outweigh the risks from chemical contamination (Kuhnlein, et al., 2001).

In summary, although there is a valuable but disparate patchwork of research that helps in assessing the contribution of nutrients from traditional foods to the diet and some major issues in regard to chemical exposures through food pathways, research to date has not succeeded in providing reliable regional information on First Nations diets and the risk of chemical exposure through the consumption of locally-harvested foods. This gap is targeted by this study titled First Nations Food, Nutrition and Environment Study (FNFNES).

The goal of this study is to provide information needed for the promotion of healthy environ-

ments and healthy foods for healthy First Nations. A national baseline of background levels of key environmental chemicals of concern and an assessment of diet quality of First Nations are this study's main objective. Moreover, it also aims to quantify the intake of trace metals through drinking water and the presence of various pharmaceutically-active compounds that are used by First Nations that may find their way into surface waters that are used for fishing or as a source for drinking water. The pharmaceutical component is considered an important first step in determining the safety of traditional food in relation to these emerging contaminants. Results of this study will be useful for the development of community-level dietary advice and food guidance for First Nations at the regional level. The information on background exposures to POPs, toxic metals and pharmaceutical products is also essential for First Nations as an enabling foundation for any future food monitoring at the community level. Results of this study will also empower communities to make informed decisions to address and mitigate environment health risks.

Active participation of First Nations was considered paramount in this project. It started with a resolution passed by the Chiefs-in-Assembly at the Assembly of First Nations' (AFN) Annual General Assembly in Halifax, Nova Scotia on July 12, 2007. An ecosystem-based sampling approach was adopted and randomly selected communities were invited to a methodology workshop where information about the project was shared. The research began with signing of a Community Research Agreement between the researchers and the community leaders outlining the details of the research partnership. Communities participated by providing input into the methodology and by identifying traditional foods making up the typical diet, hiring community research assistants to implement the survey, collecting samples of food, water and hair for analysis, identifying surface water sampling sites and providing input into the development of the various reports. No surveys were conducted or samples collected without the written informed consent of the participant. This phase of the study was led by three principal investigators; Dr. Laurie Chan from the University of Northern British Columbia, Dr. Olivier Receveur of the Université de Montréal, and Dr. Donald Sharp from the Assembly of First Nations.

FNFNES is being implemented region by region over a 10 year period. FNFNES will eventually be representative of all Canadian First Nations for regions south of the 60th parallel. The study was first implemented in 21 First Nations communities in British Columbia in 2008 and 2009 (Chan, et al., 2011). In 2010, data collection was conducted in nine Manitoba First Nations communities. After Ontario, Manitoba has the second highest on-reserve (84,874) and total First Nations population (140,975) in Canada (Aboriginal Affairs and Northern Development Canada, 2012). There are 63 First Nations in Manitoba, including 6 of the 20 largest First Nations communities in Canada; 60% of Manitoba First Nations members live on reserves.

This regional report, descriptive in its intent, was developed on the basis of aggregated information and provided to the communities that participated in the study, regional and national First Nations organizations and has been made publicly available in print and online. Preliminary results were disseminated through meetings with each participating community and feedback on the content of these reports is included in this report.

METHODOLOGY

Sampling

For the purposes of this study, we sampled communities using a combined ecozone/culture area framework to ensure that the diversity in ecozones and cultural areas are represented in the sampling strategy.

Terrestrial Ecozones are very large scale divisions of the earth's surface based on distribution of plants and animals. Ecozones are separated by such features as oceans, deserts or high mountain ranges that formed barriers to plant and animal migration. Within Canada there are 15 terrestrial ecozones and five aquatic ecozones. The province of Manitoba contains five ecozones (Prairies, Boreal Plains, Boreal Shield, Hudson Plains and Taiga Shield). Further information on ecozones can be found within the first National Ecological Framework Report, published by Agriculture and Agri-Food Canada in 1995 (Smith, et al., 1995), and at the Ecological Framework of Canada website (ecozones.ca). Table A provides a brief description of the five ecozones within the Manitoba AFN region.

Culture Areas is an older concept developed by anthropologists in the nineteenth century to identify geographic areas within which Indigenous communities shared a greater number of traits/cultural affinities than from those outside the area. In Manitoba, there are two identified culture areas (Plains and Subarctic).

Table A. Description of the five ecozones within the Manitoba AFN Region

Ecozone Name	General Description
Prairies	Most of this ecozone is located within the United States with the northeastern corner situated in southwestern and south central Manitoba. This ecozone consists of flat and rolling plains and foothills covered by mixed grassland. Forests of aspen and poplar trees border the area between the Prairies and the Boreal Plains.
Boreal Plains	The Boreal Plains span from northeastern BC across the mid-section of Alberta, Saskatchewan and into central Manitoba. The ecozone is marked by low-lying valleys, plains and the Boreal Forest The majority of the surface waters are part of three watersheds: those of the Saskatchewan River, the Beaver River and Peace, Athabasca and Slave rivers' watershed.
Boreal Shield	Stretching from the northeastern Alberta to Newfoundland, this ecozone includes a northern and eastern Manitoba. The boreal shield is an immense flat plain of bedrock covered in boreal forest, millions of lakes, ponds and wetlands.
Taiga Shield	The Taiga Shield stretches across most of the Northwest Territories and the southern edge of this large ecozone dips down into Saskatchewan, north western Manitoba and across to northern Quebec and southern Nunavut. The land consists of rolling hills and flat lands covered in lakes, wetlands and small conifers that mark the northern edge of the boreal forest.
Hudson Plains	Northeastern Manitoba contains the western edge of the Hudson Plains, most of which are found in Ontario. This large flat lowland contains most of Canada's wetlands.

FNFNES will eventually be representative of all First Nations in Canada for regions south of the 60th parallel. Within the eight AFN regions south of 60, there are close to 600 First Nations communities. FNFNES is inviting approximately 100 communities to participate in this study.

Using the ecozone/culture area framework, Manitoba First Nations communities were stratified by ecozone and culture area into five strata. The number of communities allocated to the Manitoba region (12 communities) was distributed among the five strata (ecozones), allowing

for a minimum of two communities per ecozone and a maximum of four (due to budgetary constraints) for the ecozone with the greatest population. The selection of communities was done independently for each stratum. Communities were selected using a systematic random sampling method with probability proportional to the size of communities. This selection method makes sure that the most populated communities are more likely to be chosen in the sample than the smallest ones. The sampling strategy is similar to the one used recently in Ontario (Leenen, et al., 2008). Table B presents a summary of the collection effort in each stratum.

Table B. Summary of collection effort for each stratum in Manitoba

Stratum Number	Ecozone / culture area	Total Population on Reserve per Stratum+	Total Number of Communities per Stratum	Sample Allocation	Sample Actually Collected	Total Population on IR per Community
1	Prairies/Plains	12,899	14	2	2	691
	Prairies/Subarctic					3,324
2	Boreal Plains/ Plains	22,121	21	2	2	1,217
	Boreal Plains/ Subarctic					1,254
3	Boreal Shield/ Subarctic	41,016	25	5	3	3,191
						951
						3,027
						4,825
						2,169
4	Taiga Shield/ Subarctic	1,138	2	2	2	342
						796
5	Hudson Plains	1,241	1	1	0	1,241
Total		**78,415**	**63**	**12**	**9**	**78,415** *(71,978 for 9 final communities*)*

\+ Total population at time of calculation was based on 2009 statistics
* 3 communities were not included in the final analyses due to an inadequate number of surveys collected

FNFNES relies on data collected from probability samples of adult First Nations living on reserve. Communities (Primary Sampling Units or PSUs), households (Secondary Sampling Units or SSUs) and individuals (Tertiary Sampling Unit or TSU in each household), were selected using random mechanisms.

Sampling in Manitoba proceeded in three stages:

1. Primary Sampling Units (PSUs): Systematic random sampling of **communities** took place within each AFN Region. The number of communities allocated to each region was proportional to the square root of the number of communities within it. Over-sampling was carried out to account for potential community non-response.

2. Secondary Sampling Units (SSUs): Systematic random sampling of 125 **households** within each selected community. For communities with fewer households than the fixed number, every household in the community was selected. A larger sample of households than desired (100) was being fixed to adjust for expected non-response.

3. Tertiary Sampling Units (TSUs): Random selection of one responding **adult man or woman**, in each household with the following inclusion criteria:
   - 19 years of age or older;
   - Able to provide written informed consent; and
   - Self-identifies as being a First Nations person living on reserve.

The statistics produced for this study are derived from data obtained through samples of communities, households and persons. For these statistics to be meaningful for an AFN Region, they need to reflect the whole population from which they were drawn and not merely the sample used to collect them. The process of going from the sample data to information about the parent population is called estimation.

The first step in estimation is assigning a weight to each of the responding sampled units. The design weight can be thought of as the average number of units in the survey population that each sampled unit represents and is determined by the sample design. The design weight for a unit in the sample is the inverse of its inclusion probability. Note that for a multi-stage design, a unit's probability of selection is the combined probability of selection at each stage.
The final weight is the combination of many factors reflecting the probabilities of selection at the various stages of sampling and the response obtained at each stage. Final weights are the product of a design weight (the inverse of the selection probability) and of one or many adjustment factors (non-response and other random occurrences that could induce biases in the estimates). These design weights and adjustment factors are specific to each stage of the sample design and to each stratum used by the design.

Some communities may have been unable or unwilling to participate in the study. The design weight was adjusted based on the assumption that the responding communities represent both responding and non-responding communities. Assuming that non-response is not related to the topic of the study (missing at random), a non-response adjustment factor was calculated, within each stratum (see Appendix B for calculations).

Surveys with complex designs require special attention when it comes to estimation of the sampling error. Both the survey design and the unequal weights are needed to obtain (approximately) unbiased estimates of sampling error. Failing to do so can lead to severe underestimation of the sampling error. While exact formulae exist in theory for stratified PPS sample designs, the required computations become practically impossible as soon as the number of primary units (here, communities) selected per stratum exceeds two. The Bootstrap method was adopted for the estimation of the sampling error of the estimates produced for this study (see Appendix B for calculations).

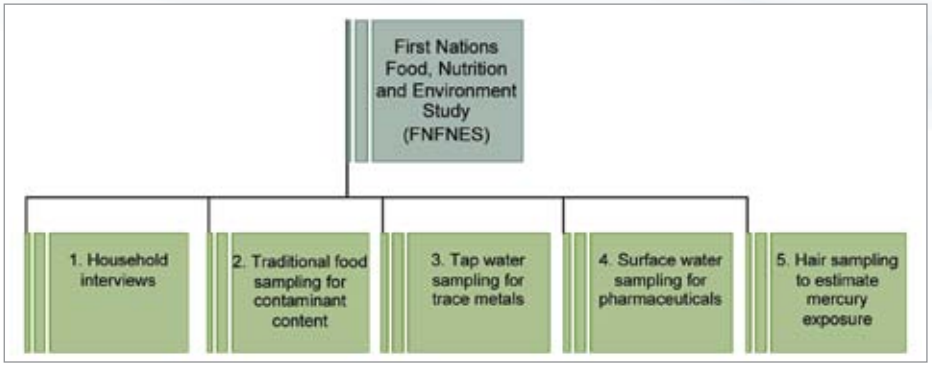
Sometimes, the sampling error might be difficult to interpret because the measure of precision is influenced by what is being estimated. For example, a sampling error of 100 would be considered large for measuring the average weight of people but would be considered small for estimating average annual income.

To resolve the apparent scale effect in the appreciation of sampling errors, *coefficients of variation (cv)* could be used. The cv of an estimate is a measure of the relative error rather than of the absolute error. It is very useful in comparing the precision of sample estimates, where their sizes or scale differ from one another. The cv is expressed as a percentage (see Appendix B for calculation).

In this report all results are weighted unless stated otherwise. Their corresponding standard errors are reported unless greater than 33.3% of the estimated parameter, in which case the estimates parameter is identified as * for being unreliable.

Principle Study Components

The following chart shows the five components of the FNFNES:



1. Household interviews: Each participant is asked to answer a series of questionnaires that focus on foods consumed (both traditional and market food), health, lifestyle and socio-economic issues, and food security.
2. Traditional food sampling for contaminant[1] content: Traditional foods that are commonly consumed by members of the participating First Nation community are collected to analyze for the presence of environmental contaminants.
3. Tap water sampling for trace metals[2]: Two water samples are collected at the household level; one that has stagnated in the plumbing overnight and a second after a five minute flush. These are analyzed for trace metals.
4. Surface water sampling for pharmaceuticals: Water samples are collected from three separate sites chosen by the participating community to analyze for the presence and amount of agricultural and human pharmaceuticals and their metabolites.
5. Hair sampling to estimate mercury exposure: Hair samples are collected voluntarily from participants. Hair analysis for mercury allows estimation of the participants' exposure to mercury.

1 FNFNES is studying the chemical safety of traditional food. The bacteriological safety is monitored by the community's Environmental Health Officer (EHO).

2 This study determines the chemical safety of the community water supplies. The bacteriological safety is monitored by the EHOs.

Household Interviews

Traditional Food Frequency Questionnaire

This questionnaire was developed based on previous work conducted with First Nations, Inuit and Métis in Canada (Kuhnlein, et al., 2001). Questions were developed that sought information on frequencies of consumption of all identified traditional foods (retrospectively for the four past seasons). The traditional food list was constructed based on a review of existing literature for Manitoba and after eliciting input of representatives of each participant community. Table C demonstrates the categorization of frequency of consumption that was used as an aid when the respondent had difficulty recalling a more precise estimate. For the purposes of this study, each of the four seasons consisted of 90 days each.

Table C. Categorization of frequency of consumption

Frequency	Average Days/Season
Very Rarely (< 1 day/month)	2 days/season
Rarely 1-2days/month	6 days/season
Quite Often 1 day/week	12 days/season
Often 2-3 days/week	30 days/season
Very Frequently 4-5 days/week	54 days/season
Almost Every Day 5-7 days/week	72 days/season

24-Hour Diet Recall

The 24-hour diet recall was an "in-person" interview aimed at recording all foods and beverages (including their approximate quantities) consumed the previous day using food and beverage models.[3]
This interview used the multi-pass technique with 3 stages as follows:

1. Make a quick list of all foods consumed during a 24-hour period (the first pass);
2. Get a detailed description of the foods and beverages (brands, amounts, and amount eaten); and
3. Review the recall with the participant to see if anything was missed.

A subsample of 20% of the respondents were invited to fill a second 24-hr recall for later analyses using SIDE (see Statistical Analyses section) to partially adjust for intra-individual variation. This method allows for a better approximation of the usual diet.

Socio/Health/Lifestyle (SHL) Questionnaire

The SHL questionnaire incorporates several questions from the Canadian Community Health Survey 2.2 (CCHS 2.2) questionnaire (2004) and others derived from previous work with Aboriginal Peoples in Canada (Kuhnlein, et al., 2001) as appropriate, including:

- General health
- Height and weight (either measured or self-reported)
- Vitamin and dietary supplement use
- Physical activities
- Smoking
- Food security
- Socio-demographic characteristics
- Economic activity

3 Plastic models that resemble food quantities to assist in determining amounts consumed.

Food Security Questionnaire

The questionnaire in use in this project is the US Household Food Security Survey Module developed by the USDA (United States Department of Agriculture, Economic Research Service), used also in the CCHS 2.2 questionnaire and further adapted for Aboriginal households (Lawn, et al., 2004). In its analyses, the criteria used by Health Canada in analyzing CCHS.2.2 were applied as shown in Table D (Heath Canada, 2007).

Table D: Categorization of Food Security Status

Category Labels	Category Description	Score on 10-Item Adult Food Security Scale	Score on 8-Item Child Food Security Scale
Food Secure	no, or one, indication of difficulty with income-related food access	0 or 1 affirmed responses	0 or 1 affirmed responses
Food Insecure, Moderate	indication of compromise in quality and/or quantity of food consumed	2 to 5 affirmed responses	2 to 4 affirmed responses
Food Insecure, Severe	indication of reduced food intake and disrupted eating patterns	≥6 affirmed responses	≥5 affirmed responses

More information on the household questionnaire is available on the FNFNES website: **www.fnfnes.ca**

Water Sampling for Trace Metals and Pharmaceuticals

Tap Water Sampling

The drinking water component aimed to collect tap water samples from 20 participating households in every community. Selection of sampling sites was based on what would be considered representative of the water distribution system, i.e. at the ends of pipelines and at miscellaneous points within the system. Maps were used to help in the selection. In addition, if a household in the community was accessing a source of drinking water that was not part of the community water supply system, such as a well, nearby spring, or a trucked water source, these were also sampled.[4]

Water Sample Preparation

Dissolved Metals: Prior to analysis, samples were filtered through a 0.45 micron pore size filter and acidified with nitric acid (using methodology based upon EPA Method # 200.1).

Total Metals: Prior to analysis samples were digested using nitric acid (using methodology based upon EPA Method # 200.2).

Analysis

Inductively Coupled Argon Plasma Mass Spectroscopy (ICP/MS) was used to perform all analysis for the elements requested (using methodology based upon EPA Method # 200.8). Mercury was determined using Cold Vapour Atomic Fluorescence Spectroscopy (using methodology based upon EPA Method # 245.7). All sample results are reported as micrograms per-litre "parts per billion" on either dissolved or total basis.

Please refer to Appendix C for detection limits.

Pharmaceuticals in Surface Water

In the last ten years there has been considerable interest concerning the occurrence of pharmaceuticals in surface water and drinking water (Aga, 2008). These emerging chemicals that find their way into the environment have yet to be characterized in surface waters on reserve.

This study component was undertaken to:

- Establish a baseline of agricultural and human pharmaceuticals occurrence in surface water on reserves in Canada;
- Determine the exposure of fish and shellfish (an important component of many First Nations' diets) to pharmaceuticals in surface water on reserves in Canada; and
- Establish a pharmaceuticals priority list for future health and environmental effects studies.

The criteria used for the selection of pharmaceuticals were: 1) levels of detection of the pharmaceuticals in the aquatic environment in previous studies; 2) frequency of detection of the pharmaceuticals in the environment in previous studies; and, 3) evidence of usage of the pharmaceuticals in First Nations communities. The First Nation usage information was provided by Non-Insured Health Benefits (NIHB), First Nations and Inuit Health Branch (FNIHB) (Booker, Personal Communication 2011). FNFNES has chosen a list of 42 pharmaceuticals that meet the above criteria and can be analyzed by the laboratory that is participating in the FNFNES study (Appendix C, Table C.10).

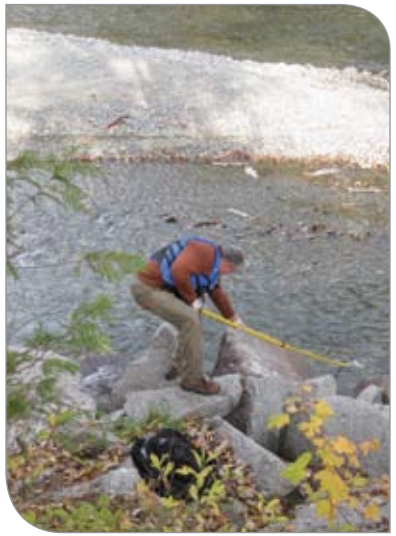
4 The Environmental Public Health Services, FNIHB, Health Canada monitors drinking water in First Nations Communities which includes weekly microbiologic monitoring, annual basic chemical monitoring and a comprehensive chemical and radiological monitoring on a five year cycle. The region maintains a database with complete and historic records on community drinking water quality and water system profiles for all the communities in Manitoba.

Pharmaceuticals and Personal Care Products in Water

Two separate 250 mL sample aliquots are required to analyze all of the target analytes. One aliquot is adjusted to pH 1.95-2.0 and mixed with 500 mg of Na4EDTA·2H2O. The sample is loaded onto a HLB solid phase extracting column. The column is washed with 10 mL water and eluted with 12 mL of methanol. The eluent is evaporated and reconstituted with 450 µL water and 50 µL internal standard. The extract is analyzed by LCMSMS in positive and negative ion mode. The second 250 mL aliquot is adjusted to pH 10 ± 0.5. The sample is loaded onto a HLB solid phase extracting column. The column is eluted with 6 mL of methanol followed by 9 mL of 2% formic acid in methanol. The eluent is evaporated and reconstituted with 450 µL acetonitrile and 50 µL internal standard. The extract is analyzed by LCMSMS in positive ion mode.

17α-Ethinylestradiol in Water

A 20 mL aliquot of the sample is loaded onto a HLB SPE column. The column is washed with 3 mL of water and eluted with 3 mL of methanol. The eluent is evaporated to dryness. 100 µL of 100 mM sodium bicarbonate (pH 10.5) is added followed by 100 µL of 1 mg/mL Dansyl Chloride to derivatize the ethynylestradiol. Samples are then incubated at 60°C for 6 minutes. After cooling to room temperature, the samples are diluted with 50 µL of 1:1 acetonitrile:water. The extracts are analyzed by LCMSMS in positive ion mode.



Please refer to Appendix C for detection limits.

In each community, three sampling sites were chosen by the First Nation. These sites were selected based on where fish may be harvested, at the drinking water supply intake, or other location of importance to the participating First Nation. Samples were collected by an Environmental Health Officer (EHO), First Nations and Inuit Health Branch (FNIHB), Manitoba region.

Hair Sampling for Mercury

The First Nations Food, Nutrition and Environment Study includes a non-invasive bio-monitoring component, relying on sampling of human hair for analysis for mercury (Hg). This sampling was done in order to use this information for additional validation of dietary assessments and to develop a new estimate of First Nations populations' exposure to mercury across Canada.

The hair is collected in the early fall of each study year according to the established procedure of the certified First Nations and Inuit Health Branch (FNIHB) Laboratory in Ottawa, Ontario.

In essence, a 5 mm bundle of hair is isolated and cut from the occipital region (the back of the head), ensuring a minimal and most often unnoticeable effect on participants' aesthetics. The hair bundle (full length, as cut from the scalp) is placed in a polyethylene bag and fastened to the bag with staples near the scalp end of the hair bundle. The hair sample is sent to the FNIHB Laboratory for analysis.

Each hair bundle is cut into 1 cm segments, starting from the scalp end. Three segments are analyzed to provide the level of mercury in participants' hair for approximately the last three months. Total mercury (all samples) and inorganic mercury (20% of samples) in the hair are analyzed.

Segmented hair samples are chemically treated to release ionic mercury species which are further selectively reduced to elemental mercury. The latter is concentrated as its amalgam using gold traps. The mercury is then thermally desorbed from the gold traps into argon gas stream, and concentration of mercury vapours is measured with a UV-detector at 254 nm wavelength using Cold Vapor Atomic Fluorescence Spectrophotometer (CVAFS). Selective reduction of the ionic mercury species allows measurement of total or inorganic mercury. The limit of quantitation is 0.06 ppm (or µg/g) for total and 0.02 ppm (or µg/g) for inorganic mercury in hair.

Any unused hair left from the original bundle is reattached to the polyethylene bag and together with unused segments are returned to participants at the end of each study year.

Food Sampling for a TDS Suite of Contaminants

Traditional food composites were collected on the basis of input from communities so that collected foods represented traditional foods consumed that season/year in the region. The food-sampling strategy was as follows:

- Up to 30 food samples were to be collected from each participating community.
- The community was to identify the most commonly consumed food; the foods that are of the most concern from a nutrition or environmental perspective; and, based on existing knowledge, foods that are known to accumulate higher concentrations of contaminants.
- Each food sample was a composite of tissues from 5 different animals or plants.

The traditional food samples collected were analyzed for the following categories of toxic chemicals, based on the general structure of the Canadian Total Diet Study 1992-1999.

- Perfluorinated compounds (PFCs)
- Polycyclic aromatic hydrocarbons (PAHs)
- Organophosphate and organochlorine pesticide residues
- Polychlorinated biphenyls (PCBs)
- Polychlorinated dibenzo-p-dioxins and polychlorinated dobenzofurans (PCDD/Fs)
- Polybrominated fire retardants (PBDEs)
- Trace elements and heavy metals

In addition, traditional food composites were analyzed for essential trace metals when data were missing.

All food samples were sent for analysis to MAXXAM Analytics, formerly CANTEST, in Burnaby, BC. The choice of the contract lab was based on a rigorous performance evaluation and a formal bidding process. A comprehensive quality assurance/quality control (QA/QC) program was implemented by the analytical laboratory and the QA/QC results were verified and approved by the PIs of FNFNES.

Tissue Samples

Prior to digestion, samples were homogenized to provide a homogeneous sample for subsequent digestion. If required, a moisture value was determined gravimetrically after drying a portion of the blended sample at 105°C overnight.

Metals in Tissue Samples

Samples were digested using an open vessel in a combination of nitric acid and hydrogen peroxide using methodology based upon EPA Method # 200.3. Inductively Coupled Argon Plasma Mass Spectroscopy (ICP/MS) was used to perform all analyses for the elements requested. Mercury was determined using Cold Vapour Atomic Fluorescence Spectroscopy. Blanks, duplicates and certified reference materials were digested and analyzed concurrently. All sample results are reported as either micrograms per gram “As Received” or on a “Wet Weight” basis.

Perfluorinated Compounds in Tissue Samples

One gram of homogenized tissue sample undergoes an alkaline digestion using 10 mL of 10mM potassium hydroxide in methanol and shaking for 16 hours. A 5 mL aliquot of the extract is diluted with water and the pH is adjusted to 4-5 with 2% formic acid. The diluted pH adjusted extract is then loaded onto a weak anion exchange (WAX) column and the column washed with 1 mL of 25mM sodium acetate at pH 4.0. The first fraction is eluted with 3 mL of methanol to recover PFOSA. This is directly transferred to a vial for analyzed by LCMSMS in negative ion mode. The second fraction is eluted with 3 mL of 0.1% ammonium hydroxide in methanol to recover the remaining PFCs. This fraction is evaporated and reconstituted with 1 mL of 85:15 water: acetonitrile and analyzed by LCMSMS in negative ion mode.

PAH in Tissue Samples

Six grams of homogenized tissue is homogenized in dicloromethane (DCM) and filtered through anhydrous sodium sulphate. The extract is evaporated to 6 mL, and 5 mL is injected onto the Gel Permeation Chromatography (GPC) column where a fraction of the eluent is

collected, concentrated, and solvent exchanged to hexane. Further clean-up is performed by eluting this extract through 7.3% deactivated silica gel and anhydrous sodium sulphate. The final extract is concentrated and solvent exchanged to isooctane. Analysis is performed using GCMS in Selective Ion Monitoring (SIM) mode with an EI source.

Pesticides and PCBs in Tissue Samples

Six grams of tissue is homogenized in dicloromethane (DCM) and filtered through anhydrous sodium sulphate. The extract is evaporated to 6 mL and 5 mL is injected onto the Gel Permeation Chromatography (GPC) column where a fraction of the eluent is collected, concentrated, and solvent exchanged to acetone:hexane (1:1). Further clean-up is performed by eluting this extract through PSA columns. The final extract is concentrated and solvent exchanged to isooctane. Analysis is performed for the pesticides (except for toxaphene) and PCBs using GCMS in Selective Ion Monitoring (SIM) mode with and EI source. Analysis for toxaphene is performed using GCMS in SIM mode with a CI source.

PCDD/F in Tissue Samples

Approximately 10-12 g of tissue is spiked with 0.5-1 ng each of 15 carbon-13 labeled PCDD/F internal standards and then digested with 80 mL of pre-cleaned concentrated hydrochloric acid (conc. HCl). Following overnight digestion of the tissue, the samples are extracted with three 20 mL portions of 9:1 dichloromethane:acetone. The sample is placed in a pre-tared test tube and the remainder of solvent is removed by passing a gentle stream of nitrogen over the surface. The sample is reweighed for lipid concentration. The sample is placed in a vial to which 10 mL of concentrated H_2SO^4 is added. It is vigorously shaken and left to sit overnight to allow the layers to separate. The extract is then cleaned up on a mixed bed silica gel column (basic, neutral and acidic silica gel). The final cleanup is with basic alumina. The eluate from the alumina column is concentrated by rotary evaporator to 2 mL and final reduction to dryness is by a gentle stream of nitrogen. Recovery standard (1 ng) is added and the final volume made up to 10 µL.

All samples are analyzed on a Thermo Instruments DFS high resolution mass spectrometer coupled with an Thermo Trace gas chromatograph. The column used is a 60 m RTX-DIOXIN2, 0.25 µm, 0.25 mm i.d. An initial six point calibration (CS-Lo, CS-1 to CS-5) containing all PCDD/F congeners is run covering the range of 0.1 ng/mL to 2000 ng/mL.

PBDE in Tissue Samples

Approximately 10-12 g of tissue is spiked with 1-10 ng each of carbon-13 labeled PBDE standards and then digested with 80 mL of pre-cleaned conc. HCl. Following overnight digestion of the tissue, the samples are extracted with three 20 mL portions of 9:1 dichloromethane:acetone. The sample extract is concentrated and placed in a vial to which 10 mL of concentrated H2SO4 is added. It is vigorously shaken and left to sit overnight to allow the layers to separate. The extract is then cleaned up on a mixed bed silica gel column (basic, neutral and acidic silica gel). The final cleanup is with basic alumina. The eluate from the alumina column is concentrated by rotary evaporator to 2 mL and final reduction to 50 µL is by a gentle stream of nitrogen. Recovery standard (1-5 ng) is added and the final volume made up to 100 µL.

All samples are analyzed on a Thermo Instruments DFS high resolution mass spectrometer coupled with a Thermo Trace gas chromatograph. The column used is a 15 m DB-5HT, 0.1 µm, 0.25 mm i.d. An initial five point calibration (CS-1 to CS-5) consisting all PBDEs is run covering the range of 0.25 ng/mL to 1000 ng/mL.

Please refer to Appendix C for detection limits.

Mixed Traditional Foods

Timeline for Data Collection

First, randomly selected communities were contacted by the Assembly of First Nations and invited to send a representative to a two day Methodology Workshop where the study design was presented in detail. After this workshop, arrangements were made for the principal investigators (PIs) to visit each selected community to discuss the project with the Chief and Council and in some cases with the community at large. The main purpose of these visits was to introduce the project in person to leadership and the larger community and to answer questions and concerns about the nature of the partnership. Following this exchange, a Research Agreement (see sample on www.fnfnes.ca) was signed by the Chief and FNFNES PIs marking the formal beginning of research activities.

Shortly after signing the community research agreement, financial arrangements were agreed upon and community members were hired and trained to be Community Research Assistants (CRAs). After training, which was conducted by Nutrition Research Coordinators (NRCs), the CRAs carried out data collection activities that continued between the months of October and December. This was conducted under the supervision of the NRCs.

All collected data were entered into a database by the NRCs, except for information derived from the 24-hr recalls, which were entered by research nutritionists at the Université de Montréal. To ensure the accuracy of data entry, a sub-sample of 10% of the records were entered twice and discrepancies reconciled.

Ethical Considerations

This research was conducted following the Canadian Institutes of Health Research (CIHR) Guidelines for Health Research Involving Aboriginal Peoples (Canadian Institutes of Health Research, 2007), the Tri-Council policy statement on ethical conduct for research involving human subjects (Canada. Panel of Research Ethics, 1998), and the document entitled: “Indigenous peoples & participatory health research: Planning & management, Preparing research agreements” published by the World Health Organization (World Health Organization, 2010). Its protocol was accepted by the Ethical Review Boards at Health Canada, the University of Northern British Columbia and the Université de Montréal. Individual participation in the project was voluntary and based on informed written consent after an oral and written explanation of each project component.

Project direction followed agreed-upon guiding principles (see www.fnfnes.ca), which included advice provided by a Steering Committee made up of the PIs and ex-officio members from Health Canada, and consultation with Statistics Canada for the sampling methodology and random sample selection.

Statistical Analyses

All data were entered using Epi-Info version 3.5.3[5] except for the 24-hr recall which used CANDAT.[6] For food groupings, in addition to assigning each food code to only one food group when feasible, a set of 11 multi-food group classifiers was created for complex recipes (see Appendix D).

Data analysis used SAS/STAT software (version 9.2) with regional estimates generated according to the complex survey design using the bootstrapping SAS subroutines. The SIDE SAS sub-routine[7] was used to assess nutrient adequacy accounting for intra-individual variation and therefore approximating usual nutrient intakes. When single bootstrap estimates were greater than the observed mean plus 4 times the standard deviation of the 1st day intake, they were deleted and resampled until they fell within the margin for inclusion in calculations of the standard error of percentiles. The 95th percent confidence intervals were obtained by ordering the 500 bootstraps and using the 2.5th percentile as a lower level and 97.5th for % below EAR, % > UL, % below AMDR, % above AMDR and % within AMDR.

The intent of this regional report is to be descriptive with an aim to generate representative estimates (i.e. min., max., mean, median, 75th percentile, 95th percentile, etc) at the regional level (weighted estimates) and some estimates at the ecozone/culture area level for illustration of the potential geographical variability (unweighted estimates).

Subsequent analyses examining the relationships between the variables studied will be the objective of separate publications.

For individuals interested in community level estimates, the respective Chief and Council need to be contacted to access the data. A backup copy of all data have been archived at the Assembly of First Nations (thereafter named Data Custodian) and to which requests for accessing the community data must be presented. The data will not be released without the respective First Nation's approval.

Results of this study were first presented to each community and their suggestions and concerns are summarized at the end of this report.

[5] More information about the software is available online: <http://www.cdc.gov/epiinfo>
[6] More information about the software is available online: <http://www.candat.ca>
[7] More information about the software is available online: <http://cssm.iastate.edu/software/sidesas.html>

RESULTS

This report contains information on socio-demographics, health and lifestyle practices, nutrient and food intake with comparisons to Canada's Food Guide, traditional food use, income-related household food security, environmental concerns, contaminant exposure, drinking water and hair analyses. Results are compared when applicable to the 2004 Canadian Community Health Survey (CCHS) and its Manitoba component, as well as to the Total Diet Studies (TDS) for the contaminant results.

Sample Characteristics

Data collection for Manitoba took place from September to December 2010. Twelve communities were randomly selected to participate; nine completed an adequate number of surveys in order to be included in the analyses for this report. The nine participating Manitoba First Nations communities were: Swan Lake First Nation, Sandy Bay Ojibway First Nation, Pine Creek First Nation, Chemawawin Cree Nation, Sagkeeng First Nation, Hollow Water First Nation, Cross Lake Band of Indians, Sayisi Dene First Nation and Northlands Denesuline First Nation (Figure 1). Table 1 lists the number of participants from each participating community and the ecozone where the community is located.

Table 2 describes some of the characteristics of each participating community, including distance to Winnipeg and road access to a service centre (the nearest community to which a First Nation can gain access to government services, banks and suppliers). Sagkeeng First Nation is the closest community to Winnipeg, while Northlands Denesuline First Nation is the furthest. The remoteness of these communities is demonstrated by the fact that the nearest service centre is at least an hour away. There is year-round road access to all the communities except the two northern ones, Northlands Denesuline First Nation and Sayisi Dene First Nation. All communities had health centres/offices or nursing stations. At over 8700 hectares, Sagkeeng First Nation has the largest land base, while Sayisi Dene First Nation has the smallest at 212 hectares.

The regional findings presented in this report are based on a total of 706 study participants. However, in cases where some variables have missing data, the corresponding sample size is indicated in the results graph or table. All estimates presented in this report are weighted when possible to be considered representative of all Manitoba First Nations households on-reserve.

A sufficient number of participants were included at each ecozone/culture area to present estimates at those levels. However, some estimates are presented unweighted and illustrate only geographical variation when applicable. A sufficient number of participants were included at each ecozone/culture area to present estimates at those levels, except for the North East Hudson Plains since its only community (Shamattawa First Nation) did not complete the study.

Table 3 shows that the overall participation rate was 82% (706/865 eligible households), which is higher than the rate for the CCHS 2.2 (2004) at 76.5%. No formal probing was conducted to determine how participants differed from non-participants but there was a higher ratio of female participants (68%) than male participants (32%).

Socio-demographic Characteristics

The average age of Manitoba First Nations participants was similar for women (42 years old) and men (41 years old) and was fairly stable across all four ecozones (Table 4). Figures 2a and 2b demonstrate the age group distribution of participants by gender and ecozone. In Ecozone 4 (Taiga Shield), there were a higher percentage of younger participants (age group 19-30) and fewer older participants (aged 71 and over).

In participating Manitoba First Nations on-reserve households, 64% of individuals were between the ages of 15-65 years of age, with children less than 15 years of age representing 31% and elders (over the age of 65), 5% (Figure 3).

The median number of people per household was 5, with 25% of households containing 7 or more people (Table 5). The majority of households had 1 person employed full-time. Most participants had completed an average of 10 years of school (grade 9), while 25% had completed 12 or more years of school. Less than 25% of participants had obtained a high school diploma, 8% had obtained a general equivalency diploma (GED), 23% had obtained a vocational degree and 4% had obtained a bachelor's degree (Figure 4). In the Manitoba portion of the First Nations Regional Longitudinal Health Survey (RHS) (2002/2003), 14% of participants reported having a degree or diploma (Elias, et al., 2006).

Figure 5 shows that the main source of income was wages (44%), followed by social assistance (40%) and pension (10%). Worker's compensation was the main source of income for 3% of participants. Figure 6 shows that the percent of participants on social assistance ranged from 36% to 58%, with an overall average of 40% for Manitoba First Nations. In the Manitoba RHS survey (2002/2003), the primary income was reported as social assistance by 54% of participants followed by wages (44%) (Elias, et al., 2006).

Health and Lifestyle Practices

Participants were asked a series of health related questions in order to understand the relationships between diet, lifestyle and health risks. Height and weight measurements were both self-reported and measured for individuals who agreed to have it recorded. There was no statistical difference between self-reported and measured body weights and heights so both values were used to calculate Body Mass Index (BMI), an index used to categorize body weights and risk of disease (See Appendix E for further information). The Body Mass Index (BMI) is a proxy measure of body fat based on a person's weight and height. A BMI less than 18.5 categorizes a person as underweight, while a BMI between 18.5 and 24.9 categorizes a person as normal weight. A BMI over 25 categorizes a person as overweight, while a person with a BMI over 30 is obese. People who are overweight or obese are more likely to develop health problems.

Based on their BMIs, 16% of participants had a normal or 'healthy weight', 31% were classified as overweight and 52% of participants were classified as obese (Figure 7a). Sixty-four percent of women aged 19-30, 80% of women aged 31-50 and 91% of women aged 51 and over were overweight or obese (Figure 7b). Seventy-nine percent of men aged 19-30, 89% of men aged 31-50 and 87% of men aged 51 and over were overweight or obese (Figure 7c).

In the Canadian general population, based on measured weight and height data from the CCHS 2008, approximately 25% of adults aged 18 years and older are obese and 38% are overweight (Public Health Agency of Canada, 2011). The First Nations Regional Longitudinal Health Survey Phase 2 (2008-2010) reports that 40% of First Nations adults on reserve are obese and 34% are overweight based on self-reported height and weight (First Nations Information Governance Centre, 2011). Data from the Manitoba RHS Phase 2 (2008-10) are not yet available, however the Manitoba First Nations RHS (2002/03) found similarly that 40% of Manitoba First Nations adults were obese based on self-reported heights and weights (Elias, et al., 2006). Manitoba rates for overall obesity among adults (18 years and older), which do not include First Nations individuals living on-reserve, is 28.9% for males, and 25.3% for females (Fransoo, et al., 2011).

Obesity is a risk factor for diabetes and heart disease. Twenty-three percent of Manitoba participants reported having been told by a health care provider that they had diabetes (Figure 8). In order to compare with previous studies, age-standardized rates were calculated using the 1991 Canadian census data. The age-standardized rate was slightly lower at 21%; nonetheless, these rates are much higher than the rate of 8.7% found in Canadian adults aged 20 and over (Public Health Agency of Canada, 2011). These rates are also higher than those reported in other studies involving First Nations, Inuit and Métis communities (Table 6).

Participants aged 40 and over were almost four times more likely to report having diabetes than younger participants (Figure 9). The majority of participants with diabetes reported having Type 2 diabetes (Figure 10).

Figure 11 shows that 8% of total participants reported that they were dieting to lose weight on the day of the 24-hour recall; younger men reported dieting more often than older men.

Over half (59%) of Manitoba First Nations participants smoked (Figure 12). Smoking rates ranged from 55% in ecozone 3 to 74% in ecozone 1. These rates are over triple the national smoking rate of 17% for all Canadians aged 15 and over (Health Canada, 2010) and higher than the 43% smoking rate reported for the First Nations Longitudinal Regional Health Survey Phase 2 (2008/2010) (First Nations Information Governance Centre, 2011). Moreover, diabetes and smoking are a dangerous combination since both cause hardening of the

arteries and damage to the blood vessels, increasing the risk of heart disease. The risk of having a heart attack is 2-3 times greater for a smoker with diabetes compared to a non-smoker with diabetes, especially in women (Willett, et al., 1987).

The majority of female and male participants reported their activity level as being somewhat active (Figures 13a and 13b). More men reported being highly active than women. In terms of self-perceived health, most of the younger women and men (less than 50 years of age) said their health was good, while most of the older women and men (aged 51 and over) said their health was fair (Figures 14a and 14b). Only 19% of women aged 19-30, 21% of women aged 31-50 and 17% of women aged 51 and over said their health was excellent or very good. Younger men were more likely to report their health to be excellent or very good compared to older men.

Traditional Food Use and Gardening

Participating community members were asked to describe how often they consumed traditional food in each season during the last year. Participants were also asked to describe their personal and family traditional food harvesting and gardening practices. In Manitoba, both traditional food harvesting (hunting, fishing, and gathering of wild plants) and cultivation of plants, especially in southern Manitoba, are important parts of the traditional food systems of First Nations communities. Together, this information tells us about the value of community food activities to the health of First Nations.

Table 7 presents the list of traditional food available in Manitoba and the extent of use by participants. Overall, fish was consumed by 83% of all participants, land mammals by 86%, wild birds by 56%, wild berries or nuts by 68%, wild plants by 27%, tree foods by 2% and mushrooms by 2%. Geographical differences played a role in traditional food availability as walleye was the most consumed fish in the southern communities while lake whitefish was more popular in the northern communities. Moose meat was more popular in ecozones 2 and 3, while deer meat was eaten more often in ecozone 1. Caribou meat was eaten mainly by participants in ecozone 4. Canada goose and mallard were the most commonly eaten wild birds while blueberries and raspberries were the most popular berries. Wild rice and Labrador tea were consumed by a fair number of participants.

On average, moose meat and walleye were consumed 12 days per year or once per month (Table 8a) by Manitoba First Nations. Deer meat, blueberries and ducks were consumed about six times a year (or once every other month). Other traditional food items that appear by ecozone/culture area are Saskatoon berries (Table 8b), white sucker (Table 8c), wild rice (Table 8d) and Labrador tea (Table 8e). Overall, there appears to be little seasonal variation in consumption of meat and fish whereas berries are eaten more frequently during the summer.

In terms of food harvesting, about the same percent of participants from each ecozone hunted or set snares for food (Figure 15a). However, more people from ecozone 4 reported that they fished (45%) and collected wild plant food (28%) compared to the other ecozones (Figures 15a and 15b). Thirteen percent of all participants reported planting a garden (Figure 15b) and 39% of participants reported eating vegetables from a private/community garden (Figure 16). This indicates that for some communities, the community garden is a significant contributor to the intake of vegetables and fruits and that sharing of garden produce is an important activity. The different kinds of garden vegetables and fruits reported to be eaten by all Manitoba First Nations participants are listed in Appendix F. Potatoes and carrots are the most commonly consumed garden vegetables.

When asked if their household would like to have more traditional food, the majority (66%) said that they would (Figure 17). The main barriers preventing greater use of traditional food by Manitoba First Nations households are the absence of a hunter, equipment, transportation and a lack of time (Figure 18). Other reported barriers that limit harvesting for foods such as moose, rabbit and berries included: government restrictions, hydro, forestry and roadways (Figures 19 and 20).

When asked by open-ended question, participants reported that the most important benefits of traditional food were that they were healthy, natural and good-tasting. As well, traditional foods are perceived to be cheaper and fresher than market food, and were an important part

of the culture (Figure 21). As for the most important benefits of market food, participants reported their availability and convenience, as well as their variety. They also liked that market food was already portioned, could be cheaper than traditional food due to the cost of equipment and transportation, and were healthy (Figure 22).

Nutrient Intake

In the 24-hour recall, participants were asked to describe the amounts and types of food and beverages they had consumed in the 24 hours prior to the interview. Data from the 24-hour recalls allow evaluation of the population diet quality by comparing to "Dietary Reference Intakes" (Institute of Medicine, 2000) and "Eating Well with Canada's Food Guide – First Nations, Inuit and Métis" (Health Canada, 2007).

Dietary Reference Intakes (DRIs) are recommendations for nutrient intakes. There are four types of reference values: Estimated Average Requirements (EARs); Recommended Dietary Allowance (RDA); Adequate Intake (AI); and Tolerable Upper Intake (UL). The EAR is the median daily intake that is estimated to meet the needs of 50% of the individuals in a group. The EAR is used to assess whether a group of men or women is likely to be getting enough of a certain nutrient for good health. The Recommended Dietary Allowance is the amount of a nutrient that would meet the daily needs of up to 98% of healthy individuals in the population. An AI for some nutrients (such as potassium and sodium) exists as there is currently insufficient evidence to establish an EAR and an RDA. The UL is the highest daily nutrient intake that is not likely to pose a risk to health.

Tables 12.1-12.37 compare nutrient intakes from Manitoba First Nations study participants to "Dietary Reference Intakes" (Institute of Medicine, 2000). Due to limited sample sizes in some age-gender groups and the fact that nutrient requirements are the same between these age groups (except for a slight difference for magnesium), the 19-30 and 31-50 age groups were combined. Due to lack of sample size in the 71 and over age group (n=24), these participants were not included in these analyses. Pregnant and lactating women were also excluded due to different nutrient requirements for these groups. The SIDE SAS sub-routine nutrient analyses were performed on a total of 658 participants (438 women and 220 men).

Overall, in terms of nutrient intake for Manitoba First Nations, there are:

- High intakes of fat and sodium (salt);
- Low intakes of fibre, vitamin A, vitamin D, calcium and magnesium;
- Low intake of vitamin C among men and smokers of both sexes;
- Low intake of folate for women and men over 51;
- Low intake of vitamin B6 for women over 51; and
- Adequate intakes for iron, vitamin B12, riboflavin, niacin, thiamine, zinc and phosphorous.

High (excess), as well as low (inadequate) nutrient intakes can have serious consequences on health. High intake of fat is linked to obesity and saturated fat is particularly associated with heart disease. High intake of sodium (salt) has been linked to high blood pressure, which can also lead to heart disease. People with diabetes are 2-3 times more likely to develop heart disease than those without. Reducing intake of foods high in fat and sodium are key steps to promoting better health.

In terms of quality food intake, comparisons to the "Eating Well with Canada's Food Guide – First Nations, Inuit and Métis" (CFG) reveal that Manitoba First Nations adults do not meet the type and amounts of foods recommended. Manitoba First Nations adults consumed more than the recommended number of servings from the Meats and Alternatives group (Table 13) and below the recommended intake for the other 3 food groups, particularly among women (Milk and Alternatives, Vegetables and Fruit, and Grain Products).

The following describes the eating patterns of Manitoba First Nations compared to the guidelines in more detail:

Vegetables and Fruit group: CFG recommends that adult males have 7-10 Food Guide servings daily while females have 7-8 Food Guide Servings of vegetables and fruit per day.

Manitoba First Nations men and women consumed below the recommended amounts (5 and 4 servings per day, respectively). This lower consumption can lead to low intakes of several nutrients, including fibre, vitamin A, vitamin C, magnesium and folate. These nutrients are important for several functions within the body, including: maintaining healthy skin (vitamins A and C); producing healthy blood (folate and vitamin C); and reducing the risk of infection and cancer (vitamin A, C, magnesium and fibre).

Grain Products group: CFG recommends that adult males have 7-8 Food Guide Servings a day, while females have 6-7 Food Guide servings of grain products per day; half of these servings should be whole grain foods. Whole grain foods, such as brown rice, wild rice, barley and oats, are a good source of fibre and have many health benefits. Foods high in fibre can help us feel full longer, maintain a healthy body weight, as well as reduce the risk of heart disease, diabetes and cancer. Grain products are also an important source of several nutrients necessary for good health including riboflavin, thiamin, zinc, folate, iron, magnesium and niacin. Manitoba First Nations men and women did not meet the recommendations for grain products.

Milk and Alternatives group: CFG recommends that adult males and females aged 19-50, consume 2 servings from this food group per day. Adults aged 51+ are recommended to have at least 3 Food Guide Servings/day. This food group contains the primary sources of calcium and vitamin D which are essential for building and maintaining healthy bones and teeth. In Manitoba, female participants reported consuming less than 1 serving per day and men reported having 1 serving per day. This low intake poses a concern for inadequate intakes for calcium and vitamin D, especially since most participants did not report taking a supplement that contains calcium and vitamin D (Appendix G).

Meat and Alternatives group: CFG recommends that adult men consume 3 servings of food from the meat and alternates food group every day, while the recommendation for women is 2 servings per day. In this study, men consumed an average of 4 servings of meat per day and women consumed 3 servings per day. Consuming more than the daily recommended servings of foods from the Meat and Alternatives group can contribute to a high fat intake and replace foods from other food groups which are consumed in low amounts.

Overall, the food choices of Manitoba First Nations men and women are very similar; a handful of food items make up over 50% of the foods chosen from each food group (Table 14). Among those, the low contributions of fresh fruits, fresh and frozen vegetables and whole grains to their respective food groups is particularly problematic and points towards the need to find ways to increase consumption of these food items.

Table 15 shows the foods that are the most important contributors to nutrients. As mentioned above, fat and salt intakes were above the recommended levels. The main source of fat in the diet came from potato chips; the main source of saturated fat came from cold cuts and sausages; and the main source of salt came from canned soups. Eating potato chips less often and replacing processed cuts of meat with non-processed leaner meat, pork, chicken and fish would help in reducing fat and salt intake. Choosing canned soups with lower sodium content would also reduce salt intake. Increasing consumption of vegetables and fruit would help to increase intakes of vitamin A, vitamin C and fibre. Increasing intake of milk and milk products (such as milk, yogurt and cheese or fortified soy beverage) would increase intakes of vitamin D and calcium. Finally, eating more whole grain products such as whole grain breads, cereals and whole wheat pasta would increase intakes of folate and fibre.

Table 15 also shows that traditional foods are important sources of nutrient intake as they were major contributors to protein, vitamin D, iron and zinc, which are required for strong bones (vitamin D), proper growth, healthy blood and maintenance of muscles. The important contribution of traditional food to nutrient intake is further illustrated in Table 16. On days that traditional food is eaten, the diet is healthier-intakes of most nutrients are significantly higher than on days that only included market food. It should also be noted that intake of saturated fat is significantly higher on days when only market food is consumed. As mentioned above, saturated fat is linked to heart disease.

Table 17 shows the top 10 market foods consumed for Manitoba overall and by ecozone. There is little variation observed in the types of foods being consumed. Soup was the most popular food consumed by all Manitoba First Nations participants. Coffee was the most popular beverage, followed by water and soft drinks. It should be noted that sugar-sweetened beverages such as soft drinks, fruit-flavoured drinks, lemonade, sweetened iced tea, sports drinks and energy drinks can increase the risk of overweight, thereby increasing the risk of

diabetes and heart disease (Hu, et al., 2010). Drinking water instead of these other above-mentioned beverages would be a healthier alternative. Table 18 shows the same estimates for all traditional foods reported to be consumed in the fall season. Moose, caribou and deer were the most frequently consumed traditional foods.

The use of nutritional supplements was higher in men and women aged 51 and over compared to the younger age groups (Figure 23). Nutrient supplements reported to be taken by all Manitoba First Nations participants are listed in Appendix G. Overall, the most commonly reported supplement was calcium, followed by multivitamins. The intake of calcium and multivitamin supplements can play an important role in reducing nutrient inadequacy when the diet quality is low or when food alone cannot meet nutrient needs. For example, the need for vitamin D increases over the age of 50. As such, it is recommended that men and women over 50 take a vitamin D supplement of 10 µg (400 IU) per day.

Food Security

Food security has been defined by the Food and Agricultural Organization of the United Nations in the State of Food Insecurity 2001 as: "… when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (Food and Agriculture Organization, 2002).

To describe whether First Nations households perceive that they have adequate access to culturally important traditional foods, participants were asked a series of questions about traditional food supply. With respect to running out of traditional food, 27% of participants reported that they sometimes worried, while 13% often worried that they would run out before they could get more (Figure 24). Moreover, 26% sometimes worried and 16% often worried that the traditional food that they had just didn't last and they couldn't get more (Figure 25).

For FNFNES, food security as it related to market food was defined as per the Canadian Community Health Survey (2004). To be food secure, a household had to have a maximum of one affirmed answer to the standard 18 item questionnaire; moderately insecure households were identified by 2-5 affirmed answers; and, severely food insecure households, by more than 5 affirmed answers. Answers to the 18 questions are presented in Table 19. Looking at the responses to the 18 questions in detail; 35 % of households worried that their food would run out before they could buy more, 32% said that the food that they bought didn't last and there wasn't any money to get more and 31% couldn't afford to eat balanced meals. Moreover, 32% of households with children relied on less expensive foods to feed their children and 24% said they couldn't afford to feed their children balanced meals. In comparison, in the 2002/2003 Manitoba RHS, 50% of adults reported that they were worried that their food would run out before they could buy more (Elias, et al., 2006).

Overall, 38% of Manitoba First Nations households were classified in this study as food insecure: 32% moderately and 6% severely food insecure (Figure 26 and Table 20). When only households with children are examined, the rates of food insecurity are similar to total households (Figure 27). However, the rates of food insecurity are much higher in households without children, where 12% are severely food insecure (Figure 28). The CCHS Cycle 2.2 (2004)reported that food insecurity is experienced in 33% of Aboriginal households (off-reserve) and 9.2% of Canadian households (9.4% of Manitoba households).

When examined by ecozone/ cultural area, food insecurity was highest in northern Manitoba communities where 73% of households were classified as food insecure; 60% moderately and 13% severely insecure (Figure 29). These findings are consistent with a previous study by researchers at the University of Manitoba, which reported a rate of 75% food insecurity in northern Manitoba First Nations communities (Thompson, et al., 2010) .

Figure 30 shows that when stratified by income level, participants on social assistance reported the highest levels of food insecurity (40% moderately and 10% severely). However, even 25% of participants earning a salary reported some degree of food insecurity.

The high cost of food is a contributing factor to high food insecurity. In each participating community, a Nutrition Research Coordinator (NRC) asked permission of the local grocery store manager to document the cost of common grocery items. The 1988 National Nutritious Food Basket Tool (Heatlh Canada) was used instead of the more recent version in order to compare results with those from Thompson et al (2010). This tool was used to calculate the weekly price of a healthy food basket for a family of four. Table 21 presents average food prices from a total of 11 stores from the 4 ecozones. Results showed that the cost of groceries was $57-$70 more in ecozones 1-3 (southern Manitoba) and over double the cost in ecozone 4 (northern Manitoba) compared to Winnipeg. Moreover, food prices were 60% more in northern Manitoba compared to southern Manitoba, which is similar to results found by Thompson et al (2010).

Environmental Concerns

When asked if they had noticed any significant climate change in their traditional territory in the last ten years, over half of total Manitoba First Nations participants (54%) said that they had (Figure 31). The range of positive response ranged from 39% to 62% among the 4 ecozones. Climate change was mainly perceived to decrease the availability of traditional food, increase the difficulty in getting traditional food and affect the animals' usual cycles or patterns (Figure 32).

Tap Water Sampling Results

Community Water Systems

Each of the nine communities participating in the Manitoba regional study has two or more water treatment systems. As a result, a total of 26 water treatment systems (locations) were surveyed. These drinking water systems include Community Water Systems (CWS), Individual Water Systems (IWS), Public Water Systems (PWS), Trucked Water Systems (TWS) and Trucked Public Water Systems (TPWS). Each participating community has a water treatment plant, with two communities having two treatment plants for a total of 11 plants in use at the time of the study. All 11 water treatment systems were operational at the time of the survey, although one has since closed and been replaced by a newly built facility. Ten water treatment systems were surveyed. The oldest water treatment plant was built in the late 1960's, and the newest in 2005:

- One plant was built in the late 1960's.
- One plant was built in 1975.
- Two plants were built in the early to mid-1980's.
- Six plants were built in the mid to late 1990's.
- One plant was built in 2005.

In the participating communities, source water meant for drinking purposes was obtained mostly from surface supplies; four were from lakes, three from rivers and two from groundwater sources.

All communities reported using a filtration system at the treatment plant. Sand filtration was the most common (6 water systems). The remaining filtration systems included reverse osmosis, buoyant media absorption clarification and an iron removal filter. All nine communities reported using chlorination for disinfection at the treatment plant with five having automatic chlorine injectors while four relied on manual chlorination.

The most common disinfection method was the use of sodium hypochlorite (five plants used this). Other chemicals used for water treatment were alum, chlorine, aluminum sulphate, potassium permanganate, magnesium, polyaluminum hydroxychloride, and soda ash. Three

communities reported problems procuring required supplies and/or replacement parts. One of these communities also noted that due to airline regulations a carrier that did not normally fly to the community had to be chartered when needing chemicals for the plant. One community noted funding as a problem, and another stated that there were issues with the reservoir and pump malfunctions.

Four communities thought that their treatment plant was not up to date, with two stating that their capacity to treat water was insufficient given the growing sizes of their populations. One required an upgrade to their sand filtering system and one plant reported numerous leaks in the distribution system.

All communities reported the pipes of the water distribution system were made out of plastic (PVC) with the exception of three which were plastic in combination with either steel or cast iron pipes. Three communities had no water storage facilities. Those that did used tanks of various sizes between 1000 gallons and 2000 gallons that were made of either fiberglass, concrete, or in one community, PVC which was located in the home. Only one community had a storage reservoir that was large enough for a portion of the community: a 150,000L tank.

Many of the communities had access to alternative water sources. Only 10 participants spread between two different communities used well water from a private source; and an unknown number of people accessed spring water from a third community. One community indicated that approximately 25 people out of 600, used bottled water or had their water trucked in from another community. Lastly, one community identified 3 wells that were used; one well (90 ft deep) that served 37 people in the Band Office, and two wells (about 20 ft deep) that serviced a total of 34 people. The wells identified as alternative water sources were all tested for fecal coliforms (four weekly and two annually). At the time of the survey, operators at two of the nine communities were not certified but were in the process of acquiring full certification through an in-person workshop and subsequent exam that was scheduled to be held shortly after this survey was conducted.

As for water availability and safety, one water system issued three boil advisories in the year prior. One water system issued two boil advisories, and another system issued one. Five of the communities reported disruptions in service due to pump malfunctions and water main breaks. Lastly, one community reported that they could only use two out of three wells due to the third producing off-coloured or turbid water (brown water).

Table 22 reports the characteristics of all Manitoba participants' households and plumbing systems. The average participant's house was built in 1993, with the oldest house in the study being built in 1939 and the newest house in 2010. A total of 20% of households had upgraded plumbing, 22% of households treated their water (mainly by boiling it) and 35% had outside water storage tanks. Almost half of the households (46%) had plastic pipes under their kitchen sink.

Most households in the participating communities obtain their water from water treatment plants. Figure 33 shows that 99% of participants have tap water, 78% drink it and 93% use it for cooking. The primary source of tap water is from the treatment plant (Figure 34). For participants whose households did not have tap water or who did not drink it or use it to prepare food, 95% drank bottled water (Figure 35) while 80% used bottled water for cooking purposes (Figure 36). To understand whether chlorine levels in community water systems were a barrier to tap water use FNFNES asked "Does the taste of chlorine prevent you from drinking the tap water?" One out of three participants answered that 'sometimes' the taste of chlorine prevented them from drinking tap water and 16% said 'yes' (Figure 37).

Tap Water Analysis

The tap water analysis consisted of both sample collection for laboratory analysis and on-site testing for several parameters that would assist in later interpretation of the laboratory data. At each home selected to participate in this component, two tap water samples were

collected: the first draw sample was collected after the water had been sitting stagnant in the pipes for a minimum of 4 hours and a *second draw sample* was taken after running the water for five minutes. Tap water samples were collected from a range of eight to 21 households in each of the nine participating communities (16.8 was the average). Taking into account duplicate samples for quality control and assurance purposes, 141 out of a planned 180 first draw and five-minute flush samples of tap water were obtained from households. There was one additional sample collected of an alternative water source used for drinking and food preparation.

Water Parameters-chlorine, pH, temperature

Chlorine: One of the tests conducted was to determine the presence of a chlorine residual necessary for adequate disinfection (free chlorine) in tap water at the household level. On-site testing revealed that free chlorine was not detected in six of the nine communities. It is believed that this may be due to the detection limit of the test strips used; i.e. the inability of the kits used to measure free chlorine at low levels. As such, FNFNES cannot comment with certainty on free chlorine results. However, where free chlorine was detected, the range was from 0.3 mg/L to a high of 1.0 mg/L which is considered to be within an acceptable range.

pH: Another test conducted was for pH in tap water which is of major importance in determining corrosiveness. The Canadian Drinking Water Guideline Aesthetic Objective (AO) for pH is between 6.5 and 8.5 (Health Canada, 2010). Water of low pH (lower than 6.5) may corrode metal from pipes and pipe fittings and result in high metal content in drinking water, as well as reduce disinfection efficiency. Failure to control pH not only can result in contamination of drinking water by metals, but can also have adverse effects on taste, odor, and appearance. Exposure to extreme high or low pH values results in irritation to the eyes, skin and mucous membranes. In sensitive individuals, gastrointestinal irritation may also occur.

The results of pH testing of tap water in the communities surveyed did not indicate a problem. However three communities exhibited an acidic pH of 6.2. All other communities measured a range between 6.8 and 8.4. Optimum pH will vary depending upon composition of the water, but is usually in the range of 6.5-8.5.

Temperature: Corrosion can be accelerated by high water temperature. At the time of sampling the temperature of the tap water was measured. This ranged from 7°C to 26.1°C. Health Canada has set 15°C as the maximum temperature for drinking water as an aesthetic objective. On-site measurements revealed that in six communities 40 of 154 tests conducted showed results above 15°C. This could be due to the temperature of water in an indoor or outdoor storage tank or water from the hot water heater mixing with the water being sampled at the tap.

Metals of Public Health Concern

The FNFNES quantified nine metals that are of concern to human health when the maximum acceptable concentration (MAC) of the Canadian Guidelines of Drinking Water Quality (Health Canada, 2008) is exceeded:

- Antimony
- Arsenic
- Barium
- Boron
- Cadmium
- Chromium
- Lead
- Selenium
- Uranium

The results of water sample testing for metals in drinking water of public health concern are listed in Table 23.

In the first round of sample taking (first draw), 13 households had lead levels above the maximum acceptable guideline of 10 µg/L. These households were in communities located in the Prairies/Plains (12.3 µg/L), the Boreal Plains/Subarctic (10-17 µg/L), the Boreal Shield/Subarctic (15.3-50.7 µg/L), and in the Taiga Shield/Subarctic (11.2 µg/L). Following a five-minute flush of the household piping, 12 of these 13 households had lead levels well below the maximum acceptable guideline (ranging from below the detection limit to 0.6 µg/L). Therefore, one household (located in the Boreal Shield/Subarctic area) required further investigation after the initial tap water sample collection and analysis in the fall of 2010. The Environmental Health Officer resampled this household, along with four households which

had elevated lead levels in the first draw sample, on the next visit to the community with the following results:

- The sole household from a Boreal Shield/Subarctic community that had an elevated lead level tested below the detection limit.
- Four households in the same Boreal Shield/Subarctic community that had previously tested above the guidelines for the first draw (stagnant sample) were resampled and tested below the guideline for lead.

Aesthetic Objective (AO) Metals Sampled

Six metals had concentrations above the aesthetic guidelines. These are listed in Table 24.

Aluminum: Six communities had aluminum samples above the guideline (100 µg/L):

- Fourteen households from a community in the Prairies/Subarctic had elevated aluminum levels after the first round of sampling ranging from 101 - 290 µg/L.
- Eighteen households from a community in the Boreal Plains/Plains had first round sampling levels ranging from 110 – 152 µg/L.
- Thirty households from three communities in the Boreal Shield/Subarctic had first round sampling levels ranging from 102 – 33,100 µg/L.
- Fifteen households from a community in the Taiga Shield/Subarctic had first round sampling ranging from 431 – 1,060 µg/L.

In all but one of these communities, the large number of high aluminum levels, even after the 5 minute flushed samples were taken, indicated that the aluminum was originating from the water treatment plants. These plants were thus resampled two months later, and the samples were analyzed by the Saskatchewan Research Council (SRC) revealing that:

- The aluminum levels from two plants, one located in the Boreal Plains/Plains (83 µg/L) and the other located in the Boreal Shield/Subarctic (29 µg/L), were below the aesthetic objective guideline.
- The aluminum levels remained higher than the aesthetic objective guideline in three of the plants sampled: one located in the Prairies/Subarctic (130 µg/L), one located in the Boreal Shield/Subarctic (890 µg/L), and one plant located in the Taiga Shield/Subarctic (870 µg/L).
- Four households in a third community in the Boreal Shield/Subarctic were individually resampled on the next visit to the community by the Environmental Health Officer. One of the households tested below the aesthetic objective guideline while the other three households tested above the guideline in a range of 245 – 825 µg/L.

While these elevated levels of aluminum pose no health concern, the Chief and Council, the Health Canada EHO for the community and the householders have been made aware of these exceedances. Health Canada, Manitoba region have made the appropriate recommendations, after completing the investigation.

Copper: Five communities had elevated levels of copper above the guideline of 1,000 µg/L:

- One household in the Prairies/Plains had a first draw level of 1,890 µg/L. After a 5 minute flush, the level was below the guideline.
- Three households in one community in the Boreal Plains/Plains had first draw levels ranging from 1,020 – 1,820 µg/L. After a 5 minute flush, the levels in each household were below the guideline.
- Seven households from two communities in the Boreal Shield/Subarctic had first round sampling levels ranging from 1,060 – 6,540 µg/L. After a 5 minute flush, five of these households had copper levels below the guideline.
- One household in the Taiga Shield/Subarctic had a first draw level of 1,260 µg/L. After a 5 minute flush, the level was below the guideline.

Following the first round of sampling, two households in the Boreal Shield/Subarctic required additional sampling. This was undertaken by the Environmental Health Officer on the next visit to the community with the following result:

- The levels at both households at resampling were below the aesthetic guideline.

Iron: Two communities had elevated levels of iron above the guideline of 300 µg/L:

- Four households in one community in the Boreal Shield/Subarctic had elevated first draw levels ranging from 383 – 964 µg/L. Following a 5 minute flush, all four households were below the aesthetic guideline.
- Two households in one community in the Boreal Plains/Plains had elevated first round samples ranging from 382 – 1,700 µg/L.

One household from the Boreal Plains/Plains was resampled on the next visit to the community by the Environmental Health Officer. The iron level was also elevated at resampling (1,760 µg/L).

This level may be attributable to rusty pipes. While there is no health concern, the Chief and Council, the Health Canada EHO for the communities and the householders have been made aware of these exceedances. Health Canada, Manitoba region have made the appropriate recommendations, after completing the investigation.

Manganese: Three communities were found to have elevated levels of manganese above the aesthetic objective of 50 µg/L:

- Six households in one community in the Prairies/Plains had first round sampling levels of 51.1 – 80.5 µg/L.
- One household in a community in the Boreal Plains/Plains had a first round level of 191 µg/L.
- Twenty households in a community in the Boreal Shield/Subarctic had first round sampling levels ranging from 228 – 444 µg/L.

All but one of the households in the Prairies/Plains had their water resampled on the next visit to the community by the Environmental Health Officers. One household could not be resampled as the residents were away.

- Two of the households in the Prairies/Plains tested below the aesthetic guideline.
- The remaining households in the Prairies/Plains tested above the guideline in the range of 111-158 µg/L, higher than the first round of sampling.
- The household in the Boreal Plains/Plains was also above the guideline, and higher than the first round of sampling at 269 µg/L.

The large number of high level samples, even after the 5 minute flush, from one community in the Boreal Shield/Subarctic indicated that the elevated manganese concentrations were originating from the water treatment plant. This was sampled two months later, and the analysis undertaken by the SRC with the following finding:

- The plant's manganese level was 57 µg/L. This is lower than the first round of sampling, but remains above the aesthetic guideline.

While not a health concern, the Chief and Council, the Health Canada EHO for the communities and the householders have been made aware of these exceedances for manganese. Health Canada, Manitoba region have made the appropriate recommendations, after completing the investigation.

Sodium: In terms of sodium levels in tap water, three communities had levels of sodium above the 200,000 µg/L guideline:

- One household in a Prairies/Plains community had a level of 208,000 µg/L, at the first round of sampling.
- Two households in a Prairies/Subarctic community had levels from 201,000 – 215,000 µg/L at the first round of sampling.
- Twenty households in a Boreal Plains/Plains community had elevated first round sampling levels ranging from 201,000 – 392,000 µg/L.

The three households from the Prairies/Plains and Prairies/Subarctic communities were resampled on the next visit to the communities by the respective Environmental Health Officers.

- When resampled the household in the Prairies/Plains remained elevated at 608,000 µg/L of sodium.
- When resampled the households in the Prairies/Subarctic had levels at or below the guideline.

The large number of high level samples in the Boreal Plains/Plains community indicated that the elevated sodium concentrations were originating from the water treatment plant, which was later sampled by the SRC. This level was 197,000 µg/L, which is below the guideline. While not a health concern, the Chiefs and Councils, the Health Canada EHOs for these communities and the householders in the Prairies/Plains have been made aware of this exceedance. Health Canada, Manitoba region have made the appropriate recommendations, after completing the investigation.

Zinc: One community in the Boreal Shield/Subarctic had zinc levels above the guideline (5,000 µg/L):

- One household had a zinc level of 6,460 µg/L after the first round of sampling.
- Another household had a zinc level of 5,150 µg/L after the first round of sampling.

Both households were resampled on the next visit to the community by the Environmental Health Officer. The zinc levels at resampling were well below the guideline.

Surface Water Sampling for Pharmaceuticals

FNFNES quantified the 42 pharmaceuticals listed in Table 25. These pharmaceuticals are widely used in human medicines, veterinary drugs and aquaculture as analgesics, anticonvulsants, antibiotics, antihypertensives, antacids and contraceptives. In addition, these pharmaceuticals are of concern to human and/or environmental health and have been frequently reported in other Canadian and American studies (Waiser, et al., 2011) (Wu, et al., 2009) (Glassmeyer, et al., 2005) (Kolpin, et al., 2002) (Yargeau, et al., 2007).

In all, 108 samples were collected at 36 sampling sites in Manitoba. Three additional communities, that were originally part of the study, completed the collection of pharmaceutical samples but not the other components of FNFNES. As such, their pharmaceutical results are included in this report. Of all 36 sampling sites, eight (22%) revealed quantifiable pharmaceuticals (Table 26).

Six pharmaceuticals were found in one or more communities; they are listed in Table 27 along with the maximum concentration found in the Manitoba FNFNES sampling and a comparison to the highest levels reported in other Canadian or U.S. studies. These results are similar to those found in other surface waters studies in Canada and the United States.

Overview of Pharmaceuticals Detected by Type

The results of the pharmaceuticals component of the FNFNES study in Manitoba are summarized in Table 28. The following describes the results aggregated by ecozone, providing information on what was detected in each of the six ecozones and why it might have been detected in those locations.

Caffeine was the second most prevalent pharmaceutical detected. It was detected in four of the 12 communities sampled and seven of the 36 sites sampled throughout the province. Caffeine is a component of the most highly prescribed pharmaceuticals in Manitoba First Nations (Booker, et al., 2008). It is also present in many coffees, teas, soft drinks, energy drinks, and foods containing chocolate.

Carbamazepine was detected in one community at all three sites sampled. It is a medication prescribed as an anticonvulsant and mood stabilizer. It is also a potential endocrine disrupting chemical. Carbamazepine is not on the list of medications claimed in 2009 from the community where it was found (Non-Insured Health Benefits Directorate (NIHB), 2011).

Cotinine (a metabolite of nicotine) was detected in two communities. An average of 80% of nicotine that is consumed by people is excreted as cotinine. Nicotine is not prescribed (e.g. smoking cessation products, such as patches and gum) in the two communities where it was detected (Non-Insured Health Benefits Directorate (NIHB), 2011) and its presence most probably reflects tobacco use.

Ethinylestradiol was detected in one community. It is an oral contraceptive, and an endocrine disrupting chemical. Interestingly, ethinylestradiol is not on the 2009 list of medications prescribed in the community where it was detected (Non-Insured Health Benefits Directorate (NIHB), 2011).

Metformin, an anti-diabetic medication, was the most prevalent pharmaceutical detected. It was detected in five of the 12 communities sampled as part of the pharmaceuticals study, and nine of the 36 sites sampled throughout the province. Metformin was one of the top five of prescribed medications in 2009 in the five communities where it was detected (Non-Insured Health Benefits Directorate (NIHB), 2011).
Sulfamethoxazole was detected in one community. It has been detected at a rate of 100% of surface water samples in a previous Canadian study (Metcalfe, et al., 2004). It is an antibiotic and a potential endocrine disrupting chemical.

Overview of Pharmaceuticals Detected by Ecozone

Prairies/Plains: One community was sampled within the Prairie/Plains ecozone. No pharmaceuticals were detected.

Prairies/Subarctic: One community was sampled within the Prairies/Subarctic ecozone. One pharmaceutical was detected within the ecozone: cotinine.

Boreal Plains/Plains: One community was sampled within the Boreal Plains/Plains ecozone. One pharmaceutical was detected within the ecozone: caffeine.

Boreal Plains/Subarctic: One community was sampled within the Boreal Plains/Subarctic ecozone. Four pharmaceuticals were detected within the ecozone: carbamazepine, cotinine, metformin, and sulfamethoxazole.

Boreal Shield/Subarctic: Five communities were sampled within the Boreal Shield/Subarctic ecozone. Three pharmaceuticals were detected within the ecozone: caffeine, 17α-ethinylestradiol, and metformin.

Three communities had detectable levels of caffeine; one community had detectable levels of 17α-ethinylestradiol and four communities had detectable levels of metformin.

Taiga Shield/Subarctic: Two communities were sampled within the Taiga Shield/Subarctic ecozone. No pharmaceuticals were detected in this ecozone.

Hudson Plains/Subarctic: One community was sampled within the Hudson Plains/Subarctic ecozone. No pharmaceuticals were detected in this ecozone.

Pharmaceutical Guidelines

Currently only one pharmaceutical in Canada has a guideline level, 17α-ethinylestradiol at 0.5 ng/L in the province of British Columbia (Nagpal, et al., 2009). This pharmaceutical was detected at a swimming area in one community in the Boreal Shield/Subarctic ecozone. The level detected (0.45 ng/L), was below the province of British Columbia guideline. Ethinylestradiol is absorbed through the skin however; the current level should not cause problems to swimmers at this site. Drinking more than 14 glasses of water from this site over a prolonged period could result in headaches, nausea, dizziness, increased blood pressure and increase the risk of cardiovascular disease and gallbladder disease. Levels found at this site could also lower the fertility of fish. The concentrations of the five other pharmaceuticals in the FNFNES study would not pose a threat to human health or the aquatic environment.

Mercury in Hair Results

Of the 706 participants in Manitoba, only 244 individuals consented to hair sampling for mercury (35% of the total). After the exclusion of two duplicate values, as well as the data from six individuals who did not provide their age and sex information, the sample size used for weighting and post-stratification by age and sex was 236 participants. From 236 samples, 198 were provided by females and 38 by males. The underrepresentation of males in the sample was likely due to several factors such as the unavailability of males at the time of survey and sampling, high prevalence of very short haircuts among males that did not allow the application of the FNFNES sampling protocol and, sometimes, the lack of interest in sampling among male community members.

The mercury sample was further adjusted to account for the way sampling was performed, for the communities' response rate, and for the individual response rates within communities. These adjustments resulted in a set of weights; this set of weights shows the number of people (from the on-reserve population) that are represented by one response. For example, a weight of 335 implies that an individual response represents 335 people, or a weight of 73 implies that an individual response represents 73 people. After post-stratification, the weights for the Manitoba mercury sample ranged from 2.5 to 2180, with a median of 97.3.

The arithmetic mean of mercury concentration in hair among adult First Nations population living on reserves (sample data post-stratified by age and sex) was 0.33 µg/g, while the geometric mean was 0.13 µg/g. It should be stressed that even with post-stratification, total estimates of hair mercury in Manitoba are likely to be biased towards females due to collection issues and should be interpreted with caution. For women of childbearing age (19-50 age category), the arithmetic mean of mercury was 0.18 µg/g and geometric mean 0.09 µg/g.

Mercury concentrations in hair for all participants are presented for each ecozone in Figures 38a-d. Mercury concentrations in hair for female participants are presented for each ecozone in Figures 39a-d.

In general (see Table 29), FNFNES data, post-stratified by age and sex and weighted for First Nations population living on Manitoba reserves, indicate that the level of mercury body burden is below the established Health Canada mercury guideline of 6 µg/g in hair for the general population. The level of hair mercury, in the population of First Nations women of childbearing age (19-50) living on Manitoba reserves, is below the recently proposed Health Canada guideline of 2 µg/g in hair (the 90th percentile with 95% confidence for this group is 0.44 µg/g ± 0.24).

The results of the survey illustrated in Table 29 suggest that there is a clear pattern of increasing mercury exposure with age. The sample data for First Nations women of childbearing age (n=138) contained seven samples with levels exceeding 2 µg/g, which indicates the need to investigate subpopulations of high consumers of predatory fish and to continue with risk communication among First Nations.

As presented in Figures 40a-d, there appear to be certain identifiable differences in the body burden of mercury among First Nations women of childbearing age living in different ecozones.

Food Contaminant Results

A total of 651 food samples representing 83 different types of traditional foods were collected for contaminant analysis. To estimate the daily contaminant intake from traditional food, the average amount of traditional food consumed per day was first calculated by multiplying the average portion size (Table 30) times the frequency of consumption (Table 7). The average daily intake is presented in Table 31 and the 95th percentile daily intake is presented in Table 32. These values were then multiplied by the amount of contaminants measured in the food samples to estimate contaminant exposure level.

Table 33 presents the concentrations of four toxic metals in the Manitoba traditional food samples, including arsenic (As), cadmium (Cd), lead (Pb), and mercury (Hg), which is further analyzed to quantify the more toxic form of methylmercury (MeHg).

Tables 33a-d shows the main source of arsenic (As), cadmium (Cd), lead (Pb) and mercury (Hg) from Manitoba traditional food samples, by total and by ecozone. The main source of As were from walleye, rabbit meat and caribou meat (Table 34a). However, the As accumulated in animal tissues is mainly in a non-toxic organic form known as arsenobetaine (AB) and should not be of any safety concern (Agency for Toxic Substances and Disease Registry (ATSDR)). The main source of Cd was from land mammal organ meats, such as liver and kidney (Table 34b). Higher concentrations of Cd are found in the liver and kidneys of mammals as they tend to accumulate in these organs.

The main source of Pb was from deer, partridge and caribou meat (Table 34c). This is likely to be a result of Pb residuals from lead shot or lead-containing ammunition. It has been widely reported that lead concentrations can reach high levels in game animals as a result of contamination from lead bullets and shot (Pain, et al., 2010)

The main source of Hg was from walleye (Table 34d). The concentration of Hg in walleye was about 0.2 µg/g, which is a typical amount found in predatory fish such as walleye. Since there was a large amount consumed, walleye was the main source of Hg intake.

Table 35 presents the concentrations of polycyclic aromatic hydrocarbon (PAH) in selected traditional food samples from Manitoba. The highest amounts were found in duck meat. This is partly due to the high fat content of duck meat (since many contaminants tend to be stored in fat tissue) but some contamination from oil and gas production facilities could also be a factor. However, these concentrations are still very low and should have no adverse effects on the health of the animals.

Table 36 shows the concentrations of organochlorines including: hexachlorobenzene, p,p-DDE, total PCBs, trans-Nonachlor and toxaphene in selected traditional food items. All concentrations were very low at the parts per billion level and the variations in concentrations were largely due to the different fat content in different foods.

Table 37 shows the concentrations of organophosphate pesticides in selected traditional food items. None of the samples showed any detectable level of organophosphate. This is likely due to the short half-life (a few days) of organophosphate in food and the environment (Antonious, et al., 2007).

Concentrations of the fire retardant chemicals, polybrominated diphenyl ethers (PBDEs) are presented in Table 38. The concentrations were all very low at the parts per billion level. The highest concentration was found in deer meat. However, there is no concern of exposure to PBDEs from eating any of the food sampled.

Table 39 presents the concentration of perfluorinated compounds (PFCs) in selected traditional foods. The highest concentration was found in bass flesh. However, there is no concern of exposure to PFCs from eating any of the food sampled.

Table 40 presents the concentrations of dioxins and furans expressed as toxic equivalent quotient (TEQ) in selected traditional foods. Only trace amounts were found in most food. The highest concentration among the samples was found in caribou fat. The reason for this is not known, however, there is no concern of dioxin and furan exposure in any of the food sampled.

The average daily intakes of the four toxic metals using average contaminant concentrations are presented in Table 41; average daily intakes using maximum concentrations are presented in Table 42. The estimated intakes were compared to the guideline level presented as provisional tolerable intake (PTDI) as a hazard quotient (HQ=intake/PTDI). The risk will be negligible if the HQ is 1 or less.

The mean and 95th percentile HQ values for As, Cd and Hg intakes using the mean and maximum contaminant concentrations were all lower than 1, therefore the risk of toxicity is negligible. However, the HQ values for Pb at the 95th percentile was 1.5 (average concentration) and 1.64 (maximum concentration), indicating that the risk of Pb exposure is increased for high consumers of game meat if the food was high in Pb due to lead shot contamination.

Table 43 shows the exposure estimates for Hg for the female participants of child bearing age. Due to the susceptibility of the fetus to Hg toxicity, the PTDI for women of child bearing age is lower at 0.2 µg/kg/day. The HQs for both the average and the 95th percentile intake using the average Hg concentration in food were below 1, which means that risk of Hg exposure is low.

Table 44 shows the result of estimated daily intake of organic contaminants including HCBs, DDE, PCB, Chlordane, Toxaphene, PAH, PFOS, PBDE, Dioxin and Furan using the average concentrations respectively. All the HQs were below 1, indicating that there is negligible risk of exposure to these contaminants through consumption of traditional food.

COMMUNITY INPUT

This report would not have been possible without the hard work and commitment of the participating Manitoba First Nations. Before this regional report was released, the FNFNES Regional Coordinator worked with each participant community to organize a community presentation at a time of the community's choosing to present the results. Draft copies of their community's report were supplied so that the participant communities could ask questions based upon the full report and provide their input into the. The study has strictly followed the FNFNES Guiding Principles which specify that each participant First Nation be the first to receive their own results prior to the release of any regional results.

Community Presentations:
Each community held a presentation to report on the results and was provided with a small amount of funding to be used for hosting. The presentations were conducted by one of the Principal Investigators accompanied by the Regional Coordinator and when available, the NRC who had supervised the data collection in that particular community. Questions from First Nations community members, technicians and leadership were encouraged and recorded. Overall there was a good response to the presentations. Below is a discussion of the feedback that was received from the participant First Nations during the community presentations and after reviewing the community reports. Questions that the FNFNES team asked at the presentations included:

1. What kind of educational resources would be beneficial with this report?
2. Are there any gaps in the report?
3. Did we miss anything in this project?
4. Where are the best places to release this report and offer data training?
5. Are there any efforts already in place to improve the quality of diet and food security in your community?
6. Based on these results, are there areas of future work you would be interested in pursuing?
7. What are the barriers or promoters of harvesting and gardening in your community?
8. Is there a need for further related studies or programs to be developed in your community?

Community Reports:
It was heard at a number of the presentations how First Nations were interested in comparing their own community's results with the results of neighbouring communities and for the region as a whole. It should be noted that the community reports offer comparisons between results for the community and for Manitoba overall whenever possible. It was also heard from one community in particular that the four-page summary report was a useful document that would help health department staff communicate the results of the study to the community at large.

Educational Resources:
A number of educational resources were identified that the communities would find useful, although not every community had suggestions for this item. A CD that could be played for community members was identified as a potentially useful tool to provide background for the study, its goals and results that were found. Suggestions included a detailed and illustrated document that would show the links between an unhealthy diet and chronic diseases as well as a clear list of which foods to eat and which not to eat (See Appendix H). One community was interested in more education on good hunting practices and another expressed an interest in receiving agricultural land use education and training to better detect the effects of diseases on animals.

Additions to the Report and Study:
A few communities identified that there were no questions in the report asking about lactose intolerance as a potential factor for why consumption of milk and dairy products were low. A question on lactose intolerance has been added to the questionnaire for use in future years. Another community noted that questions on garden plants were missing in the Food Frequency Questionnaire and that it would be interested to see a comparison of diets across generations or what the historical or pure traditional diet would have looked like. Another community wished to see a greater discussion on the consumption of sugar as it was suspected to be a contributor to the high rates of diabetes observed. Most communities did not find gaps in the report or that the study had missed anything for their community. As such most did not have any requests for additions to either the report or study.

Nutrition:
The community presentations were an excellent opportunity to hear from community members about the types of programs and initiatives already in place to improve the quality of diet and food security. Many initiatives were identified as currently underway: school programs, youth camps, gardening initiatives, plowing of garden plots, chicken coops, cooking classes, canning, community freezers, food banks, programs to encourage hunting and other traditional activities including fuel and transportation subsidies, and informal sharing of traditional foods. One community also provided fish to diabetes patients. However, there were also barriers that inhibited the development of or access to these programs such as a lack of funding, high prices of materials and equipment, lack of storage space, poor soil for gardening, a short growing season, the distance to gardening plots and hunting areas, government restrictions, lack of knowledge and in some cases a lack of interest in engaging in these activities. Other barriers to accessing nutritious and healthy foods were the high costs of food in communities, the inadequacy of social assistance to maintain a nutritious diet, flooding of garden plots, a decrease in available wild plants, the high cost of having game butchered, a lack of retail competition, development on traditional lands and its impact on traditional harvesting, Indian Act restrictions and the loss of traditional knowledge.

Some communities identified a range of initiatives that had been tried in the past but had not been successful due to inadequate funding or other unspecified reasons that included: distribution of hunting supplies and equipment, gardening initiatives, greenhouses, bulk buying program, food bank, meals on wheels, and community meals. A frustration with lack of funding was expressed from a number of communities who felt that it would be hard to address many of the concerns identified in their report without further funding for new or expanded programs. However, there were also ideas for projects that the communities were interested in pursuing including: greenhouses, distribution/subsidies of hunting supplies and equipment, an examination of the costs of the local store, and general ideas on improving food security.

Contaminants:
One community noted that an agreement had been recently signed that would see new mining development in the area. It was noted that they were interested in using the data from their report to support a monitoring process in preparation for the development that will be occurring in the near future. Another community noted that a contaminant monitoring program for traditional foods could be based upon their results. Despite a largely positive report on contaminants in food, one community remained concerned and pointed to the poor health of the animals and fish. The community was interested in further research to assess the cause of the poor health of the animals in order to provide clarification on whether they are safe to eat. Another community noted that the cost of a box of lead bullets was less than lead-free bullets. Lead shot is suspected to be the main contributor to lead in a number of traditional foods.

Release of the Report and Further Training Opportunities:
Almost all communities identified Winnipeg as the best place to present the regional report and to offer further training. However, a First Nations' owned casino north of Winnipeg was also identified as a possible venue. It was also recommended that the results be released at the Assembly of Manitoba Chiefs' Annual General Assembly. One community wanted to make sure that there would be time to share information with other First Nations at the data training workshop so that the communities could learn from each other.

Concerns:
One of the communities noted that their members were tired of filling out questionnaires and that the consumption of traditional foods according to FNFNES appeared lower than what was observed in the community. Community members in another community expressed some concern that this study did not assess bacterial contamination of water and traditional foods. One community felt that the information on the four-page Summary of Results was not detailed enough and that further context needed to be provided in order to interpret the findings. The community also recognized that there was some reluctance to participate in the study because of fears that the results could be used against their interests.

Overall Recommendations from Community Members:
One community was very interested in studying whether following a traditional diet and lifestyle would offer protection from obesity and diabetes and other health outcomes. A number of the communities expressed an interest in conducting the same or a similar study in approximately five years' time to assess changes in levels of environmental contaminants. Another community was explicit in recognizing the advocacy potential of this report and suggested that it be presented to government and used to advocate for improvements in food insecurity while educating a wider Canadian audience.

CONCLUSIONS

This is the first comprehensive study addressing the gaps in knowledge about the diet, traditional food and environmental contaminants to which First Nations in Manitoba are exposed. The overall results indicate that the traditional food is safe to eat and contributes important nutrients to the diets of First Nations in Manitoba. However, on average, there are excess intakes of fat and sodium (salt), and inadequate intakes of fibre, vitamin A, vitamin C, vitamin D, vitamin B6, folate, calcium and magnesium. High rates of obesity, smoking and diabetes are major health issues for Manitoba First Nations. Moreover, food insecurity is a major concern in all communities. These findings highlight the need to further build upon current efforts at the community, regional, provincial and national level to improve food security and nutrition in First Nations communities. It is recognized that there are many community-level initiatives currently addressing these issues, such as community gardens, traditional food harvesting and community agriculture (such as gardening, greenhouses and freezers), bulk buying programs (such as the Good Food Box and Buying Club programs), accompanied by nutrition-related skills development and cooking programs such as community kitchens, and use of funding from programs such as the federal Canada Prenatal Nutrition Program and the Aboriginal Diabetes Initiative. Policies that promote healthy meals at preschool, school and community events would also reinforce the importance of healthy food choices for better health. See Appendix H for an example of Healthy Food Guidelines adapted from British Columbia.

There is generally no concern regarding the trace metal levels in the drinking water. It is recommended that the tap water be flushed once in the morning before consumption. In addition, flushing the toilet or using the shower before drinking tap water, will also reduce levels of exposure to metals from indoor plumbing.

The levels of pharmaceuticals found in the surface water pose no risk to human health. Contaminant levels in all traditional food samples collected were at baseline levels and should pose no health risk to the consumer. There may be occasional contamination of lead by gun shot in game meat (such as deer, partridge, caribou and rabbit) therefore consumers should be aware of the potential risk of eating game killed by lead shot. Hunters should be using steel shot, rather than lead shot to avoid exposure to lead that could be hazardous to both children and adults. Both the hair sampling and diet estimate results showed that there is minimal concern of mercury exposure.

The data collected in this report will serve as a benchmark for future studies of this type to determine if changes in the environment are resulting in an increase or decrease in concentrations of chemicals of concerns, and how diet quality will change over time. Some of the participant communities have already expressed an interest in conducting such a follow-up study in five or ten years' time.

Highlights of results:

1. Diet quality is overall inadequate but is improved when traditional food is consumed.
2. Overweight/obesity, smoking and diabetes are major issues.
3. Food insecurity is a major issue.
4. Water quality, as indicated by the trace metals levels, is overall satisfactory, but close monitoring is warranted as water sources and water treatment vary greatly.
5. Mercury exposure as indicated by hair mercury concentrations, as well as dietary estimate, is not a health concern.
6. Chemical contamination of traditional food does not warrant any health concern, but it is important to have the data derived from this study for future monitoring of trends and changes.

A summary of the study results from Manitoba can be found in Appendix I.

Sample Characteristics

Figure 1. Map of participating Manitoba First Nations communities and ecozones

Table 1. List of participating Manitoba First Nations communities and ecozones/ culture areas

Ecozone/ culture area number	Ecozone/ culture area name	Name of participating communities	Number of participants
1	Prairies/Plains	Swan Lake First Nation	79
	Prairies/Subarctic	Sandy Bay Ojibway First Nation	91
2	Boreal Plains/Plains	Pine Creek First Nation	91
	Boreal Plains/Subarctic	Chemawawin Cree Nation	96
3	Boreal Shield/Subarctic	Sagkeeng First Nation (Fort Alexander)	70
	Boreal Shield/Subarctic	Hollow Water First Nation	99
	Boreal Shield/Subarctic	Cross Lake Band of Indians	63
4	Taiga Shield/Subarctic	Sayisi Dene First Nation	65
	Taiga Shield/Subarctic	Northlands Denesuline First Nation	52
Total participants from on reserve Manitoba First Nations communities			706

Table 2. Characteristics of nine participating on-reserve Manitoba First Nations communities

Characteristics	Swan Lake First Nation	Sandy Bay Ojibway First Nation	Pine Creek First Nation	Chemawawin Cree Nation (Easterville)	Sagkeeng First Nation (Fort Alexander)	Hollow Water First Nation	Cross Lake Band of Indians	Sayisi Dene First Nation (Tadoule Lake)	Northlands Denesuline First Nation (Lac Brochet)
Distance to Winnipeg (km)	162 km	188 km	433 km	469 km	124 km	213 km	520 km	980 km	1058 km
Nearest Service Centre(s)*	Morden (83 km); Portage La Prairie (104 km); Brandon (140 km)	Portage La Prairie (101 km)	Brandon (300 km); Dauphin (110 km)	The Pas (205km)	Winnipeg (124km)	Winnipeg (213 km)	Thompson (257 km)	Thompson (320km)	Thompson (240km)
Health Centre Location	Swan Lake (Health Office)	Sandy Bay (Health Centre)	Pine Creek (Health Office)	Chemawawin (Nursing Station)	Sagkeeng (Health Centre)	Hollow Water (Health Office)	Cross Lake (Nursing Station)	Tadoule Lake (Nursing Station)	Northlands Denesuline (Nursing Station)
Access by Road	Year-round	Year-round	Year-round	Year-round	Year-round	Year-round	Year-round	Winter road access Jan/Feb to early March	Winter road access Jan/Feb to early March
Access by Air (Airport Location; # of flights)	N/A	N/A	N/A	N/A	N/A	N/A	Cross Lake; Winnipeg to Cross Lake 17 flights/week	Tadoule Lake; Thompson to Tadoule 7 flights/week	Lac Brochet; Thompson to Tadoule Lake 5 times/week
Land Base Acres	6,021.6 hectares (14, 879.7 acres)	6659.6 hectares (16, 456.2 acres)	8,111.70 hectares (20 044.4 acres) in Manitoba; 37.10 hectares (91.7 acres) in Saskatchewan	4,770.6 hectares (11 788.4 acres)	8771.30 hectares (21 674.3 acres)	1622.90 Hectares (4 010.3 acres)	8,310.9 hectares (20 536.7 acres)	212.10 hectares (524.1 acres)	2137.4 hectares (5 281.6 acres)

*The nearest community to which a First Nation can gain access to government services, banks and suppliers.

Table 3. Number of Manitoba First Nations on-reserve households surveyed and participation rate, by ecozone/culture area and total

		Ecozone/Culture Area				
		1 Prairies	2 Boreal Plains	3 Boreal Shield	4 Taiga Shield	TOTAL Manitoba
On-reserve population[1]		4,015	2,471	8,967	1138	16,591
No of occupied households		670	484	1,593	262	3009
No. of HHs selected to participate		246	247	365	237	1095
No. of HHs contacted		229	245	285	138	897
	Not eligible	1	1	2	0	4
	Reason for non-eligibility	medical, unable to communicate	Not available	under-age	n/a	Not available, medical reasons, under-age
	No. of vacant homes	4	16	8	0	28
No. of eligible HHs		224	228	275	138	865
HH Non-response	Refused	29	28	35	18	110
	Not home during interview period	21	12	8	0	41
	No. of incomplete records	4	1	0	3	8
No. of HHs (participants) that participated		170	187	232	117	706
No. of participating females		106	133	154	84	477
No. of participating males		64	54	78	33	229
HH Participation rate (# participating HHs / # eligible HHs)		**76%**	**83%**	**84%**	**85%**	**82%**

[1] Indian and Northern Affairs Canada, 2009

Sociodemographic Characteristics

Table 4. Average age of participants

Gender	Mean age in years (SE)				
	Ecozone/Culture Area				
	1	2	3	4	All Manitoba First Nations
Women	41 (5.6)	43 (0.1)	42 (1.3)	38 (1.7)	42 (1.1)
Men	38 (4.8)	43 (3.3)	42 (3.9)	37 (3.4)	41 (2.7)

Figure 2a: Age group of women, by ecozone and all Manitoba First Nations living on-reserve

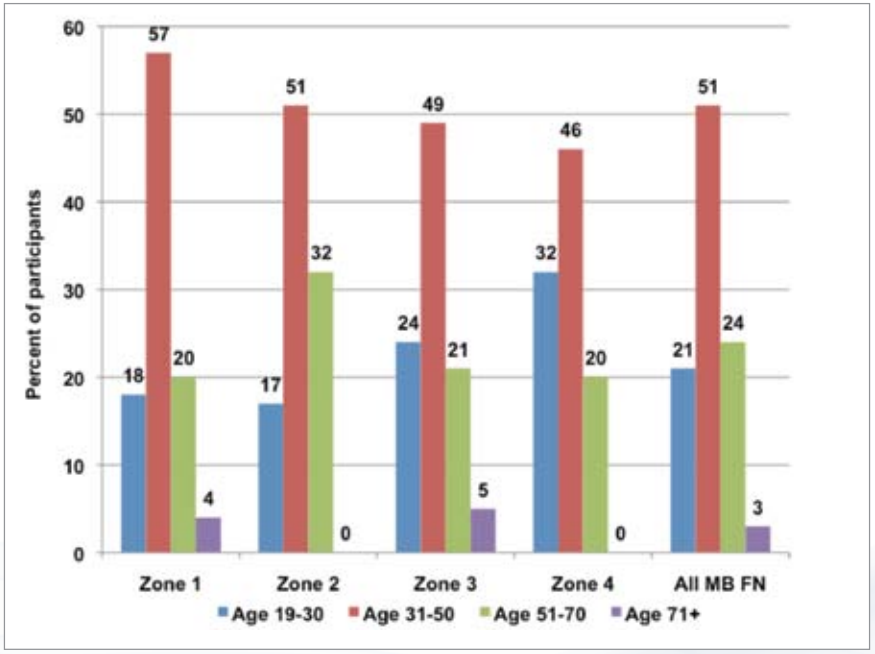


Figure 2b: Age group distribution of men, by ecozone and all Manitoba First Nations living on-reserve

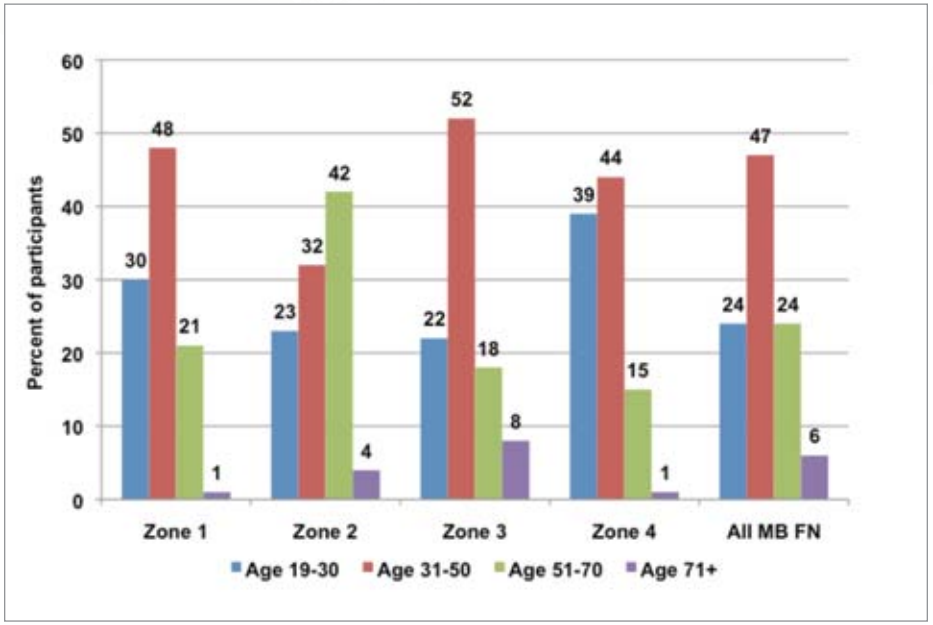


Figure 3. Percent of household members by age group, Manitoba First Nations living on-reserve (n=706)

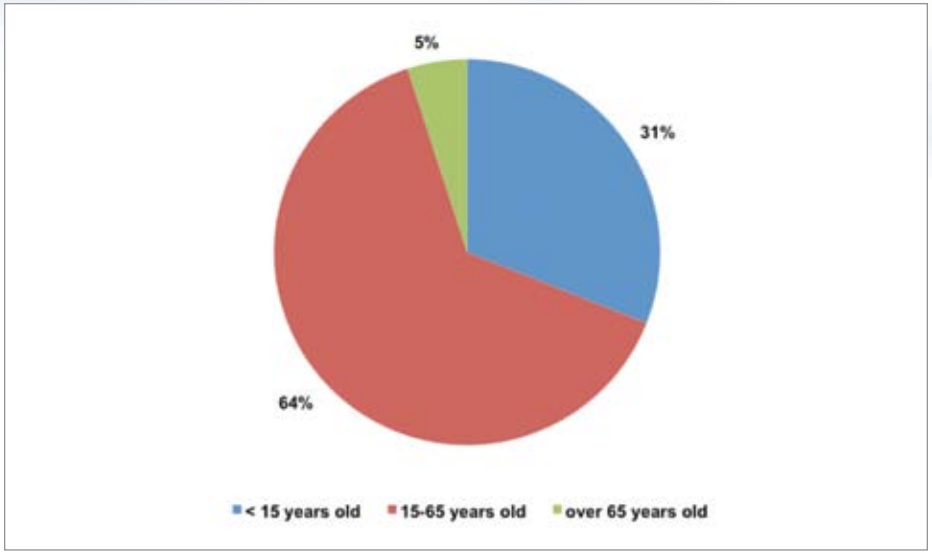
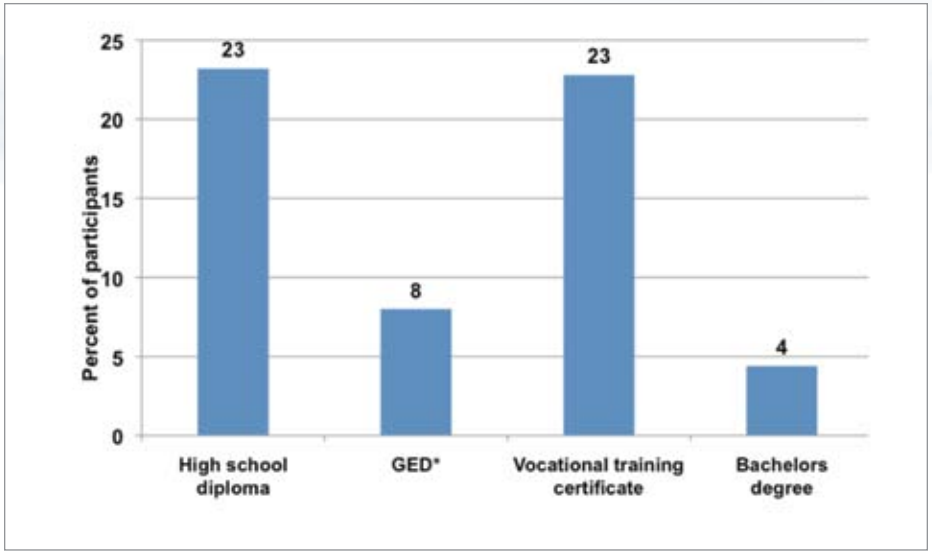


Figure 4: Diplomas, certificates and degrees obtained (n=701)

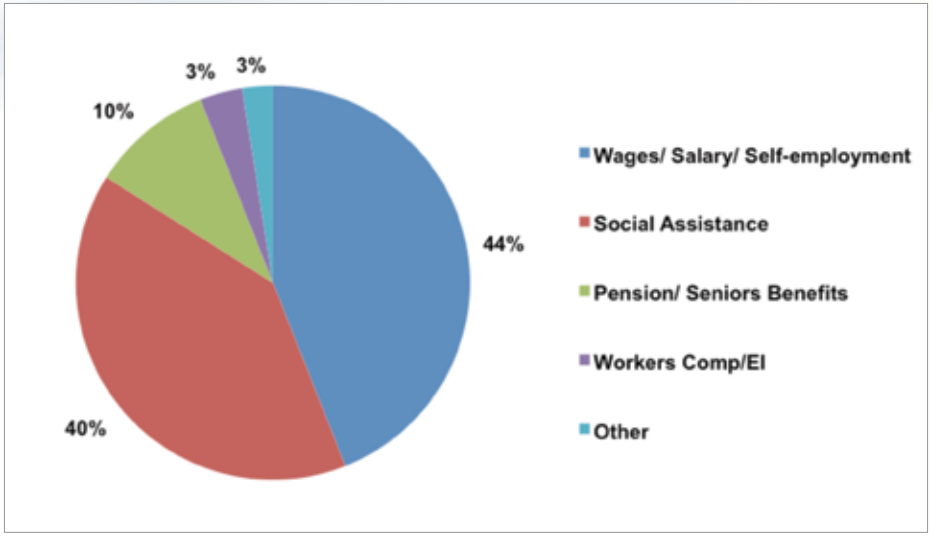


*GED=General Education Diploma

Table 5. Employment and level of education of Manitoba First Nations living on-reserve

Sociodemographic characteristics	Median (IQR)
Number of people in HH (n=706)	5 (4-7)
Number of people in HH Employed Full-time (n=702)	1 (0-2)
Number of people in HH Employed Part-time (n=702)	0 (0-0)
Number of years of school completed (n=680)	10 (8-12)

Figure 5. Main source of income for Manitoba First Nations living on-reserve (n=700)



*Other sources of income include no income (n=9) and sponsorship (job-training stipend; n=1)

Figure 6. Percent of on-reserve Manitoba First Nations on social assistance by ecozone/culture area and total

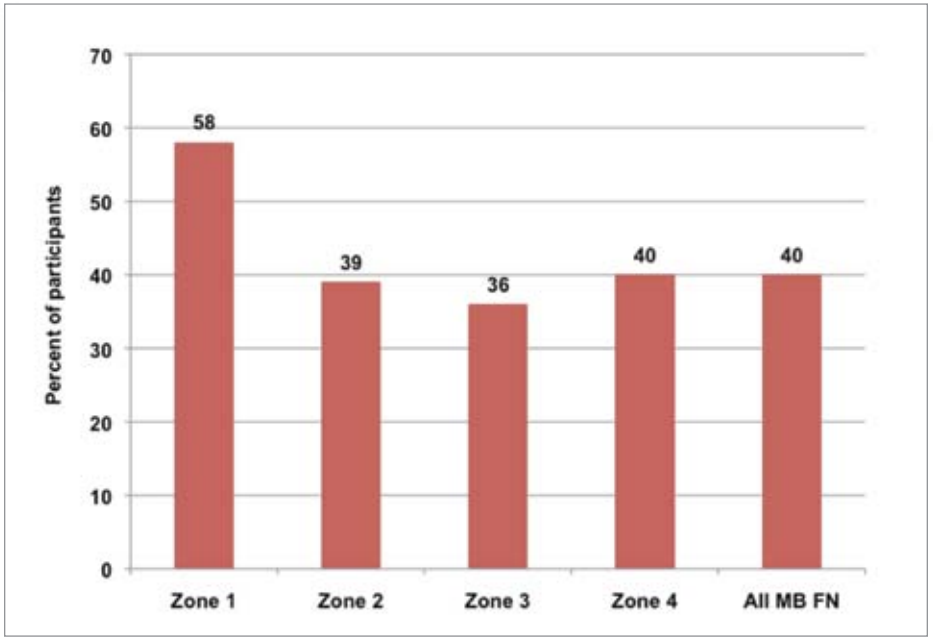


Figure 7a. Overweight and obesity in Manitoba First Nations adults living on-reserve

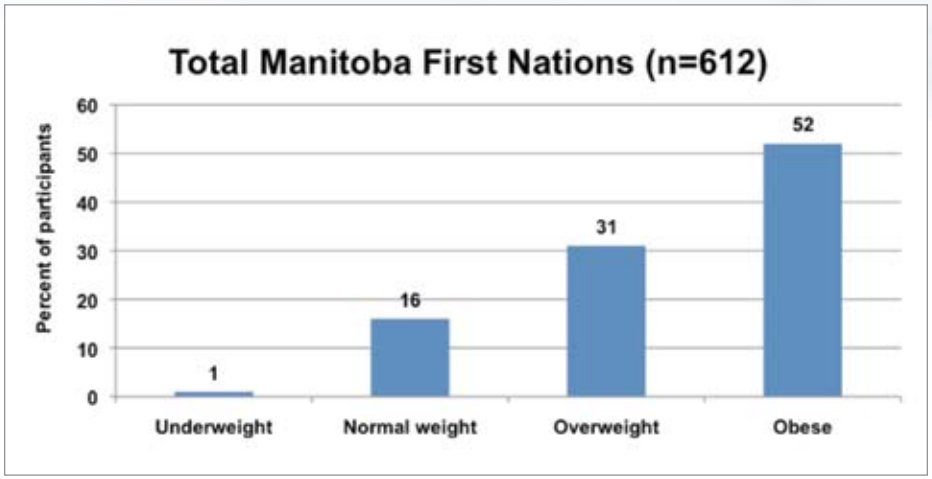
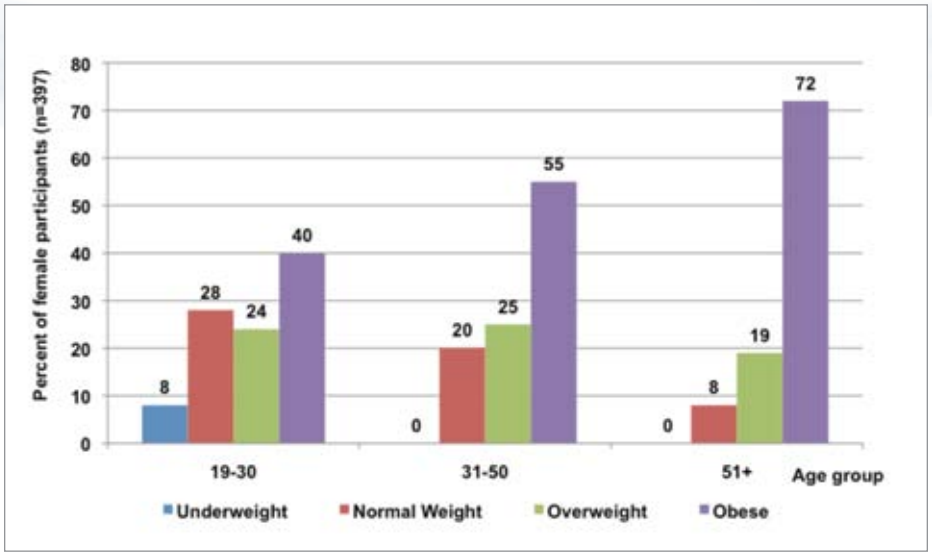


Figure 7b. Overweight and obesity in Manitoba First Nations women living on-reserve[8]



8 Classified using Health Canada's BMI categories (Health Canada, 2003)
Results include both measured and reported weight and height values; no significant differences found between measured (n=270) and reported (n=342) values; excludes pregnant and breastfeeding women (n=19)

Figure 7c. Overweight and obesity in Manitoba First Nations men living on-reserve

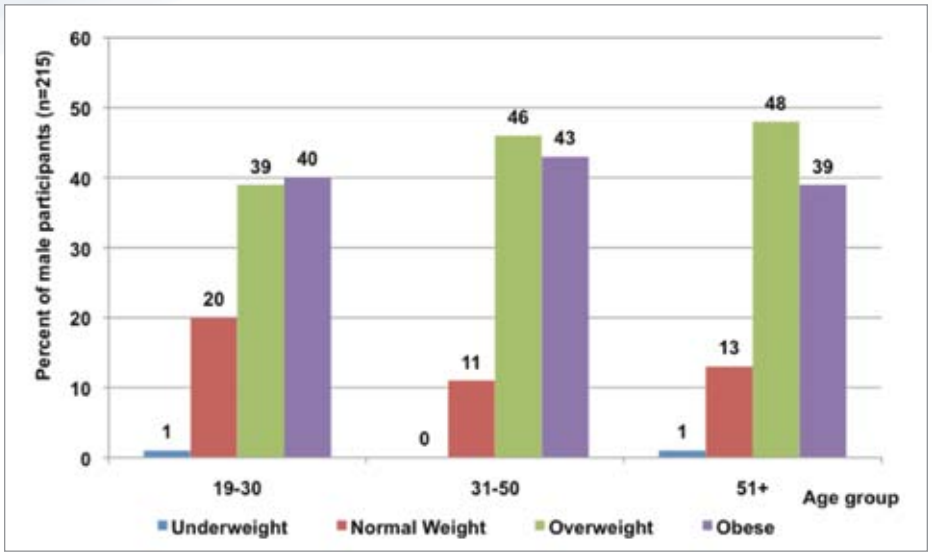
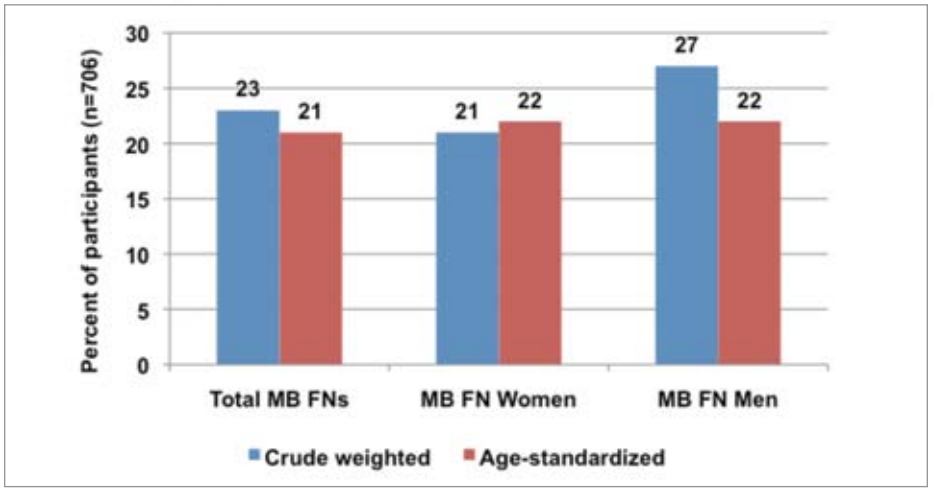


Figure 8. Prevalence of self-reported diabetes[1] in Manitoba First Nations, total and by gender (weighted and age-standardized rates[2])



[1] Excludes gestational diabetes
[2] Age-standardized to the 1991 Canadian population

Table 6. Prevalence of self-reported diabetes among Manitoba First Nations compared to other Canadian studies

Population	Age	Prevalence Rate %		Reference
		Crude	Age-Standardized‡	
Non-Aboriginal	12+	6.0	5.0	2009-2010 CCHS
First Nations (on-reserve)	18+	15.3	17.2	2008-2010 RHS
First Nations (off-reserve)	12+	8.7	10.3	2009-2010 CCHS
Inuit	15+	4.0	NA	2006 APS
Métis	12+	5.8	7.3	2009-2010 CCHS
Manitoba First Nations (on-reserve)	19+	23.3	20.8	Current study

‡ Age-standardized to the 1991 Canadian population.
CCHS= Canadian Community Health Survey
RHS= First Nations Regional Longitudinal Health Survey (Phase 2)
APS= Aboriginal Peoples Survey
Reference: (Public Health Agency of Canada, 2011)

Figure 9. Prevalence of diabetes in Manitoba First Nations by gender and age group

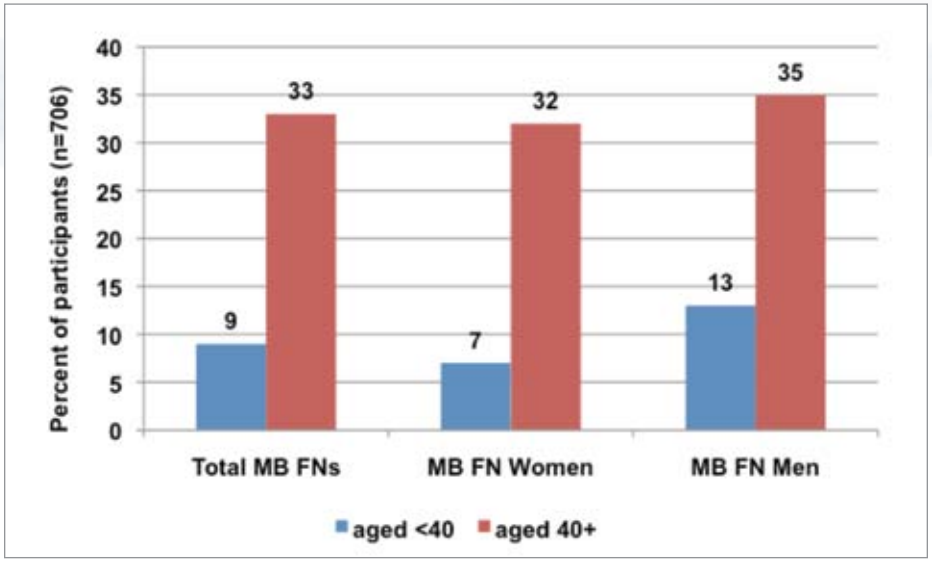


Figure 10. Type of diabetes reported by Manitoba First Nations diabetic participants

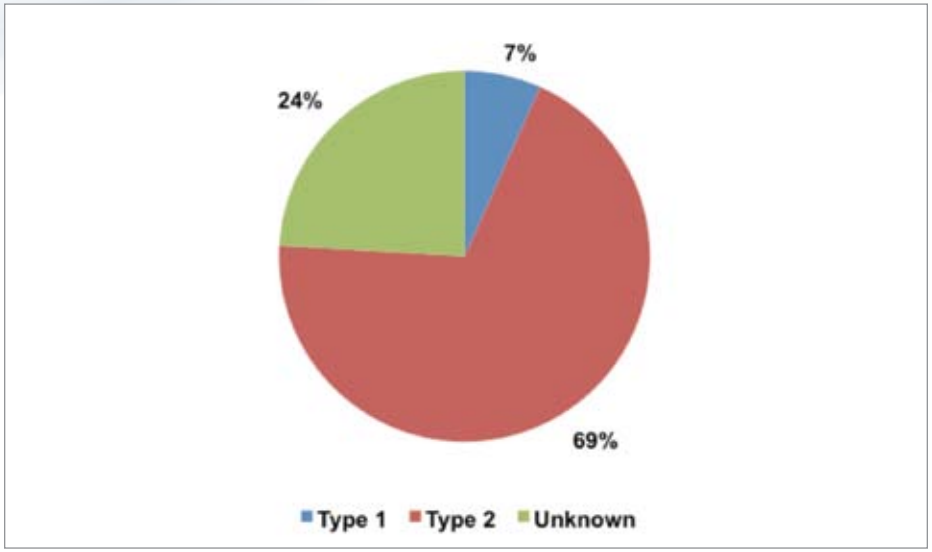


Figure 11. Percent of on-reserve Manitoba First Nations dieting (to lose weight) on the day before the interview

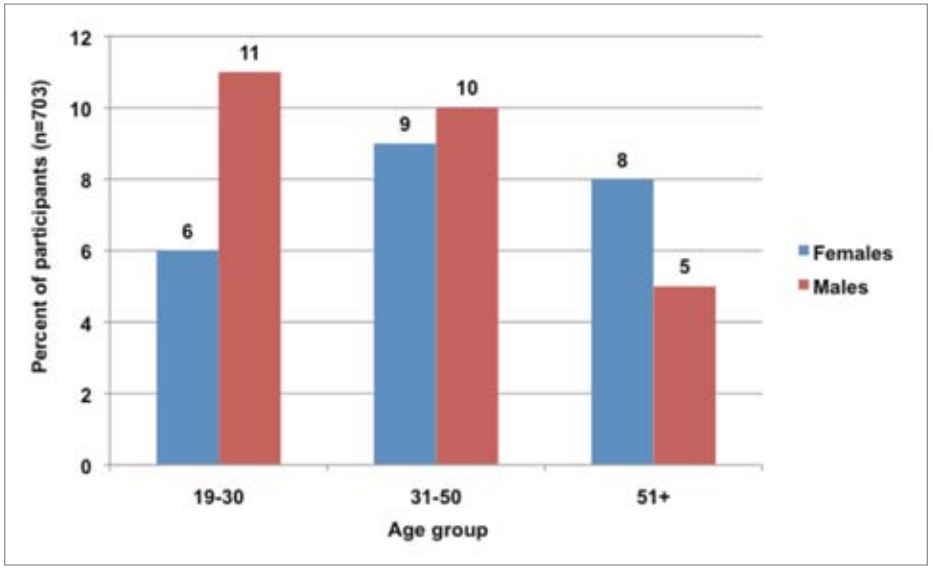


Figure 12. Percent of on-reserve Manitoba First Nations who smoke, by ecozone/ culture area and total

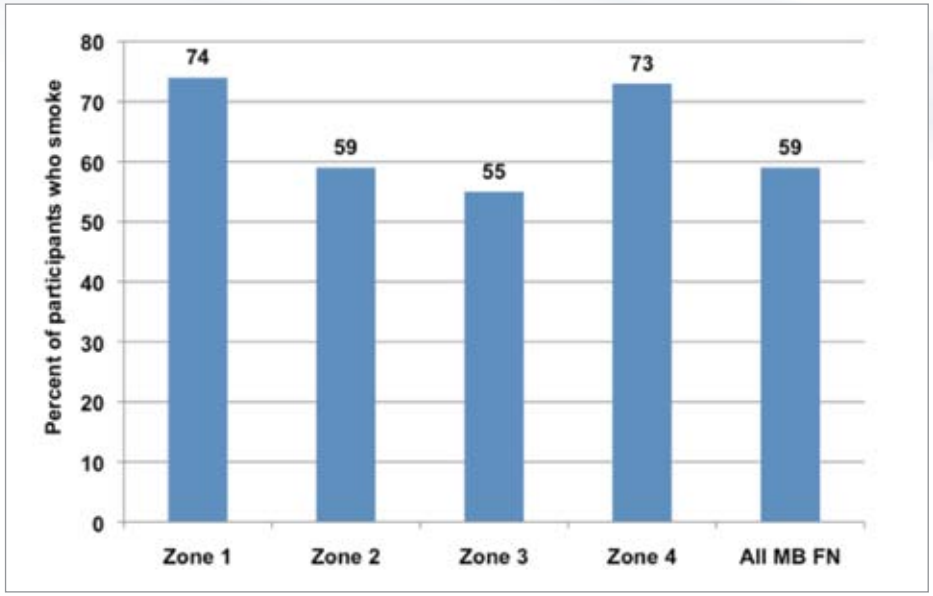


Figure 13a. Self-reported activity level in Manitoba First Nations women living on-reserve, by age group

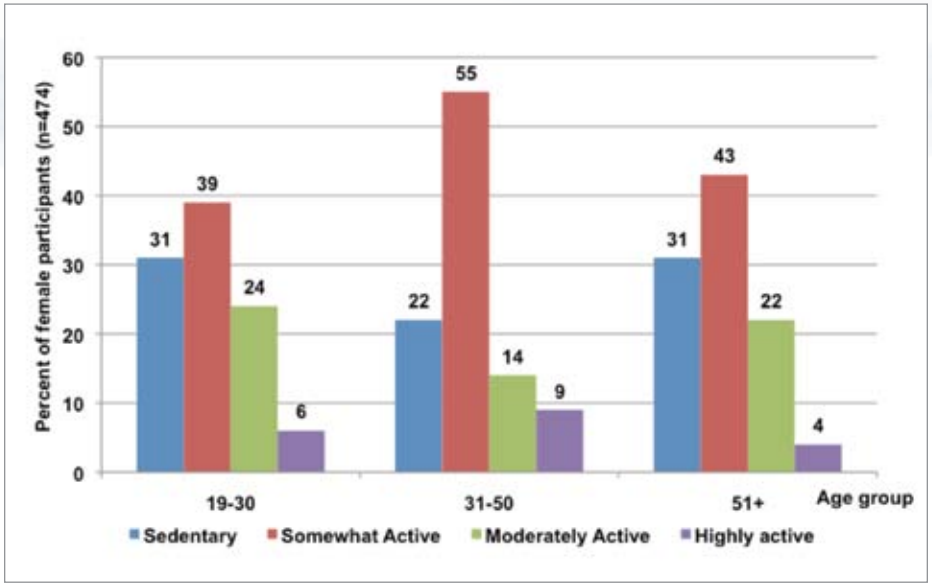


Figure 13b. Self-reported activity level in Manitoba First Nations men living on-reserve, by age group

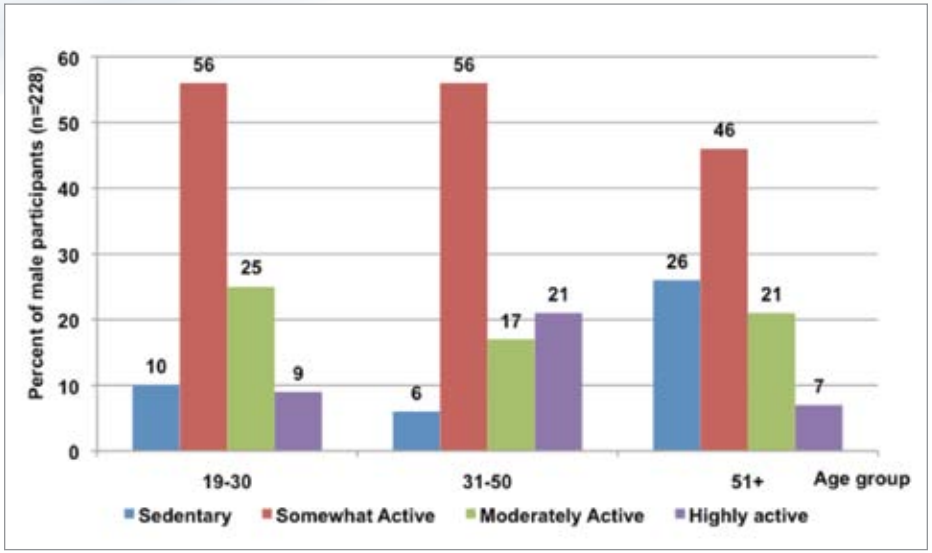


Figure 14a. Self-perceived health in Manitoba First Nations women living on-reserve, by age group

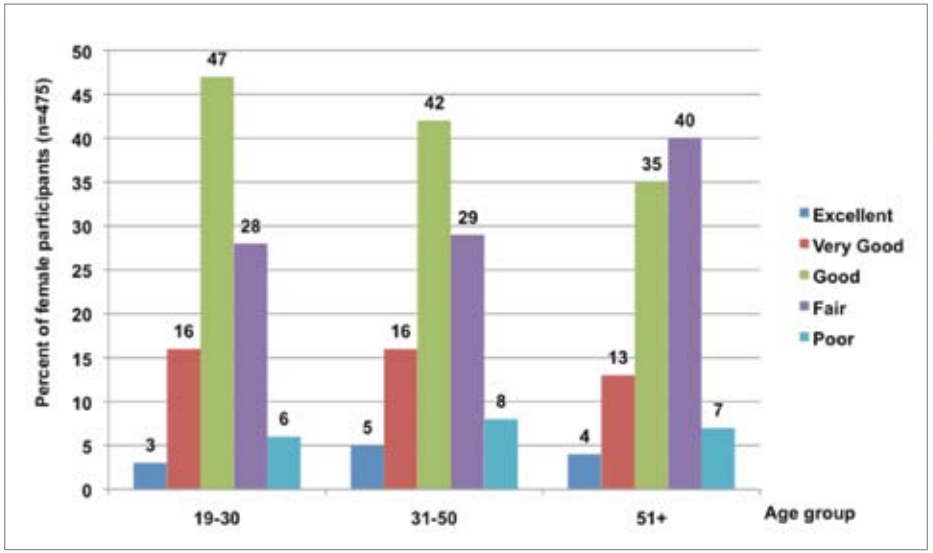


Figure 14b. Self-perceived health in Manitoba First Nations men living on-reserve, by age group

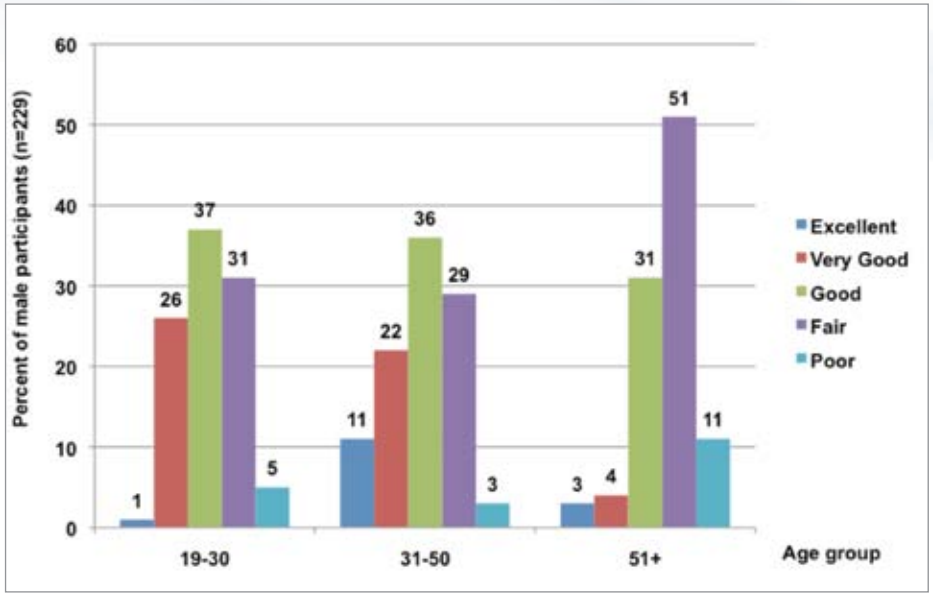


Table 7. Percent of on-reserve Manitoba First Nations consuming traditional foods in the past year, by ecozone/culture area and all Manitoba First Nations

	Percent consumption				
	Ecozone/ Culture Area				
Traditional Food	1 n=170	2 n=187	3 n=232	4 n=117	All MB First Nations n=706
FISH	73	94	79	93	83
Trout (all combined)	2	3	7	76	6
Trout, Brook	0	0	0	0	0
Trout, Lake	0	1	6	76	5
Trout, Rainbow	2	1	0	0	1
Trout, Brown	0	0	0	0	0
Trout, Kokanee	0	0	1	1	0
Trout, Cutthroat	0	0	0	0	0
Cisco	0	0	0	0	0
Arctic grayling	0	0	0	1	0
Whitefish, lake	3	34	32	77	29
Whitefish, round	0	1	2	4	1
Bluegill	0	0	0	0	0
Sunfish (pumpkinseed)	1	0	3	0	2
Smallmouth Bass	0	0	0	0	0
Largemouth Bass	0	0	2	0	1
Rock Bass	0	0	0	0	0
White perch/White Bass	1	2	1	0	1
Sauger	3	0	1	0	1
Yellow Perch	18	4	1	0	5

Table 7. Percent of on-reserve Manitoba First Nations consuming traditional foods in the past year, by ecozone/culture area and all Manitoba First Nations (continued)

	Percent consumption				
	Ecozone/ Culture Area				
Traditional Food	1 n=170	2 n=187	3 n=232	4 n=117	All MB First Nations n=706
Mooneye	0	0	0	0	0
Walleye (yellow pickerel)	60	81	76	30	74
Northern pike	14	59	23	12	31
Muskie	1	0	0	0	0
Burbot (Ling or Maria)	2	0	0	1	0
Brown bullhead catfish	0	0	0	0	0
Channel Catfish	2	0	2	0	1
Red (longnose) Sucker	1	2	0	0	1
White Sucker	6	15	0	2	5
Bigmouth buffalo sucker	1	0	0	0	0
Sturgeon (lake)	2	6	17	0	11
Other Fish (jackfish, goldeye, salmon)	2	1	0	0	1
LAND MAMMALS	87	92	83	100	86
Deer meat	86	41	29	3	41
Deer liver	18	1	2	0	4
Deer kidney	8	1	2	0	2
Elk meat	47	21	3	0	15
Elk liver	3	1	0	0	1
Elk kidney	4	1	0	0	1
Moose meat	29	86	78	63	72
Moose liver	5	3	12	1	8
Moose kidney	4	2	5	7	4

	Percent consumption				
	Ecozone/ Culture Area				
Traditional Food	**1 n=170**	**2 n=187**	**3 n=232**	**4 n=117**	**All MB First Nations n=706**
Caribou meat	0	3	3	100	5
Caribou liver	0	0	0	23	0
Caribou kidney	0	0	0	60	1
Bison meat	20	8	4	0	7
Rabbit	38	19	24	3	25
Beaver meat	1	1	11	0	6
Groundhog meat	0	0	0	0	0
Muskrat meat	10	13	9	0	10
Mink	0	0	0	0	0
Weasel	0	0	0	0	0
River otter	0	0	0	0	0
Lynx	0	1	2	0	1
Black bear meat	1	1	0	0	1
Black bear fat	1	0	0	0	0
Other Land Mammals (caribou heart and tongue; moose heart, nose and tongue; deer heart; elk heart)	2	0	2	20	2
WILD BIRDS	57	71	47	59	56
Ducks (all combined)	51	63	34	5	44
Scoter (surf, white winged, black)	1	0	0	0	0
Redhead	9	15	1	0	6
Canvasback	16	7	3	1	6
Wood Duck	2	2	1	0	1

Table 7. Percent of on-reserve Manitoba First Nations consuming traditional foods in the past year, by ecozone/culture area and all Manitoba First Nations (continued)

	Percent consumption				
	Ecozone/ Culture Area				
Traditional Food	1 n=170	2 n=187	3 n=232	4 n=117	All MB First Nations n=706
Ring necked Duck	2	2	9	0	6
Ruddy Duck	1	0	2	0	1
American Wigeon	1	1	1	0	1
Northern Pintail	8	7	7	1	7
Northern Shoveler	1	1	1	0	1
Gadwall	1	1	2	0	1
Mallard	51	62	31	3	42
American black	4	1	0	0	1
Teal (blue-winged)	14	6	8	0	9
Golden eye	2	0	4	0	2
Bufflehead	0	0	1	0	0
Loon (common, red throated)	0	0	0	0	0
Merganser (common, hooded)	0	0	0	0	0
Geese (Canada)	44	52	38	56	43
Grouse (Blue, Ruffed, sharp-tailed)	5	5	8	17	7
Gray Partridge	6	2	5	0	4
Prairie Chicken, greater	12	12	6	2	8
Wild turkey	5	0	1	0	1
Woodcock	0	0	0	0	0
Bird eggs (seagull, mud hen, duck, geese)	2	6	9	0	7
Other Wild Bird (ptarmigan, swan, blue geese, snow geese)	0	0	1	6	1

	Percent consumption				
	Ecozone/ Culture Area				
Traditional Food	**1 n=170**	**2 n=187**	**3 n=232**	**4 n=117**	**All MB First Nations n=706**
WILD BERRIES and NUTS	63	58	73	79	68
Bunchberries	2	0	0	0	0
Crowberry	2	0	1	0	1
Teaberry (wintergreen)	1	0	0	0	0
Soapberries (buffaloberry)	0	0	0	0	0
Kinnikinnick Bearberry	0	0	1	0	1
Wild Strawberry	20	35	31	2	30
Thimbleberries	0	0	0	0	0
Cloudberries (bakeapple)	0	0	0	4	0
Blackberry, large (himalayan)	1	0	1	2	0
Black raspberry (thimbleberry)	2	1	0	0	1
Raspberry (wild, dewberry)	34	31	39	3	36
Blueberries	16	40	61	73	48
Cranberry (low-bush/lingonberry, bog)	7	8	16	54	13
Highbush Cranberry (Squashberry, Mooseberry)	11	9	3	4	6
Blue huckleberry	1	0	0	0	0
Gooseberry/currant	4	4	1	0	2
Rose hips (prickly rose)	1	0	1	1	1
False Solomon's Seal berries	0	0	1	0	0
Hawthorn (black, red)	1	0	0	0	0
Saskatoon berry	49	13	8	1	16
Chokecherry	37	10	12	0	15

Table 7. Percent of on-reserve Manitoba First Nations consuming traditional foods in the past year, by ecozone/culture area and all Manitoba First Nations (continued)

	Percent consumption				
	Ecozone/ Culture Area				
Traditional Food	1 n=170	2 n=187	3 n=232	4 n=117	All MB First Nations n=706
Crabapple	32	8	13	0	14
Sumac	0	0	0	0	0
Juniper berries	1	0	0	0	0
Hazelnut	11	6	1	0	4
Acorns	1	0	1	0	1
Walnuts	1	0	0	0	1
Other Berries (wild plums, pin cherries, mossberry,)	5	0	1	2	1
WILD PLANT ROOTS, SHOOTS AND GREENS	19	8	38	41	27
Wild onion (prairie, Canada, nodding)	2	0	1	0	1
Wild leek	0	0	0	1	0
Breadroot (prairie turnip)	0	0	0	0	0
Wild rice	11	5	30	4	19
Jerusalem artichoke	0	0	0	0	0
Thistle	0	0	0	0	0
Indian potato (Bear root, Eskimo potato, Alaska carrot, sweet vetch, licorice root)	2	0	2	0	1
Wood Lily	0	0	0	0	0
Yellow Pond lily (bullhead)	1	0	0	0	0
Arrowhead	0	0	0	1	0
Tule	1	0	0	0	0
Rat root	1	0	3	5	2
Thimbleberry, salmonberry shoots	0	0	0	0	0

	Percent consumption				
	Ecozone/ Culture Area				
Traditional Food	**1 n=170**	**2 n=187**	**3 n=232**	**4 n=117**	**All MB First Nations n=706**
Fiddleheads (Spiny wood fern)	0	0	1	0	0
Cattail shoots	0	0	1	0	0
Horsetail shoots	0	0	0	0	0
Lamb's quarters	0	0	0	0	0
Sorrel	0	0	0	0	0
Fireweed	0	0	0	0	0
Dandelions	1	0	0	0	0
Western Dock	0	0	0	0	0
Cow parsnip	0	0	0	0	0
Raspberry leaves	1	0	1	0	1
Labrador Tea leaves	4	1	7	40	5
Wintergreen (teaberry) leaves	1	0	0	2	0
Bunchberry leaves	1	0	0	0	0
Mint leaves	2	1	6	0	4
Stinging nettle leaves	1	0	0	0	0
Hemp nettle leaves	0	0	0	0	0
Other Plants (Seneca root, ginger root)	1	3	9	2	6
MUSHROOMS	0	4	1	0	2
Pine mushroom (White Matsutake)	0	2	1	0	1
Chanterelle	0	0	0	0	0
Other Mushrooms (morels)	0	2	0	0	1

Table 8a. Seasonal frequency of top ten consumed traditional food items for consumers and non-consumers combined, based on average days per year, total Manitoba First Nations living on-reserve

Traditional Food	Average days per year food consumed (SE)	Percent of consumers	Average days per season (SE) for all participants (n=706)			
			Summer	Spring	Winter	Fall
Moose meat	12 (3)	73	3 (1)	2 (1)	3 (1)	4 (1)
Walleye (yellow pickerel)	11 (4)	74	4 (1)	3 (1)	2 (1)	3 (1)
Deer meat	7 (3)	41	2 (1)	1 (1)	2 (1)	2 (1)
Blueberries	6 (1)	48	4 (1)	1 (1)	1 (0)	1 (0)
Ducks (all combined)	5 (3)	44	1 (0)	2 (1)	1 (0)	2 (1)
Raspberry (wild, dewberry)	4 (2)	36	2 (1)	1 (0)	1 (0)	1 (0)
Whitefish, lake	4 (3)	29	1 (1)	1 (1)	1 (1)	1 (1)
Geese (Canada)	3 (2)	44	0 (0)	1 (1)	0 (0)	1 (1)
Elk meat	3 (2)	15	1 (0)	1 (0)	1 (0)	1 (0)
Wild Strawberry	3 (1)	30	2 (0)	1 (0)	0 (0)	0 (0)

Note: for the purpose of this report, the year is divided into 4 seasons of 90 days each.

"Traditional food is beneficial to the body; all traditional food better."

Table 8b. Seasonal frequency of top ten consumed traditional food items for consumers and non-consumers combined, based on average days per year, Ecozone 1

Traditional Food	Average days per year food consumed (SE)	Percent of consumers	Average days per season (SE) for Ecozone 1 participants (n=170)			
			Summer	Spring	Winter	Fall
Deer meat	17 (2)	87	3 (0)	2 (0)	5 (0)	6 (2)
Ducks (all combined)	10 (7)	52	1 (0)	4 (3)	1 (1)	4 (3)
Walleye (yellow pickerel)	7 (4)	60	2 (1)	2 (1)	1 (1)	2 (1)
Elk meat	6 (2)	48	1 (0)	1 (0)	1 (1)	2 (1)
Geese (Canada)	5 (4)	46	1 (0)	2 (2)	1 (1)	2 (2)
Moose meat	5 (3)	31	1 (1)	1 (1)	1 (1)	1 (1)
Rabbit	4 (2)	37	0 (0)	0 (0)	2 (1)	2 (1)
Deer liver	4 (1)	17	1 (0)	0 (0)	1 (0)	2 (0)
Saskatoon berry	3 (1)	49	2 (0)	0 (0)	0 (0)	0 (0)
Deer kidney	2 (2)	8	0 (0)	0 (0)	1 (1)	1 (1)

"Traditional food is healthier, kids don't get sick, it tastes better, it lasts longer."

Table 8c. Seasonal frequency of top ten consumed traditional food items for consumers and non-consumers combined, based on average days per year, Ecozone 2

Traditional Food	Average days per year food consumed (SE)	Percent of consumers	Average days per season (SE) for Ecozone 2 participants (n=187)			
			Summer	Spring	Winter	Fall
Walleye (yellow pickerel)	8 (4)	81	3 (1)	2 (1)	1 (0)	1 (0)
Moose meat	7 (2)	86	2 (0)	1 (0)	2 (1)	2 (1)
Deer meat	4 (5)	41	1 (1)	1 (1)	1 (1)	1 (1)
Northern pike	4 (1)	59	2 (1)	1 (0)	1 (0)	1 (0)
Ducks (all combined)	4 (2)	63	0 (0)	1 (1)	0 (0)	2 (1)
Blueberries	3 (2)	40	1 (2)	0 (0)	0 (0)	0 (0)
Elk meat	2 (3)	21	1 (1)	0 (0)	0 (1)	1 (1)
Geese (Canada)	2 (0)	52	0 (0)	1 (0)	0 (0)	1 (0)
White Sucker	2 (2)	15	0 (1)	0 (1)	0 (1)	0 (1)
Wild Strawberry	2 (1)	35	1 (0)	0 (0)	0 (0)	0 (0)

"It is a part of our history. It is rich, healthy, and full of medicine."

Table 8d. Seasonal frequency of top ten consumed traditional food items for consumers and non-consumers combined, based on average days per year, Ecozone 3

Traditional Food	Average days per year food consumed (SE)	Percent of consumers	Average days per season (SE) for Ecozone 3 participants (n=232)			
			Summer	Spring	Winter	Fall
Moose meat	17 (5)	78	4 (1)	3 (1)	5 (1)	5 (1)
Walleye (yellow pickerel)	15 (6)	76	5 (2)	3 (1)	3 (1)	3 (1)
Blueberries	10 (2)	61	6 (2)	1 (1)	1 (0)	1 (0)
Raspberry (wild, dewberry)	7 (3)	39	4 (1)	1 (1)	1 (1)	1 (1)
Deer meat	6 (5)	28	1 (1)	1 (1)	1 (1)	2 (1)
Whitefish, lake	5 (5)	32	1 (1)	1 (1)	2 (1)	1 (1)
Ducks (all combined)	5 (4)	33	1 (1)	2 (2)	1 (1)	1 (1)
Wild Strawberry	4 (1)	30	2 (1)	1 (0)	0 (0)	1 (0)
Wild rice	4 (3)	31	1 (1)	1 (1)	1 (1)	1 (1)
Geese (Canada)	3 (3)	39	0 (0)	2 (1)	0 (0)	1 (1)

"It tastes better. I was brought up on it. It has no preservatives and is healthier."

Table 8e. Seasonal frequency of top ten consumed traditional food items for consumers and non-consumers combined, based on average days per year, Ecozone 4

Traditional Food	Average days per year food consumed (SE)	Percent of consumers	Average days per season (SE) for Ecozone 4 participants (n=117)			
			Summer	Spring	Winter	Fall
Caribou meat	113 (12)	100	27 (3)	28 (3)	34 (3)	24 (3)
Whitefish, lake	23 (4)	77	8 (1)	5 (1)	5 (1)	5 (1)
Trout (all combined)	15 (2)	76	7 (1)	3 (1)	2 (0)	4 (1)
Trout, Lake	15 (2)	76	7 (1)	3 (1)	2 (0)	4 (1)
Labrador Tea leaves	15 (5)	40	4 (1)	3 (1)	4 (2)	3 (1)
Blueberries	8 (1)	73	4 (1)	1 (0)	1 (0)	2 (0)
Caribou kidney	7 (2)	60	1 (0)	2 (1)	3 (1)	1 (0)
Cranberry (low-bush/lingonberry, bog)	7 (2)	54	2 (1)	1 (0)	1 (0)	3 (1)
Walleye (yellow pickerel)	6 (2)	30	3 (1)	1 (0)	1 (0)	1 (0)
Moose meat	5 (1)	63	2 (0)	1 (0)	1 (0)	2 (1)

"The fresh air, exercise and the meat are most important to help give you a healthy life. Too bad I have to work all the time."

Figure 15a. Traditional food harvest practices by on-reserve Manitoba First Nations by ecozone/culture area compared to all Manitoba communities (n=706)

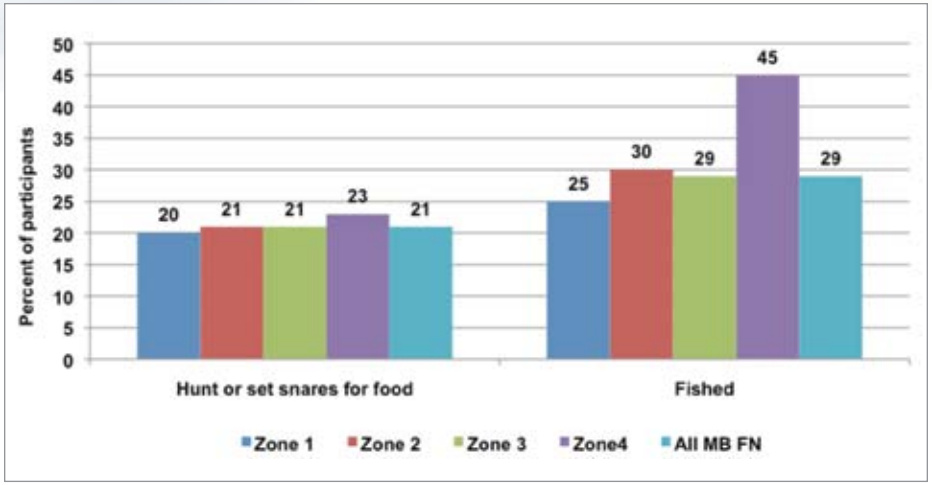
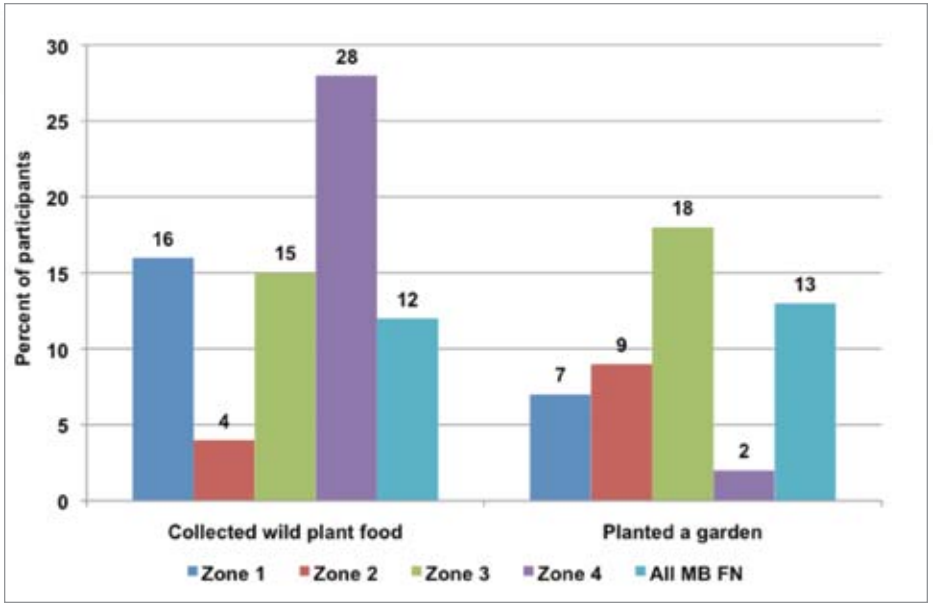


Figure 15b. Traditional food gathering practices by on-reserve Manitoba First Nations by ecozone/culture area compared to all Manitoba communities(n=706)



"Traditional food is the best."

Figure 16. Percent of on-reserve Manitoba First Nations who eat vegetables and/or fruits from their gardens or community gardens, by ecozone/culture area and total

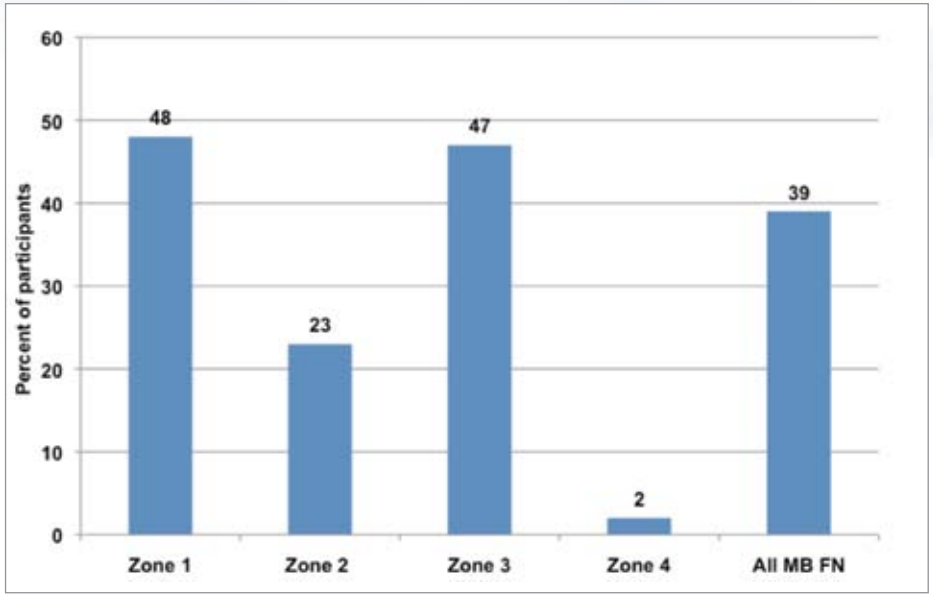
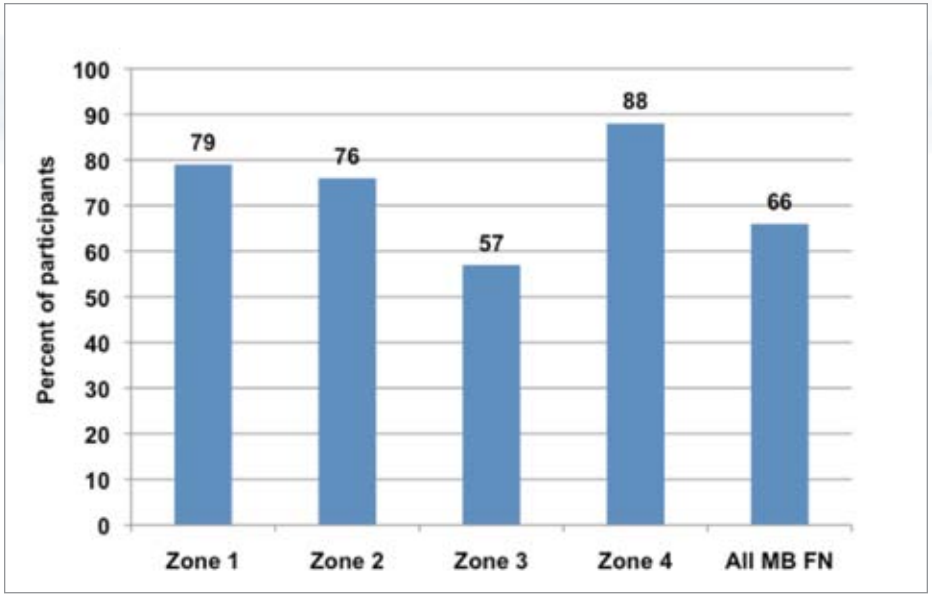


Figure 17. Percent of on-reserve Manitoba First Nations whose households would like more traditional food (n=701)



"It's organic, tradition, good to live off the land, going out each season, teaching our children their roots."

Figure 18. Top 5* barriers preventing on-reserve Manitoba First Nations households from using more traditional food (n=667)

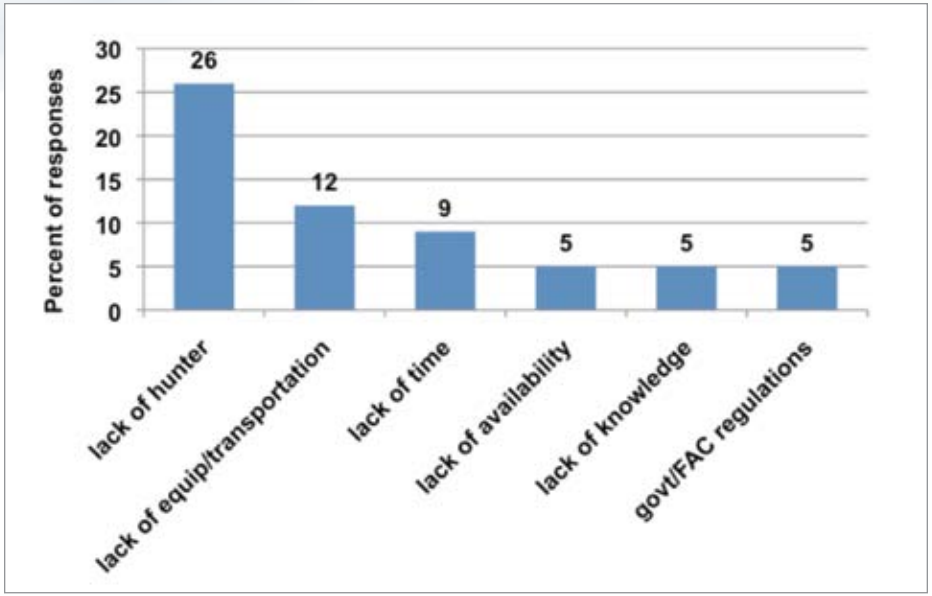
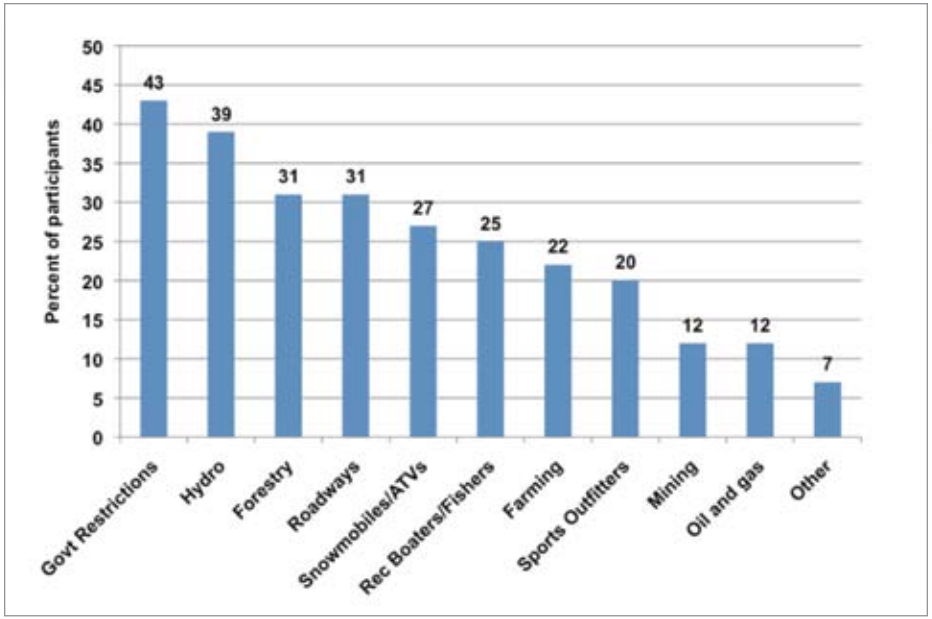


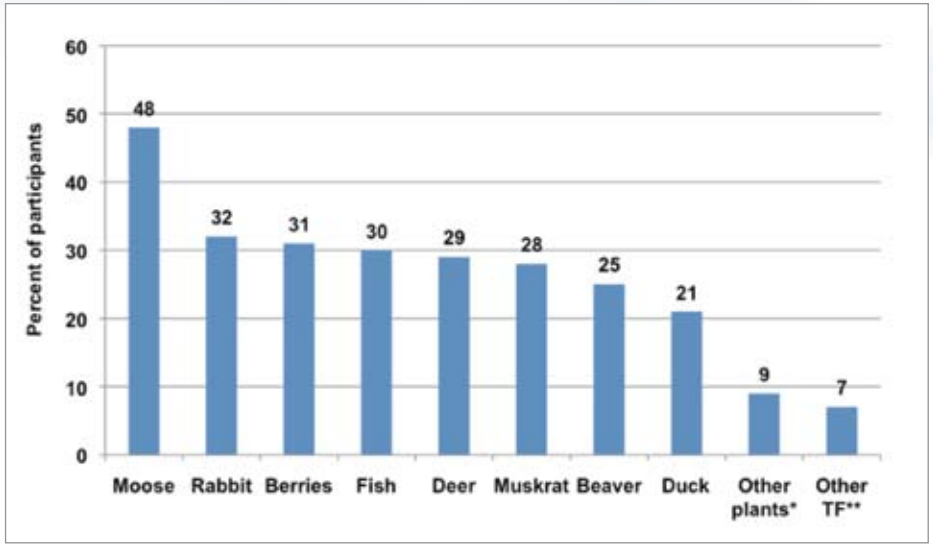
Figure 19. Percent of on-reserve Manitoba First Nations who reported that the following affected (or limited) where they could hunt, fish or collect berries (n=706)



* top 6 displayed due to tied responses
govt/FAC regulations = government/firearms certificate regulations
Note: verbatim comments to this open-ended question were grouped according to similar categories

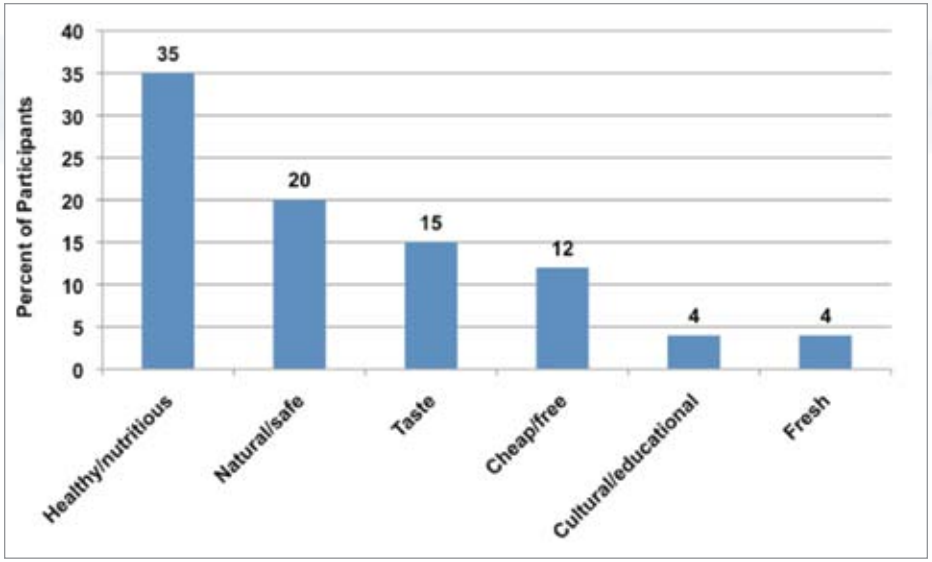
"Good for native health. I feel better when I eat traditional foods."

Figure 20. Traditional foods made less available to Manitoba First Nations living on-reserve because of the limits from Figure 19(n=706)



*other plants=sage, sweet grass, Labrador tea leaves, medicinal plants, mint, crabapples, plums, wild onions, ginger root, tamarak root, trees, Seneca root "weekay", potatoes
**other TF (traditional foods)=caribou, wild rice, all, elk, buffalo, rose hips, geese, grouse, loons, mushrooms, otter, lynx, ptarmigan

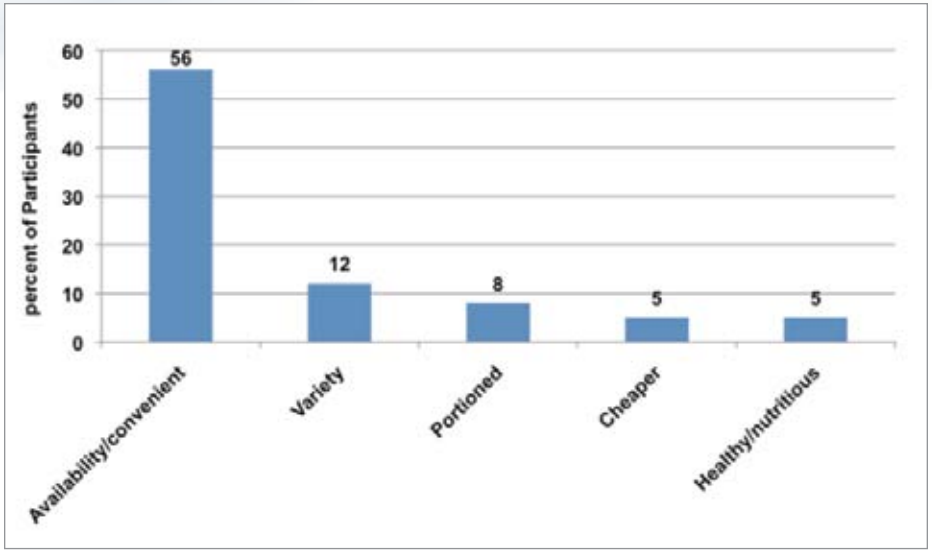
Figure 21. Top 5* benefits of traditional food reported by Manitoba First Nations living on-reserve (n=596)



Note: verbatim comments to this open-ended question were grouped according to similar categories
*top 6 presented due to tied responses

"I grew up eating all wild meat, ducks, etc. Hunters hunted all seasons and shared."

Figure 22. Top 5 benefits of market food reported by Manitoba First Nations living on-reserve (n=535)



Note: verbatim comments to this open-ended question were grouped according to similar categories

Nutrient Intake

(Note that in Tables 12.1-12.37 (-) data with a coefficient of variation (CV) >33.3%, suppressed due to extreme sampling variability

Table 12.1 Total energy intake (kcal/d): Usual intakes from food, by DRI age-sex group, household population[1]

				Percentiles (SE) of usual intake						
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	163	2246 (119)	2037 (190)	2080 (166)	2153 (133)	2237 (121)	2323 (153)	2403 (212)	2453 (256)
	51-70	57	1861 (160)	912 (270)	1108 (229)	1470 (155)	1920 (95)	2414 (166)	2896 (303)	3200 (608)
Female	19-50	324	1965 (148)	1461 (264)	1569 (237)	1759 (195)	1983 (171)	2225 (193)	2461 (258)	2610 (311)
	51-70	114	1609 (73)	1260 (96)	1349 (96)	1500 (98)	1669 (100)	1837 (104)	1986 (109)	2074 (113)

[1] no values presented for age group 71+ due to low sample size (n=15 women and n=9 men); pregnant and/or breastfeeding participants not included in analyses due to different nutrient requirements

Table 12.2 Protein (g/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake						
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	163	91 (10)	74 (16)	77 (15)	83 (13)	90 (11)	98 (12)	106 (16)	110 (19)
	51-70	57	84 (9)	25 (13)	35 (11)	54 (8)	81 (6)	113 (7)	146 (15)	167 (28)
Female	19-50	324	75 (5)	49 (11)	54 (10)	64 (8)	77 (6)	91 (6)	104 (8)	113 (10)
	51-70	114	74 (6)	50 (9)	55 (8)	64 (7)	74 (7)	86 (9)	97 (12)	104 (14)

Table 12.3 Total carbohydrates (g/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake								
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	%<EAR (95% CI)
Male	19-50	163	269 (17)	219 (21)	229 (18)	246 (16)	266 (16)	287 (21)	307 (28)	319 (33)	100	0 (0-0)
	51-70	57	207 (15)	152 (30)	166 (26)	189 (17)	217 (7)	246 (10)	274 (21)	291 (29)	100	0 (0-6.6)
Female	19-50	324	241 (21)	135 (36)	156 (33)	192 (29)	237 (25)	285 (25)	334 (31)	366 (37)	100	0.9 (0-6.7)
	51-70	114	179 (8)	114 (13)	127 (13)	152 (14)	180 (14)	209 (15)	237 (16)	255 (17)	100	2.1 (0.1-7.2)

Table 12.4 Total fats (g/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake						
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	163	93 (7)	72 (9)	76 (8)	83 (7)	91 (8)	100 (11)	110 (15)	116 (18)
	51-70	57	80 (8)	32 (11)	40 (9)	57 (7)	81 (6)	110 (11)	141 (22)	161 (32)
Female	19-50	324	80 (6)	74 (9)	75 (8)	78 (7)	82 (7)	86 (9)	89 (13)	91 (15)
	51-70	114	68 (4)	55 (4)	59 (4)	64 (4)	71 (5)	78 (5)	84 (5)	88 (6)

Table 12.5 Total saturated fats (g/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake						
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	163	29 (3)	27 (3)	27 (3)	28 (3)	29 (3)	30 (4)	31 (5)	31 (6)
	51-70	57	25 (3)	13 (4)	15 (4)	20 (3)	26 (2)	33 (3)	40 (6)	45 (9)
Female	19-50	324	25 (1)	19 (4)	20 (3)	23 (2)	26 (2)	29 (2)	32 (4)	34 (5)
	51-70	114	21 (1)	19 (1)	20 (1)	21 (1)	22 (1)	23 (1)	24 (1)	25 (1)

Table 12.6 Total monounsaturated fats (g/d): Usual intakes from food , by DRI age-sex group, household population

				Percentiles (SE) of usual intake						
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	163	36 (2)	23 (4)	25 (4)	29 (3)	34 (3)	40 (4)	47 (8)	52 (10)
	51-70	57	31 (4)	8 (5)	12 (4)	19 (3)	31 (3)	46 (6)	62 (12)	73 (16)
Female	19-50	324	30 (3)	22 (3)	24 (4)	26 (4)	30 (4)	34 (4)	37 (4)	40 (4)
	51-70	114	27 (2)	20 (2)	22 (2)	24 (2)	28 (2)	31 (2)	34 (3)	36 (3)

Table 12.7 Total polyunsaturated fats (g/d): Usual intakes from food , by DRI age-sex group, household population

				Percentiles (SE) of usual intake						
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	163	20 (2)	15 (2)	16 (2)	18 (2)	20 (2)	22 (2)	24 (3)	25 (3)
	51-70	57	16 (2)	5 (-)	6 (-)	10 (1)	15 (1)	21 (2)	29 (5)	34 (7)
Female	19-50	324	18 (2)	14 (2)	15 (2)	17 (2)	18 (2)	20 (2)	21 (2)	22 (2)
	51-70	114	14 (1)	13 (2)	13 (2)	14 (2)	15 (2)	16 (2)	18 (2)	18 (2)

Table 12.8 Linoleic acid (g/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake								
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	AI	% > AI (95% CI)
Male	19-50	163	16 (2)	13 (1)	13 (1)	15 (1)	16 (2)	18 (2)	20 (2)	21 (3)	17	41.6 (11-94.2)
	51-70	57	13 (2)	5 (-)	6 (1)	9 (1)	13 (1)	18 (2)	23 (3)	27 (4)	14	42.9 (16.5-52.3)
Female	19-50	324	14 (1)	10 (1)	11 (1)	13 (1)	15 (2)	17 (2)	19 (2)	20 (2)	12	82.9 (53.5-98.5)
	51-70	114	11 (1)	9 (1)	9 (1)	10 (2)	12 (2)	13 (2)	14 (2)	15 (2)	11	60.2 (5.9-95.5)

Table 12.9 Linolenic acid (g/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake								
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	AI	% > AI (95% CI)
Male	19-50	163	1.8 (0.06)	0.8 (-)	0.9 (0.27)	1.2 (0.21)	1.6 (0.12)	2.2 (0.17)	2.8 (0.45)	3.2 (0.71)	1.6	81.7 (62.6-100)
	51-70	57	1.7 (0.33)	0.2 (-)	0.4 (-)	0.7 (0.14)	1.3 (0.08)	2.3 (0.31)	3.6 (0.7)	4.5 (1.02)	1.6	59 (56.9-79.8)
Female	19-50	324	1.4 (0.19)	1 (0.19)	1 (0.2)	1.2 (0.22)	1.4 (0.24)	1.6 (0.27)	1.8 (0.31)	1.9 (0.33)	1.1	84.2 (23.7-99.4)
	51-70	114	1.6 (0.34)	1 (0.18)	1.1 (0.19)	1.3 (0.22)	1.4 (0.25)	1.6 (0.29)	1.8 (0.33)	2 (0.35)	1.1	90.8 (39.5-99.6)

Table 12.10 Cholesterol (mg/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake						
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	163	401 (83)	149 (69)	186 (69)	262 (71)	368 (80)	495 (100)	625 (127)	707 (147)
	51-70	57	323 (23)	88 (43)	120 (39)	190 (28)	290 (16)	418 (38)	558 (88)	653 (139)
Female	19-50	324	308 (23)	165 (49)	190 (46)	241 (39)	308 (30)	387 (30)	468 (49)	521 (68)
	51-70	114	305 (14)	191 (45)	214 (38)	257 (24)	310 (13)	369 (36)	425 (65)	460 (84)

Table 12.11 Total sugars (g/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake						
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	163	96 (13)	65 (14)	71 (13)	81 (12)	94 (12)	108 (18)	122 (26)	130 (31)
	51-70	57	55 (2)	17 (-)	23 (-)	36 (6)	54 (4)	78 (6)	106 (15)	128 (24)
Female	19-50	324	86 (13)	28 (-)	36 (-)	54 (14)	79 (14)	110 (16)	144 (21)	167 (25)
	51-70	114	51 (5)	16 (4)	20 (4)	31 (5)	48 (7)	67 (11)	86 (16)	101 (21)

Table 12.12 Total dietary fibre (g/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake								
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	AI	% > AI (95% CI)
Male	19-50	163	14 (1)	9 (1)	10 (1)	11 (1)	14 (1)	16 (1)	19 (1)	21 (1)	38	0 (0-0.1)
	51-70	57	13 (1)	8 (1)	9 (1)	10 (0.5)	13 (1)	15 (1)	18 (1)	20 (2)	30	0 (0-0.3)
Female	19-50	324	12 (1)	6 (2)	7 (2)	9 (1)	12 (1)	15 (1)	19 (1)	21 (2)	25	1.1 (0-3.1)
	51-70	114	12 (2)	5 (1)	6 (1)	8 (1)	11 (2)	15 (3)	18 (4)	21 (5)	21	4.5 (0-25.4)

Table 12.13 Vitamin A (RAE/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake								
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	%<EAR (95% CI)
Male	19-50	163	445 (50)	291 (42)	323 (45)	382 (51)	452 (57)	528 (62)	604 (69)	654 (74)	625	92.4 (71.4-99.3)
	51-70	57	531 (111)	75 (-)	124 (-)	245 (81)	445 (107)	720 (156)	1035 (196)	1257 (210)	625	67.8 (55.2-96)
Female	19-50	324	317 (27)	149 (44)	178 (40)	233 (32)	305 (26)	390 (31)	477 (47)	534 (61)	500	92.4 (86.4-100)
	51-70	114	493 (115)	233 (46)	272 (54)	351 (70)	460 (96)	600 (136)	762 (191)	879 (236)	500	58.4 (23.9-95.7)

Table 12.14 Vitamin C (mg/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake										
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	% < EAR (95% CI)	UL	% > UL (95% CI)
Male	19-50	163	69 (11)	55 (13)	58 (13)	64 (13)	72 (14)	80 (19)	88 (-)	93 (-)	75	60.5 (22.2-87.9)	2000	0 (0-0)
	51-70	57	56 (4)	7 (-)	12 (-)	26 (7)	53 (9)	98 (17)	161 (41)	212 (68)	75	64.6 (57.6-86.2)	2000	0 (0-0.1)
Female	19-50	324	78 (14)	73 (14)	74 (14)	76 (14)	79 (15)	81 (16)	83 (16)	85 (16)	60	0 (0-99.8)	2000	0 (0-0)
	51-70	114	65 (13)	11 (-)	16 (-)	29 (-)	53 (13)	94 (19)	152 (-)	200 (-)	60	55.8 (23.4-80.8)	2000	0 (0-0)

Table 12.15 Vitamin C (mg/d): Usual intakes from food (by smoking status)

				Percentiles (SE) of usual intake										
Sex	Smoking status	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	% < EAR (95% CI)	UL	% > UL (95% CI)
Males 19+	Non-smoker	93	62 (18)	6 (-)	10 (-)	22 (-)	47 (12)	91 (21)	154 (38)	205 (55)	75	68.1 (54.9-81.6)	2000	0 (0-0)
	Smoker	136	65 (8)	26 (5)	31 (5)	44 (7)	64 (11)	92 (16)	125 (23)	148 (28)	110	84.8 (72.4-98.6)	2000	0 (0-0)
Females 19+	Non-smoker	165	78 (9)	75 (12)	77 (13)	79 (13)	81 (14)	84 (14)	86 (15)	88 (15)	60	0 (0-11.9)	2000	0 (0-0)
	Smoker	289	72 (17)	31 (-)	37 (-)	50 (15)	68 (17)	92 (24)	120 (37)	140 (-)	95	77.1 (39.9-97.8)	2000	0 (0-0)

Table 12.16 Vitamin D (µg/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake										
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	% < EAR (95% CI)	UL	% > UL (95% CI)
Male	19-50	163	4.2 (0.4)	2.2 (0.7)	2.6 (0.78)	3.4 (0.5)	4.3 (0.4)	5.4 (0.5)	6.4 (0.9)	7 (1.3)	10	99.8 (95.8-100)	100	0 (0-0)
	51-70	57	4.8 (1.4)	2.1 (0.2)	2.6 (0.2)	3.4 (0.4)	4.6 (0.7)	6 (1.1)	7.3 (1.6)	8.1 (2.0)	10	99.3 (93.4-100)	100	0 (0-0)
Female	19-50	324	3.6 (0.4)	1.2 (-)	1.5 (0.5)	2.2 (0.4)	3.2 (0.4)	4.5 (0.6)	6.2 (1.0)	7.5 (1.6)	10	98.6 (95.7-100)	100	0 (0-0)
	51-70	114	3.2 (0.1)	1.9 (0.5)	2.1 (0.5)	2.6 (0.3)	3.1 (0.1)	3.6 (0.4)	4.2 (0.8)	4.5 (1.2)	10	100 (99.1-100)	100	0 (0-0)

Table 12.17 Folate (DFE/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake								
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	%<EAR (95% CI)
Male	19-50	163	366 (20)	197 (37)	224 (32)	273 (25)	342 (21)	431 (35)	531 (68)	605 (95)	320	42.3 (17.3-52.4)
	51-70	57	316 (34)	106 (-)	140 (42)	209 (33)	306 (26)	428 (36)	560 (58)	650 (75)	320	53.3 (31.1-81)
Female	19-50	324	304 (20)	216 (18)	233 (18)	263 (18)	301 (19)	345 (23)	388 (28)	417 (32)	320	61.9 (35.4-80.2)
	51-70	114	278 (18)	187 (31)	206 (25)	239 (17)	281 (17)	327 (32)	374 (49)	405 (61)	320	71.8 (49.3-100)

Table 12.18 Vitamin B6 (mg/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake										
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	% < EAR (95% CI)	UL	% > UL (95% CI)
Male	19-50	163	1.5 (0.1)	0.9 (0.1)	1 (0.1)	1.3 (0.1)	1.5 (0.2)	1.8 (0.2)	2.1 (0.2)	2.3 (0.3)	1.1	13 (2.5-25.6)	100	0 (0-0)
	51-70	57	1.4 (0.2)	0.5 (-)	0.7 (0.2)	1 (0.2)	1.4 (0.1)	1.9 (0.1)	2.4 (0.1)	2.8 (0.2)	1.4	48.9 (19.8-57.5)	100	0 (0-0)
Female	19-50	324	1.3 (0.1)	0.9 (0.2)	1 (0.2)	1.2 (0.1)	1.4 (0.1)	1.6 (0.1)	1.9 (0.2)	2.1 (0.3)	1.1	19.7 (0-36.9)	100	0 (0-0)
	51-70	114	1.2 (0.1)	0.6 (0.1)	0.7 (0.1)	0.9 (0.1)	1.2 (0.1)	1.5 (0.2)	1.9 (0.3)	2.1 (0.4)	1.3	57 (28.6-81.7)	100	0 (0-0)

Table 12.19 Vitamin B12 (µg/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake								
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	%<EAR (95% CI)
Male	19-50	163	5.5 (1.1)	3.3 (0.7)	3.8 (0.8)	4.6 (0.8)	5.5 (1.0)	6.6 (1.2)	7.8 (1.5)	8.6 (1.7)	2.0	0.1 (0-3.1)
	51-70	57	4.7 (0.9)	2.9 (0.2)	3.2 (0.3)	3.8 (0.4)	4.6 (0.7)	5.5 (1.2)	6.5 (1.8)	7.1 (2.3)	2.0	0.3 (0-0.7)
Female	19-50	324	4.3 (0.2)	2.8 (0.7)	3.1 (0.7)	3.6 (0.5)	4.3 (0.3)	5.1 (0.3)	5.9 (0.8)	6.5 (1.2)	2.0	0.3 (0-15.9)
	51-70	114	4.4 (0.8)	2.3 (-)	2.7 (0.8)	3.3 (0.8)	4.2 (0.8)	5.2 (1.0)	6.3 (1.3)	7.1 (1.7)	2.0	2.2 (0-31.3)

Table 12.20 Thiamin (mg/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake								
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	%<EAR (95% CI)
Male	19-50	163	1.9 (0.2)	1.2 (0.1)	1.3 (0.1)	1.5 (0.1)	1.8 (0.2)	2.2 (0.2)	2.5 (0.3)	2.7 (0.3)	1.0	1 (0.3-2.2)
	51-70	57	1.8 (0.2)	0.7 (0.2)	0.8 (0.2)	1.2 (0.2)	1.8 (0.2)	2.4 (0.1)	3.1 (0.3)	3.6 (0.4)	1.0	15.2 (2.9-25.9)
Female	19-50	324	1.6 (0.1)	1 (0.2)	1.1 (0.2)	1.3 (0.2)	1.5 (0.2)	1.8 (0.2)	2.1 (0.2)	2.3 (0.3)	0.9	1.7 (0-12)
	51-70	114	1.6 (0.1)	0.7 (0.2)	0.8 (0.2)	1.1 (0.2)	1.5 (0.2)	2 (0.2)	2.6 (0.2)	3 (0.2)	0.9	14.6 (0.7-23.1)

Table 12.21 Riboflavin (mg/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake								
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	%<EAR (95% CI)
Male	19-50	163	2.3 (0.2)	1.5 (0.2)	1.7 (0.2)	1.9 (0.2)	2.2 (0.2)	2.6 (0.2)	2.9 (0.3)	3.2 (0.3)	1.1	0.2 (0-1.5)
	51-70	57	2 (0.2)	1 (0.3)	1.2 (0.2)	1.6 (0.2)	2.1 (0.1)	2.7 (0.2)	3.2 (0.4)	3.6 (0.5)	1.1	6.5 (0-19.3)
Female	19-50	324	1.9 (0.1)	1.1 (0.2)	1.2 (0.2)	1.5 (0.2)	1.8 (0.1)	2.2 (0.1)	2.6 (0.2)	2.9 (0.3)	0.9	1.9 (0-8)
	51-70	114	2 (0.2)	1.2 (0.2)	1.4 (0.2)	1.6 (0.2)	2 (0.2)	2.3 (0.2)	2.7 (0.3)	3 (0.4)	0.9	0.7 (0-2.2)

Table 12.22 Niacin (NE/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake								
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	%<EAR (95% CI)
Male	19-50	163	41.7 (3.6)	39.4 (5.8)	39.9 (5.2)	40.8 (4.4)	41.9 (4.1)	42.9 (5.0)	43.9 (6.8)	44.4 (8.3)	12	0 (0-0.4)
	51-70	57	39.8 (4.7)	14.9 (7.1)	20.1 (5.6)	27.2 (4.2)	37.5 (3.6)	52 (2.5)	68.9 (7.5)	83.6 (12.4)	12	3.3 (0-6.6)
Female	19-50	324	35.8 (2.5)	25.9 (5.1)	28.1 (4.7)	32 (3.9)	36.7 (3.2)	41.8 (3.3)	46.8 (4.5)	49.9 (5.5)	11	0 (0-0.5)
	51-70	114	33.3 (2.8)	21.2 (3.5)	23.8 (3.3)	28.2 (3.0)	33.5 (3.2)	39.4 (4.2)	45.3 (5.8)	49.2 (7.3)	11	0 (0-2.5)

Table 12.23 Calcium (mg/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake										
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	% < EAR (SE)	UL	% > UL (95% CI)
Male	19-50	163	650 (53)	538 (40)	560 (43)	599 (50)	645 (58)	695 (67)	742 (75)	772 (80)	800	97.6 (53.5-100)	2500	0 (0-0)
	51-70	57	476 (63)	202 (-)	258 (79)	367 (60)	500 (34)	645 (32)	802 (70)	917 (101)	800	89.9 (85.9-100)	2000	0 (0-0)
Female	19-50	324	549 (37)	398 (81)	428 (73)	479 (60)	541 (50)	608 (53)	673 (72)	714 (89)	800	99.1 (88.3-100)	2500	0 (0-0)
	51-70	114	514 (30)	329 (54)	363 (46)	423 (33)	496 (38)	575 (66)	650 (99)	697 (121)	1000	100 (95.7-100)	2000	0 (0-0)

Table 12.24 Iron (mg/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake										
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	% inadequacy	UL	% > UL (95% CI)
Male	19-50	163	16.1 (1.0)	11.6 (0.6)	12.5 (0.7)	14.1 (0.8)	16 (1.1)	18.2 (1.4)	20.4 (1.7)	21.8 (1.9)	6.0	0 (0-0)	45	0 (0-0)
	51-70	57	13.9 (1.0)	5 (2.6)	6.8 (2.3)	10 (1.7)	14.1 (0.9)	18.4 (0.9)	22.5 (1.8)	25.1 (2.5)	6.0	7.6 (0-12.1)	45	0 (0-0.1)
Female	19-50	324	13.9 (1.6)	8.1 (2.1)	9.1 (2.0)	11.1 (1.9)	13.7 (1.8)	17 (2.1)	20.6 (2.9)	23.2 (3.8)	7.7	3.5 (0-15)	45	0 (0-0.6)
	51-70	114	12.7 (0.9)	6.8 (1.1)	7.9 (1.0)	10 (0.9)	12.5 (0.9)	15.4 (1.1)	18.5 (1.7)	20.7 (2.2)	5.0	1.2 (0-4.1)	45	0 (0-0.1)

Table 12.25 Potassium (mg/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake								
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	%<EAR (95% CI)
Male	19-50	163	2645 (242)	1776 (321)	1944 (301)	2249 (294)	2617 (329)	3008 (405)	3379 (510)	3614 (591)	4700	0.1 (0-8.9)
	51-70	57	2427 (142)	1149 (346)	1409 (289)	1882 (190)	2453 (95)	3061 (152)	3636 (295)	3991 (386)	4700	1 (0-2.8)
Female	19-50	324	2346 (161)	1655 (330)	1802 (297)	2060 (239)	2368 (186)	2705 (187)	3037 (266)	3252 (343)	4700	0 (0-1.3)
	51-70	114	2220 (217)	1385 (322)	1564 (316)	1870 (256)	2215 (223)	2568 (433)	2908 (544)	3132 (602)	4700	0 (0-6.6)

Table 12.26 Sodium (mg/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake										
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	AI	% > AI (95% CI)	UL	% > UL (95% CI)
Male	19-50	163	4011 (251)	3025 (538)	3210 (476)	3538 (365)	3937 (257)	4379 (268)	4813 (429)	5091 (569)	1500	100 (99.5-100)	2300	100 (92.1-100)
	51-70	57	3147 (216)	1618 (523)	1932 (448)	2507 (298)	3211 (134)	3975 (219)	4711 (457)	5171 (631)	1300	98 (89.1-100)	2300	81.2 (66.8-100)
Female	19-50	324	3264 (243)	2295 (446)	2495 (403)	2853 (334)	3286 (293)	3758 (352)	4217 (492)	4507 (603)	1500	100 (96.3-100)	2300	94.9 (75.5-100)
	51-70	114	2737 (191)	1443 (229)	1683 (205)	2119 (173)	2661 (186)	3283 (295)	3931 (477)	4367 (626)	1300	97 (91.4-100)	2300	67 (48-81.6)

Table 12.27 Magnesium* (mg/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake						
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	163	259 (18)	183 (13)	198 (14)	224 (17)	256 (21)	292 (26)	329 (31)	353 (35)
	51-70	57	238 (16)	151 (41)	169 (36)	201 (27)	240 (15)	281 (10)	320 (21)	344 (31)
Female	19-50	324	226 (18)	144 (34)	160 (31)	190 (26)	227 (20)	268 (18)	309 (22)	335 (28)
	51-70	114	225 (23)	123 (22)	141 (22)	174 (23)	216 (27)	266 (35)	318 (45)	352 (53)

* %<EAR not calculated due to different EAR by age-groups

Table 12.28 Phosphorus (mg/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake										
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	% < EAR (95% CI)	UL	% > UL (95% CI)
Male	19-50	163	1254 (99)	958 (72)	1015 (78)	1117 (89)	1239 (104)	1372 (120)	1501 (136)	1583 (145)	580	0 (0-0)	4000	0 (0-0)
	51-70	57	1085 (104)	449 (146)	573 (125)	806 (86)	1099 (42)	1424 (45)	1742 (93)	1943 (127	580	10.4 (0-17.5)	4000	0 (0-0)
Female	19-50	324	1055 (65)	829 (127)	880 (114)	969 (95)	1072 (86)	1183 (101)	1289 (133)	1355 (159)	580	0 (0-4.5)	4000	0 (0-0)
	51-70	114	995 (60)	622 (90)	702 (82)	839 (73)	996 (75)	1158 (91)	1314 (117)	1413 (137)	580	3.4 (0-9)	4000	0 (0-0)

Table 12.29 Zinc (mg/d): Usual intakes from food, by DRI age-sex group, household population

				Percentiles (SE) of usual intake										
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	EAR	% < EAR (95% CI)	UL	% > UL (95% CI)
Male	19-50	163	13 (1.3)	9.6 (2.0)	10.4 (1.8)	11.7 (1.5)	13.3 (1.2)	15 (1.5)	16.7 (2.5)	17.8 (3.3)	9.4	4 (0.7-41.4)	40	0 (0-0.7)
	51-70	57	11.3 (0.6)	6 (1.9)	7 (1.7)	8.8 (1.2)	11.1 (0.5)	13.6 (0.7)	16 (1.5)	17.5 (2.1)	9.4	31 (4.1-46.7)	40	0 (0-0)
Female	19-50	324	10.4 (0.6)	6.4 (1.6)	7.2 (1.5)	8.6 (1.2)	10.4 (0.9)	12.5 (0.8)	14.7 (1.0)	16.2 (1.3)	6.8	7.3 (0-24.5)	40	0 (0-0)
	51-70	114	10.4 (0.9)	6.1 (1.6)	6.9 (1.5)	8.5 (1.4)	10.4 (1.2)	12.5 (1.5)	14.5 (2.1)	15.7 (2.6)	6.8	9 (0-38.2)	40	0 (0-0.1)

Table 12.30 Percentage of total energy intake from protein, by DRI age-sex group, household population

				Percentiles (SE) of usual intake										
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	AMDR	% below AMDR (95% CI)	% within AMDR (95% CI)	% above AMDR (95% CI)
Male	19-50	163	16 (2)	10 (2)	11 (2)	13 (2)	15 (2)	18 (2)	22 (2)	24 (3)	10-35	5.4 (0-20.4)	94.1 (79.6-100)	0.5 (0-1.5)
	51-70	57	19 (1)	14 (2)	14 (1)	16 (1)	18 (1)	20 (1)	23 (2)	24 (2)	10-35	0 (0-2.7)	100 (96.5-100)	0 (0-1)
Female	19-50	324	16 (1)	11 (2)	12 (1)	14 (1)	16 (1)	19 (0)	22 (1)	24 (2)	10-35	3.5 (0-10.1)	96.4 (89.2-100)	0.2 (0-0.8)
	51-70	114	19 (2)	14 (1)	15 (1)	16 (1)	18 (1)	21 (2)	23 (2)	25 (2)	10-35	0.1 (0-0.3)	99.9 (99.6-100)	0 (0-0.2)

Table 12.31 Percentage of total energy intake from carbohydrates, by DRI age-sex group, household population

				Percentiles (SE) of usual intake										
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	AMDR	% below AMDR (95% CI)	% within AMDR (95% CI)	% above AMDR (95% CI)
Male	19-50	163	49 (3)	38 (2)	40 (1)	44 (2)	49 (3)	53 (4)	57 (5)	59 (5)	45-65	28.9 (9.5-59.9)	70.3 (40.1-89.7)	0.8 (0-4.9)
	51-70	57	45 (1)	32 (1)	35 (1)	40 (1)	45 (1)	50 (2)	54 (2)	56 (2)	45-65	50.8 (37.5-64.6)	49.1 (35.4-61.5)	0.1 (0-1.7)
Female	19-50	324	49 (2)	36 (2)	39 (2)	44 (2)	49 (2)	55 (2)	60 (3)	63 (4)	45-65	30.1 (21-45.3)	66.7 (53.1-77.6)	3.1 (0-10.4)
	51-70	114	45 (1)	33 (2)	35 (2)	39 (2)	44 (2)	49 (2)	54 (2)	57 (2)	45-65	56.7 (36.9-71.8)	42.6 (27.7-61.7)	0.6 (0-1.3)

Table 12.32 Percentage of total energy intake from fats, by DRI age-sex group, household population

				Percentiles (SE) of usual intake										
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)	AMDR	% below AMDR (95% CI)	% within AMDR (95% CI)	% above AMDR (95% CI)
Male	19-50	163	37 (2)	30 (1)	31 (1)	34 (2)	36 (2)	39 (2)	42 (2)	44 (2)	20-35	0 (0-0)	36.5 (10.7-61.9)	63.5 (38.1-89.3)
	51-70	57	37 (1)	29 (0)	31 (0)	34 (0)	37 (1)	41 (1)	44 (1)	46 (2)	20-35	0 (0-0)	30.7 (24.8-32.7)	69.3 (67.3-75.2)
Female	19-50	324	36 (1)	27 (3)	29 (3)	32 (2)	36 (1)	39 (1)	42 (2)	44 (2)	20-35	0.1 (0-2.8)	44.9 (16-55.1)	55 (43.2-84)
	51-70	114	37 (1)	29 (1)	31 (1)	34 (1)	38 (2)	42 (2)	45 (2)	46 (2)	20-35	0 (0-0.2)	29.2 (19.9-57.2)	70.8 (42.8-80)

Table 12.33 Percentage of total energy intake from saturated fats, by DRI age-sex group, household population

				Percentiles (SE) of usual intake						
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	163	11.5 (0.5)	9.2 (0.3)	9.6 (0.4)	10.4 (0.5)	11.3 (0.5)	12.3 (0.6)	13.1 (0.7)	13.7 (0.8)
	51-70	57	11.5 (0.7)	8.8 (1.1)	9.4 (0.9)	10.5 (0.6)	11.6 (0.5)	12.8 (0.7)	13.9 (1.1)	14.6 (1.3)
Female	19-50	324	11.4 (0.3)	7.4 (0.9)	8.2 (0.7)	9.6 (0.5)	11.2 (0.4)	12.8 (0.6)	14.4 (0.9)	15.3 (1.1)
	51-70	114	11.3 (0.4)	8.4 (0.3)	9 (0.3)	10.1 (0.4)	11.3 (0.5)	12.6 (0.7)	13.7 (0.9)	14.4 (1.0)

Table 12.34 Percentage of total energy intake from monounsaturated fats, by DRI age-sex group, household population

				Percentiles (SE) of usual intake						
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	163	14 (1.0)	12 (1)	13 (1.0)	13 (1.0)	14 (1.0)	15 (1.0)	15 (1.0)	16 (1.0)
	51-70	57	14.1 (0.7)	8.5 (1.7)	9.6 (1.4)	11.6 (0.8)	13.9 (0.4)	16.3 (0.9)	18.6 (1.6)	20 (2.0)
Female	19-50	324	13 (1.0)	9 (2.0)	10 (1.0)	11 (1.0)	13 (1.0)	15 (1.0)	16 (1.0)	17 (1.0)
	51-70	114	14.1 (0.4)	10.4 (0.6)	11.2 (0.5)	12.6 (0.5)	14.3 (0.5)	16.1 (0.6)	17.6 (0.7)	18.6 (0.7)

Table 12.35 Percentage of total energy intake from polyunsaturated fats, by DRI age-sex group, household population

				Percentiles (SE) of usual intake						
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	163	7.9 (0.5)	5.4 (0.9)	5.9 (0.8)	6.8 (0.5)	7.8 (0.4)	8.9 (0.7)	10.1 (1.2)	10.9 (1.5)
	51-70	57	6.8 (0.7)	4.3 (0.4)	4.7 (0.7)	5.6 (-)	6.8 (-)	8 (-)	9.1 (-)	9.7 (-)
Female	19-50	324	7.6 (0.3)	5.8 (0.3)	6.1 (0.3)	6.8 (0.4)	7.6 (0.4)	8.4 (0.5)	9.1 (0.5)	9.6 (0.6)
	51-70	114	7.6 (0.3)	5.9 (1.0)	6.4 (0.9)	7.1 (0.5)	7.9 (0.4)	8.8 (0.7)	9.7 (1.1)	10.2 (1.5)

Table 12.36 Percentage of energy from linoleic acid, by DRI age-sex group, household population

				Percentiles (SE) of usual intake						
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	163	6.5 (0.5)	4.3 (0.8)	4.8 (0.7)	5.5 (0.4)	6.5 (0.4)	7.5 (0.7)	8.6 (1.3)	9.4 (1.8)
	51-70	57	5.7 (0.7)	5.5 (-)	5.6 (-)	5.6 (-)	5.7 (-)	5.7 (-)	5.8 (-)	5.8 (-)
Female	19-50	324	6.1 (0.2)	5.9 (0.3)	6 (0.3)	6 (0.3)	6.1 (0.3)	6.2 (0.3)	6.2 (0.3)	6.3 (0.3)
	51-70	114	5.9 (0.3)	6 (0.6)	6 (0.6)	6 (0.6)	6.1 (0.7)	6.2 (0.7)	6.2 (0.7)	6.3 (0.7)

Table 12.37 Percentage of energy from linolenic acid, by DRI age-sex group, household population

				Percentiles (SE) of usual intake						
Sex	Age	n	Mean (SE)	5th (SE)	10th (SE)	25th (SE)	50th (SE)	75th (SE)	90th (SE)	95th (SE)
Male	19-50	163	0.7 (0.06)	0.3 (0.12)	0.4 (0.11)	0.5 (0.09)	0.7 (0.07)	0.9 (0.08)	1.1 (0.13)	1.2 (0.19)
	51-70	57	0.7 (0.07)	0.3 (0.06)	0.3 (0.05)	0.5 (0.03)	0.7 (0.04)	0.9 (0.1)	1.1 (0.18)	1.3 (0.24)
Female	19-50	324	0.6 (0.06)	0.4 (0.05)	0.4 (0.05)	0.5 (0.06)	0.6 (0.07)	0.7 (0.08)	0.8 (0.09)	0.9 (0.1)
	51-70	114	0.8 (0.08)	0.5 (0.06)	0.5 (0.06)	0.6 (0.07)	0.8 (0.09)	0.9 (0.12)	1 (0.16)	1.1 (0.19)

Table 13. Mean number of food guide servings consumed per day by Manitoba First Nations men (n=229) and women (n=454) living on-reserve compared to Canada's Food Guide (CGF) recommendations (unweighted)

Food Group	Gender	Manitoba First Nations current intake	Canada's Food Guide Recommendations
		Food Guide Servings per day	
Vegetables & Fruits	men	5.0	7 - 10
	women	4.3	7 - 8
Meat & Alternatives	men	3.9	3
	women	2.9	2
Grain Products	men	6.1	7 - 8
	women	4.9	6 - 7
Milk & Alternatives	men	1.0	2 - 3
	women	0.8	2 - 3

Table 14. Top 5 contributors to Canada's Food Guide (% of total group intake), Manitoba First Nations women and men, living on-reserve

Gender	Canada's Food Guide Food Groups			
	Fruit/Vegetable (%)	Meat & alternates (%)	Grain products (%)	Milk & alternates (%)
Women	Potatoes 42.6% Vegetable soups 10.9% Fruit juices 7.4% Fresh fruits 5.5% Fresh/frozen vegetables 5.3%	Moose/caribou /elk/deer 14.8% Eggs 12.6% Chicken 9.8% Ham/sausages 8.6% Ground beef 8.4%	White bread 24.7% Noodles 17.5% Rye/whole wheat bread 12.0% Bannock 8.4% Rice 5.4%	Fresh milk 28.8% Cream soups 22.1% Macaroni & cheese 11.1% Mashed potatoes 9.7% Cheddar cheese 9.2%
Men	Potatoes 43.5% Vegetable soups 18.2% Fruit juices 4.1% Fresh fruits 3.4% Fresh/frozen Vegetables 7.1%	Moose/caribou/ elk/deer 12.8% Eggs 12.2% Ham/sausages 12.1% Chicken 11.7% Ground beef 7.3%	White bread 24.0% Noodles 21.0% Bannock 11.4% Rye/whole wheat Bread 11.0% Rice 3.8%	Fresh milk 25.6% Cheddar cheese 20.6% Cream soups 16.8% Macaroni & cheese 7.0% Mashed potatoes 6.0%

Table 15. Ten most important contributors to macro and micronutrients for Manitoba First Nations living on-reserve

a) Energy		b) Protein		c) Fat		d) Carbohydrate	
FOOD	**% of total**	**FOOD**	**% of total**	**FOOD**	**% of total**	**FOOD**	**% of total**
Chips/popcorn/salty snacks	6.4	Chicken	13.0	Chips/popcorn/salty snacks	9.9	Carbonated drinks, regular	11.5
Carbonated drinks, regular	5.5	Beef	8.7	Chicken	7.3	Bread, white	8.3
Bread, white	5.3	Moose meat	8.1	Margarine	7.2	Pasta	7.6
Chicken[1]	5.3	Eggs	6.3	Cold cuts/sausages	6.6	Jam/honey/syrup/sugar	6.0
Pasta	5.2	Pasta	5.3	Eggs	6.6	Chips/popcorn/salty snacks	5.6
Pizza	4.2	Cold cuts/sausages	4.7	Beef	5.1	Cereal	5.4
Soups[2]	3.8	Pizza	4.3	Pizza	4.9	Soups	4.6
Eggs	3.6	Bread, white	3.9	Vegetable oil	4.3	Bread, whole wheat	4.4
Beef[3]	3.5	Pork[4]	3.6	Hash browns, french fries, onion rings	3.7	Bannock	4.0
Cold cuts/sausages	3.4	Soups	3.0	Butter	3.2	Hash browns, french fries, onion rings	3.7

e) Saturated Fat		f) Monounsaturated Fat		g) Polyunsaturated Fat		h) Cholesterol	
FOOD	**% of total**	**FOOD**	**% of total**	**FOOD**	**% of total**	**FOOD**	**% of total**
Cold cuts/sausages	7.4	Margarine	8.6	Chips/popcorn/salty snacks	20.8	Eggs	46.0
Beef	6.6	Cold cuts/sausages	7.8	Margarine	11.1	Chicken	10.5
Chips/popcorn/salty snacks	6.5	Chicken	7.7	Chicken	7.8	Beef	6.3
Butter	6.4	Eggs	7.3	Eggs	5.5	Cold cuts/sausages	4.6
Chicken	6.1	Vegetable oil	7.2	Vegetable oil	5.4	Moose meat	4.3
Eggs	5.9	Chips/popcorn/salty snacks	7.1	Hash browns, french fries, onion rings	4.2	Pork	2.5
Pizza	5.7	Beef	6.3	Pizza	4.0	Butter	2.0
Margarine	4.1	Pizza	5.3	Bread, white	3.7	Milk	1.6
Coffee whitener	3.9	Hash browns, french fries, onion rings	3.8	Cakes/pies/pastries	3.5	Pizza	1.6
Hash browns, french fries, onion rings	3.6	Hotdogs	3.5	Cold cuts/sausages	3.0	Fish	1.3

Table 15. Ten most important contributors to macro and micronutrients for Manitoba First Nations living on-reserve (continued)

i) Total Sugars		j) Fibre		k) Vitamin A		l) Vitamin C	
FOOD	**% of total**	**FOOD**	**% of total**	**FOOD**	**% of total**	**FOOD**	**% of total**
Carbonated drinks, regular	29.8	Bread, whole wheat	11.3	Eggs	22.5	Fruit drinks	32.7
Jam/honey/syrup/sugar	16.4	Cereal	10.6	Vegetables	15.6	Fruit juice	27.3
Fruit drinks	5.9	Chips/popcorn/salty snacks	8	Margarine	14.9	Vegetables	7.7
Fruit juice	4.9	Bread, white	7.3	Milk	10.1	Chips/popcorn/salty snacks	5.9
Milk	4.4	Vegetables	6.9	Soups	7.2	Fruits	5.9
Fruits	4.1	Pasta	6.7	Butter	5.3	Potatoes, boiled/baked/mashed	5.0
Cakes/pies/pastries	3.7	Hash browns, french fries, onion rings	5.9	Pizza	3.7	Hash browns, french fries, onion rings	2.8
Iced tea	3.0	Soups	5.6	Moose liver	3.6	Soups	2.7
Cereal	2.7	Pizza	5.2	Chicken	2.5	Milk	1.4
Soups	2.4	Potatoes, boiled/baked/mashed	4.4	Cheese	2.1	Moose meat	1.2

m) Vitamin D		n) Folate		o) Calcium		p) Iron	
FOOD	**% of total**	**FOOD**	**% of total**	**FOOD**	**% of total**	**FOOD**	**% of total**
Margarine	25.3	Pasta	14.9	Milk	14.5	Cereal	12.3
Eggs	19.9	Bread, white	12.8	Bread, white	8.7	Bread, white	9.1
Milk	17.8	Soups	9.2	Pizza	8.1	Moose meat	6.4
Fish	10.9	Eggs	7.2	Bannock	7.8	Soups	6.2
Pasta	4.8	Bread, whole wheat	5.8	Cheese	5.6	Pasta	5.7
Cold cuts/sausages	4.6	Tea	4.3	Pasta	5.3	Beef	4.5
Chicken	3.0	Chips/popcorn/salty snacks	4.1	Fruit drinks	4.6	Bread, whole wheat	4.2
Hotdogs	1.8	Vegetables	4.0	Eggs	3.8	Pizza	3.8
Pork	1.8	Cereal	3.7	Bread, whole wheat	3.4	Chicken	3.7
Beef	1.5	Pizza	3.3	Cereal	3.1	Eggs	3.6

Table 15. Ten most important contributors to macro and micronutrients for Manitoba First Nations living on-reserve (continued)

q) Sodium		r) Zinc	
FOOD	**% of total**	**FOOD**	**% of total**
Soups	15.2	Beef	13.9
Cold cuts/sausages	7.7	Moose meat	12.3
Bread, white	7.2	Chicken	6.3
Salt, table	6.1	Cereal	5.2
Pizza	5.1	Eggs	4.4
Chips/popcorn/salty snacks	4.9	Pasta	4.1
Pasta	4.6	Pizza	3.9
Bread, whole wheat	4.0	Cold cuts/sausages	3.8
Eggs	3.4	Soups	3.2
Condiments	2.7	Bread, whole wheat	2.8

[1] chicken= roasted, baked, fried and stewed
[2] soups= canned soups and ramen noodles
[3] beef= ground, steak, ribs and brisket
[4] pork= loin, chops and ribs

Table 16. Comparison of nutrient intake (mean ± SE) on days with and without traditional food (TF), Manitoba First Nations living on-reserve

Nutrient	Days with TF (n=140 recalls)	Days without TF (n=566 recalls)
	mean ± SE	
Energy (kcals)	2024 ± 75.46	1941 ± 40.74
Protein (g)***	122 ± 5.04	72 ± 1.74
Fat (g)	76 ± 3.98	81 ± 2.18
Carbohydrate (g)	222 ± 10.1	237 ± 5.58
Total sugars (g)*	67 ± 5.03	82 ± 3
Fibre (g)	13 ± 0.85	13 ± 0.34
Cholesterol (g)**	411 ± 21.99	317 ± 12.16
Total Saturated Fat (g)*	22 ± 1.27	26 ± 0.69
Total Monounsaturated Fat (g)	30 ± 1.91	30 ± 0.86
Total Polyunsaturated Fat (g)	17 ± 1.05	17 ± 0.62
Linoleic acid (g)	13 ± 0.85	14 ± 0.55
Linolenic acid (g)**	2 ± 0.21	1 ± 0.06
Calcium (mg)	602 ± 29.09	559 ± 15.66
Iron (mg)***	23 ± 1.49	13 ± 0.29
Zinc (mg)***	19 ± 0.98	10 ± 0.26
Magnesium (mg)***	293 ± 13.6	224 ± 4.93
Copper (mg)***	2 ± 0.09	1 ± 0.03
Potassium (mg)***	2992 ± 109.48	2284 ± 52.43
Sodium (mg)***	2707 ± 159.69	3439 ± 87.28
Phosphorus (mg)***	1466 ± 59.14	1031 ± 23.99
Vitamin A (µg)	471 ± 68.69	390 ± 14.94
Vitamin D (µg)**	6 ± 0.69	3 ± 0.13
Vitamin C (mg)	85 ± 10.18	76 ± 6.33
Folate (µg)	303 ± 19.02	314 ± 9.09
Thiamin (mg)	2 ± 0.11	2 ± 0.05
Riboflavin (mg)***	2.4 ± 0.11	1.9 ± 0.04
Niacin (mg)***	49 ± 2.1	35 ± 0.82
Vitamin B6 (mg)***	2 ± 0.1	1 ± 0.03
Vitamin B12 (µg)***	12 ± 0.86	3 ± 0.11

*significantly different, unpaired t-test, $p<0.05$; **$p<0.01$; ***$p<0.0001$

Table 17. Top 10 consumed market food (grams/person/day), consumers and non-consumers combined, ranked by overall decreasing amount of consumption, total and by ecozones

Total Manitoba participants		Ecozone 1		Ecozone 2		Ecozone 3		Ecozone 4	
Market Food	g/person/day	Market Food	g/person/day	Market Food	g/person/day	Market Food	g/person/day	Market Food	g/person/day
BEVERAGES									
Coffee	509	Coffee	558	Coffee	587	Coffee	444	Coffee	810
Water, tap	365	Water, tap	443	Water, bottled	293	Water, tap	427	Water, tap	573
Carbonated drinks, regular	279	Tea	295	Tea	277	Carbonated drinks, regular	282	Tea	277
Tea	264	Carbonated drinks, regular	289	Carbonated drinks, regular	275	Tea	247	Carbonated drinks, regular	126
Water, bottled	205	Water, bottled	136	Water, tap	188	Water, bottled	186	Fruit drinks	67
Fruit drinks[1]	79	Fruit drinks	89	Carbonated drinks, diet	109	Fruit drinks	71	Milk	36
Milk	65	Milk	59	Fruit drinks	91	Milk	68	Water, bottled	35
Fruit juice[2]	53	Iced tea	52	Milk	63	Fruit juice	63	Fruit juice	21
Carbonated drinks, diet	41	Fruit juice	45	Fruit juice	42	Iced tea	16	Iced tea	16
Iced tea	26	Carbonated drinks, diet	28	Iced tea	32	Carbonated drinks, diet	10	Vitamin water	2
FOOD									
Soups[3]	182	Soups	176	Soups	166	Soups	194	Soups	138
Pasta	55	Potatoes	76	Pasta	52	Cereal	55	Pasta	99
Cereal	45	Pasta	63	Vegetables	44	Pasta	53	Eggs	59
Vegetables[4]	45	Cold cuts/sausages	50	Chicken	44	Chicken	48	Vegetables	45
Chicken[5]	44	Pizza	45	Bread, white	42	Vegetables	48	Chicken	43
Eggs	42	Bannock	45	Cereal	35	Eggs	47	Bread, white	36
Bread, white	38	Bread, white	44	Potatoes	35	Bread, white	34	Cereal	35
Potatoes[6]	38	Chips/popcorn/salty snacks	38	Eggs	33	Rice/barley	34	Hash browns, french fries, onion rings	32
Pizza	32	Vegetables	36	Pizza	32	Fruits	33	Potatoes	29
Fruits	28	Eggs	34	Beef[7]	31	Pizza	29	Beef	27

1 fruit drinks= fruit flavoured, sweetened drinks, frozen/crystals/canned
2 fruit juice= pure fruit juice, fresh/frozen/canned
3 soups=canned soups and ramen noodles
4 vegetables= fresh, frozen, canned (excludes potatoes)
5 chicken= roasted, baked, fried and stewed
6 potatoes= boiled, baked, mashed (excludes French fries)
7 beef= ground, steak, ribs and brisket

Table 18. Mean grams of traditional food per person per day (from fall 24hr recalls), consumers and non-consumers combined, ranked by overall decreasing amount of consumption, by ecozone/culture area and total

	Ecozone				
	Total Manitoba First Nations	1	2	3	4
	Percent of recalls with traditional food (Number of recalls over total recalls)				
	20% (140/706)	16% (27/170)	14% (26/187)	13% (30/232)	49% (57/117)
Traditional Food	Mean grams/ person/ day				
Moose meat	18.27	2.88	14.62	24.09	31.87
Wild rice	3.03	.	.	5.57	.
Walleye-pickerel	2.75	.	.	4.94	3.30
Duck meat	2.53	8.46	4.30	.	.
Deer meat	1.86	11.07	0.49	.	.
Caribou meat	1.67	.	.	.	88.46
Elk meat	1.54	8.56	0.75	.	.
Salmon	1.41	1.20	2.53	0.94	.
Blueberries	1.08	.	0.84	1.47	2.31
Rabbit	0.92	4.19	0.94	.	.
Strawberries	0.81	.	.	1.49	.
Moose kidney	0.71	.	.	1.29	0.59
Whitefish	0.44	.	0.29	.	18.93
Cranberries	0.24	.	0.61	.	3.79
Pike	0.16	.	0.58	.	.
Labrador tea	0.16	0.00	.	0.29	0.00
Moose liver	0.12	.	0.43	.	.

Table 18. Mean grams of traditional food per person per day (from fall 24hr recalls), consumers and non-consumers combined, ranked by overall decreasing amount of consumption, by ecozone/culture area and total (continued)

	Ecozone				
	Total Manitoba First Nations	1	2	3	4
	Percent of recalls with traditional food (Number of recalls over total recalls)				
	20% (140/706)	16% (27/170)	14% (26/187)	13% (30/232)	49% (57/117)
Traditional Food	Mean grams/ person/ day				
Raspberries	0.12	.	.	0.21	.
Perch	0.07	0.10	.	0.11	.
Moose fat	0.03	.	.	0.05	.
Caribou fat	0.03	.	.	.	1.37
Trout	0.02	.	.	.	1.29
Caribou eyes	0.02	.	.	.	0.97
Ptarmigan meat	0.01	.	.	.	0.58
Caribou heart	0.01	.	.	.	0.58
Caribou brain	0.01	.	.	.	0.55
Saskatoon berries	0.002	0.01	.	.	.

(.) indicates that the food was not reported on any of the 24hr recalls from that ecozone

Figure 23. Use of nutritional supplements used by Manitoba First Nations living on-reserve (see Appendix G for list of types of supplements reported)

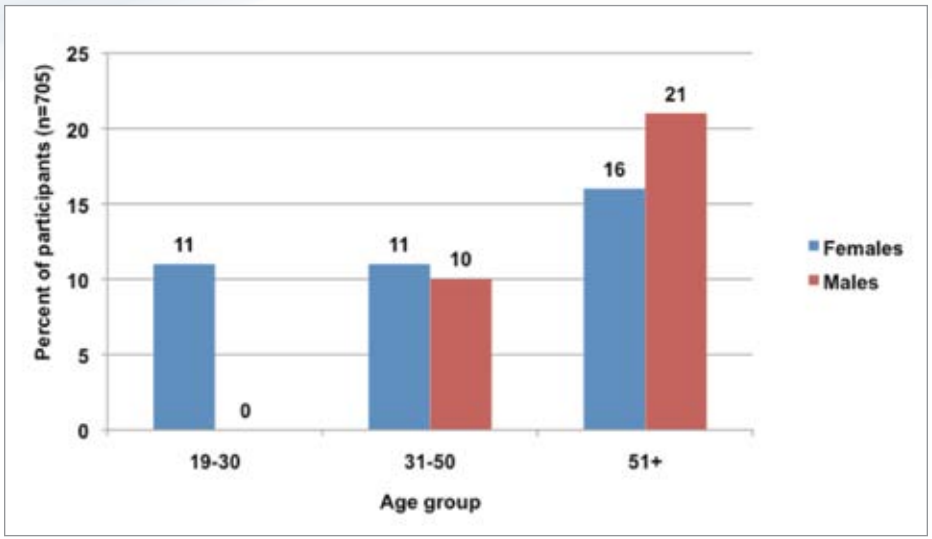


Figure 24. Percent of participants who, in the past 12 months, worried that their traditional food would run out before they could get more (n=656)

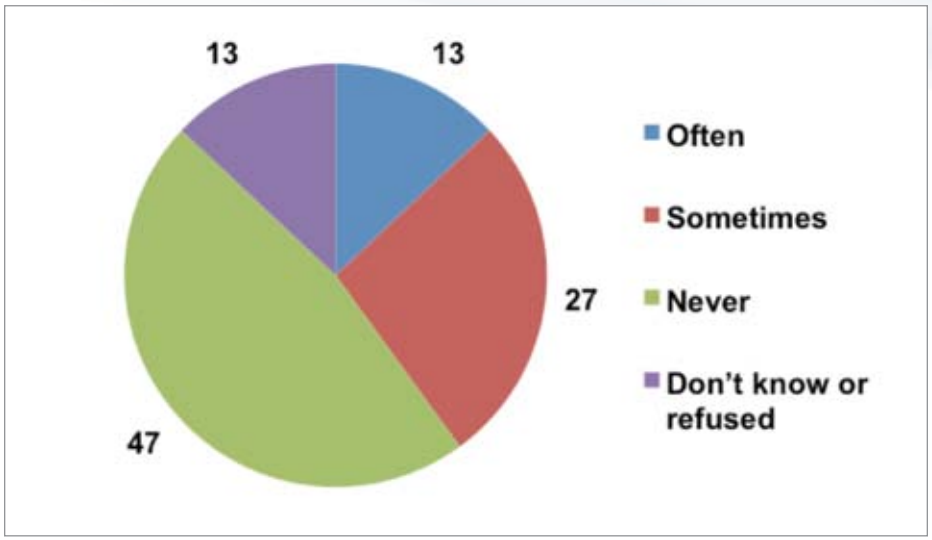


Figure 25. Percent of participants who, in the past 12 months, worried that their traditional food just didn't last and they couldn't get more (n=656)

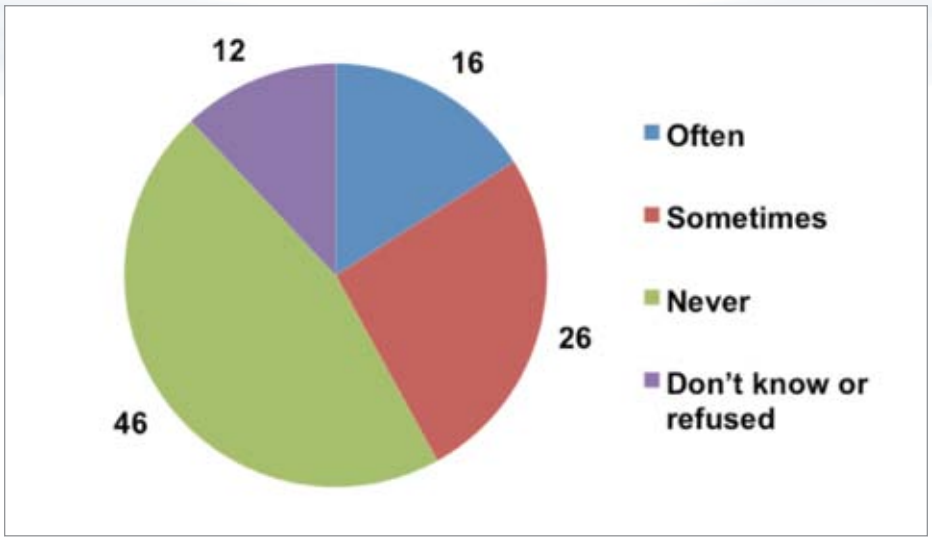


Table 19. Percent of on-reserve Manitoba First Nations who responded affirmatively to food security questions (in the last 12 months)

	Households affirming item					
	All Households (n=646)		Households with Children (n=477)		Households without Children (n=169)	
	n	%	n	%	n	%
Adult Food Security Scale						
You and other household members worried food would run out before you got money to buy more	240	35.2	171	35.1	69	35.4
Food you and other household members bought didn't last and there wasn't any money to get more	228	31.8	162	31.3	66	34.1
You and other household members couldn't afford to eat balanced meals	221	30.8	151	29.8	70	35.5
You or other adults in your household ever cut size of meals or skipped meals	74	10.8	44	9.0	30	19.2
You or other adults in your household ever cut size of meals or skipped meals in 3 or more months	52	7.4	26	5.6	26	15.5
You (personally) ever ate less than you felt you should	82	11.3	55	10.8	27	13.8
You (personally) were ever hungry but did not eat	52	8.1	33	7.2	19	12.6
You (personally) lost weight	32	4.9	18	3.9	14	10.0
You or other adults in your household ever did not eat for a whole day	30	4.0	20	3.6	10	5.6
You or other adults in your household ever did not eat for a whole day in 3 or more months	20	2.4	12	2.0	8	4.0
Child Food Security Scale						
You or other adults in your household relied on less expensive foods to feed children	161	26.2	161	31.7	-	-
You or other adults in your household couldn't feed children a balanced meal	118	19.4	118	23.5	-	-
Children were not eating enough	75	12.3	75	14.8	-	-
You or other adults in your household ever cut size of any of the children's meals	21	4.5	21	5.4	-	-
Any of the children were ever hungry	14	1.9	14	2.4	-	-
Any of the children ever skipped meals	13	1.8	13	2.2	-	-
Any of the children ever skipped meals in 3 or more months	10	1.8	10	2.2	-	-
Any of the children ever did not eat for a whole day	7	1.6	7	2.0	-	-

(-) denotes not applicable

Figure 26. Degree of food insecurity in Manitoba First Nations living on-reserve[9] (n=646)

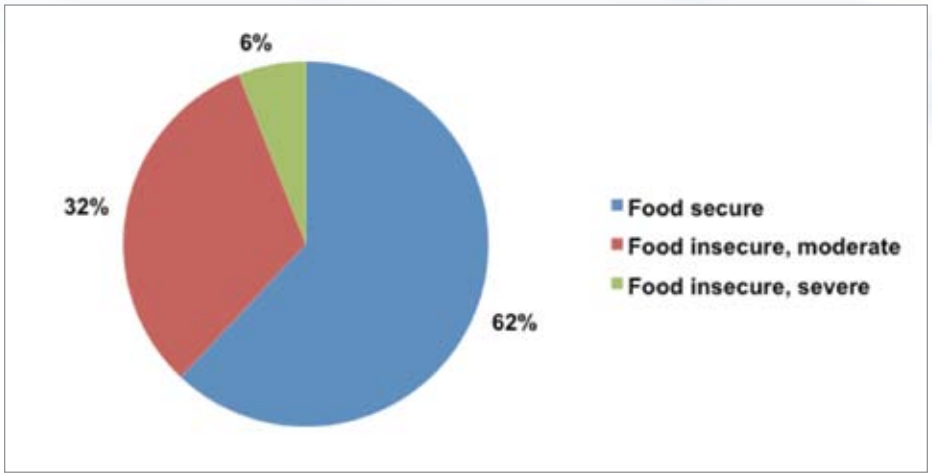
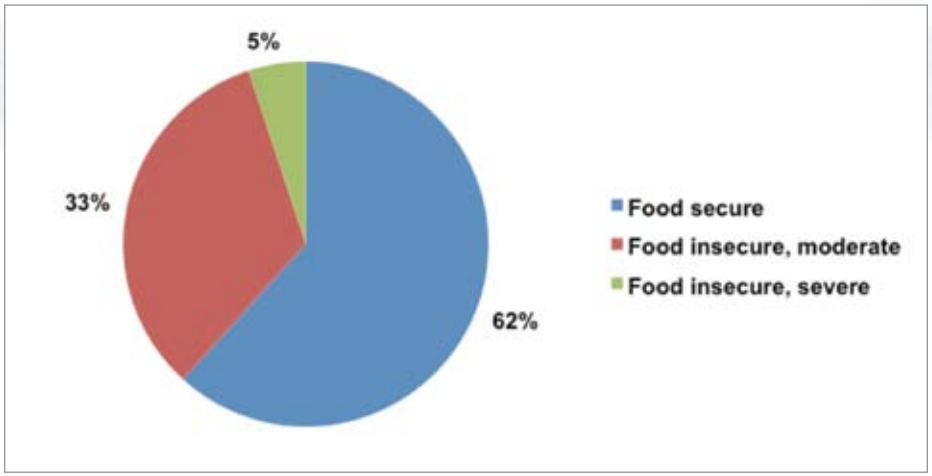


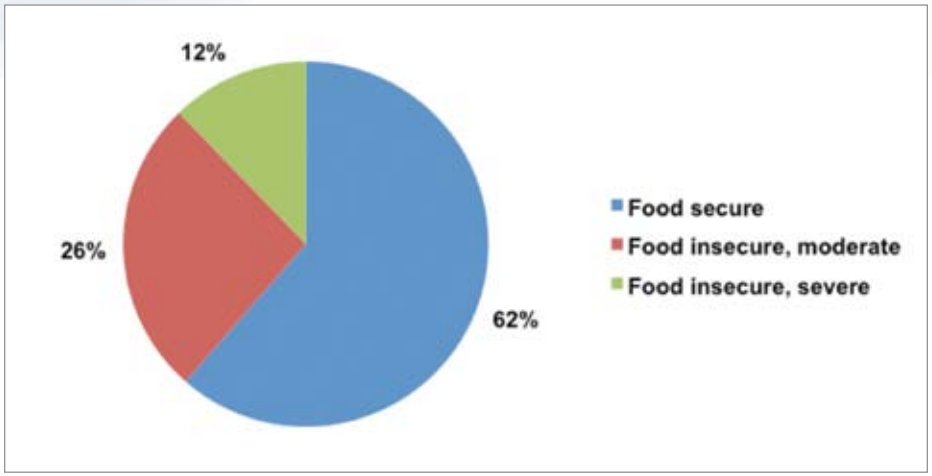
Figure 27. Degree of food insecurity in Manitoba First Nations on-reserve households with children[10] (n=477)



[9] Classification of food security scale based on CCHS 2.29. Canadian Community Health Survey Cycle 2.2, Nutrition, H. Canada, Editor. 2004, Her Majesty the Queen in Right of Canada: Ottawa.

[10] Classification of food security scale based on CCHS 2.29. Ibid.

Figure 28. Degree of food insecurity in Manitoba First Nations on-reserve households without children[11] (n=169)



11 Classification of food security scale based on CCHS 2.29. Ibid.

Table 20. Income-related Manitoba First Nations on-reserve household food security status, by households with and without children

		Income-related food security status											
		Food Secure			Food Insecure								
		All			All			Moderate			Severe		
		n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI
All households	Household status	382	62	58-65	264	38	35-42	215	32	28-36	49	6	4-8
	Adult status	398	64	60-67	248	36	33-40	199	30	26-34	49	6	4-8
	Child status	356	63	60-66	121	19	16-22	109	17	14-21	12	2	1-3
Households with children	Household status	284	62	57-66	193	38	34-43	166	33	29-37	27	5	3-7
	Adult status	300	64	60-69	177	36	31-40	150	31	27-35	27	5	3-7
	Child status	356	76	73-80	121	24	20-27	109	21	17-25	12	2	1-4
Households without children	Household status	98	61	54-69	71	39	31-46	49	26	19-33	22	12	7-17

Figure 29. Income-related Manitoba First Nations on-reserve household food insecurity by ecozone/culture area(n=706), unweighted

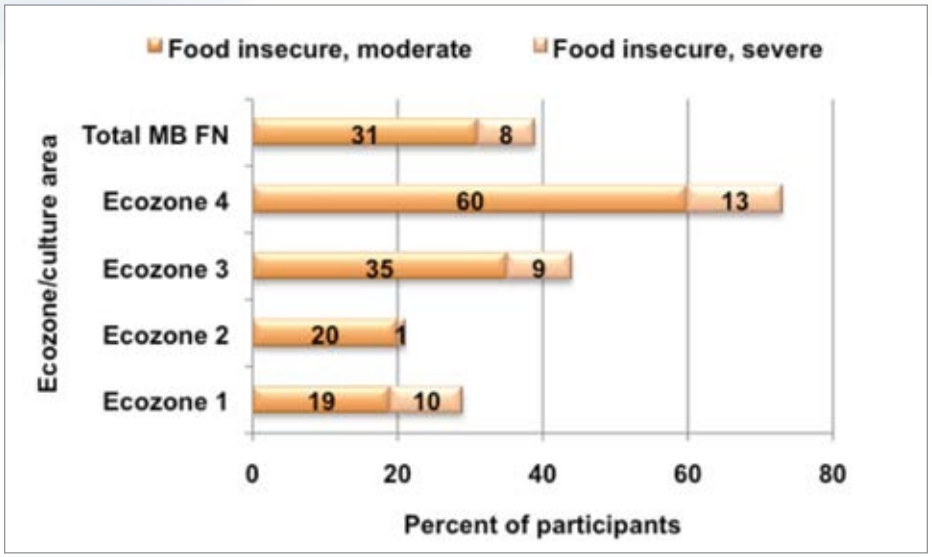
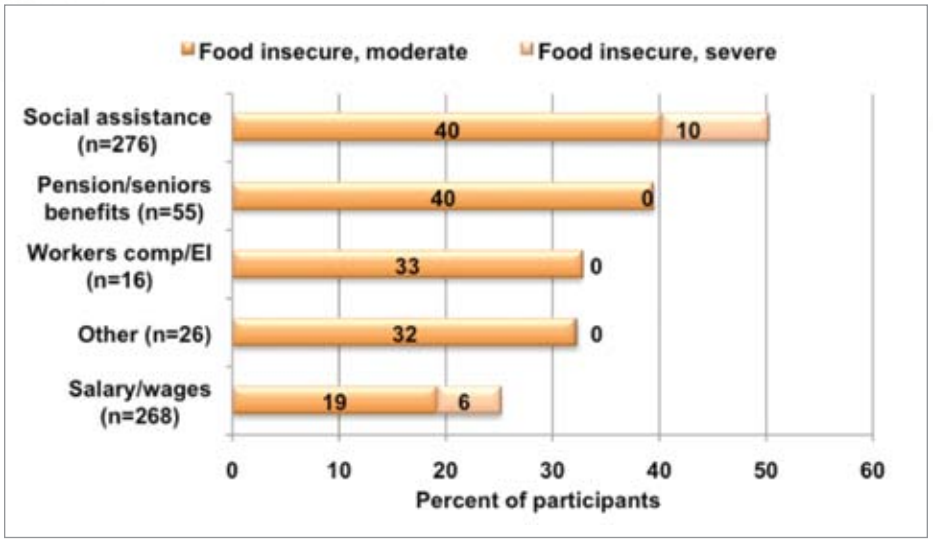


Figure 30. Income-related Manitoba First Nations on-reserve household food insecurity by income sources (n=700)



*note: other sources of income include no income and sponsorship (job-training stipend)

Table 21. Comparison of food prices in Manitoba FN communities (by ecozone) to Winnipeg

Food Item	Purchase unit	Average weekly quantity needed	Ecozone 1 (n=4 stores)	Ecozone 2 (n=2 stores)	Ecozone 3 (n=4 stores)	Ecozone 4 (n=1 store)	Winnipeg
	Price per purchase unit in dollars						
Milk Products							
2% Milk (fresh)	/4L	10.45 L	17.97	18.27	13.41	35.25	10.37
fruit yoghurt (2% MF)	/500g	230 g	1.78	1.63	1.51	2.32	1.85
cheddar cheese, medium	/227g	245 g	5.47	6.20	5.69	7.68	3.60
processed cheese slices	/500g	275 g	3.41	5.26	4.88	5.29	2.14
mozzarella cheese (16.5% MF)	/227g	365 g	8.25	8.25	7.68	12.13	3.81
vanilla ice cream (10%MF)	/2 L	900 g	2.62	2.31	2.50	4.87	1.53
Eggs							
Grade A large eggs	/dozen	1	2.59	3.12	3.10	4.09	1.97
Meat, Fish and Poultry							
inside round steak	/kg	500 g	5.04	5.31	5.58	5.31	4.32
boneless stewing beef	/kg	210 g	1.90	2.22	2.06	2.01	1.47
ground beef (regular)	/kg	655 g	3.65	2.55	4.18	3.61	3.13
pork chops (loin, centre cut)	/kg	400 g	3.76	3.62	4.52	4.04	3.08
chicken legs, no back	/kg	1.34 kg	7.26	8.64	6.89	7.30	7.08
wieners(beef and pork)	/450g	165 g	1.15	1.46	1.33	3.19	0.98
sliced ham (11%)	/175g	335 g	6.04	6.93	5.86	6.63	4.77
frozen fish fillets, block	/400g	200 g	2.71	2.64	2.57	2.64	2.73
canned pink salmon	/213 g	115 g	1.37	1.66	1.63	3.10	1.19
canned flaked light tuna, packed in water	/170g	65 g	1.13	1.06	1.02	1.11	0.51

Food Item	Purchase unit	Average weekly quantity needed	Ecozone 1 (n=4 stores)	Ecozone 2 (n=2 stores)	Ecozone 3 (n=4 stores)	Ecozone 4 (n=1 store)	Winnipeg
	Price per purchase unit in dollars						
Meat Alternatives							
canned baked beans in tomato sauce	/398 ml	330 g	1.18	1.29	1.40	1.97	0.57
dry white beans	/454g	80 g	0.39	0.50	0.36	0.40	0.34
peanut butter, smooth	/500g	365 g	2.72	4.00	3.23	2.76	1.81
Grain Products							
enriched white bread, sliced	/675g	1.4 kg	5.19	5.01	5.39	8.03	5.14
100% whole wheat bread, sliced	/675g	1.4 kg	5.91	5.47	5.67	8.01	6.75
hot dog or hamburger buns (white)	/8 pack	18 rolls	4.16	4.47	4.84	6.09	2.79
flour, all purpose	/2.5kg	655 g	1.40	1.57	1.31	2.77	1.02
flour, whole wheat	/2.5kg	165 g	0.44	0.49	0.47	0.75	0.26
macaroni or spaghetti	/900g	755 g	3.50	3.25	2.61	4.14	1.04
long grain white rice	/900g	550 g	3.21	3.37	3.70	4.64	1.20
boxed macaroni and cheese	/225g	155 g	1.01	1.16	1.03	1.65	0.47
oatmeal, regular quick cooking	/1 kg	55 g	0.16	0.27	0.20	0.26	0.16
Corn Flakes cereal	/675g	345 g	3.62	3.51	2.68	4.12	1.18
Shreddies cereal	/800g	345 g	3.19	3.25	3.08	4.27	2.33
soda crackers, salted	/450g	205 g	1.61	1.83	1.30	2.72	1.30
social tea cookies	/400g	455 g	3.40	3.40	3.40	3.40	3.22

Table 21. Comparison of food prices in Manitoba FN communities (by ecozone) to Winnipeg (continued)

Food Item	Purchase unit	Average weekly quantity needed	Ecozone 1 (n=4 stores)	Ecozone 2 (n=2 stores)	Ecozone 3 (n=4 stores)	Ecozone 4 (n=1 store)	Winnipeg
	Price per purchase unit in dollars						
Citrus Fruits and Tomatoes							
oranges	/kg	710 g	1.95	2.11	2.08	4.49	2.00
canned apple juice made from concentrate, unsweetened and vitamin C added	/1.36L	1 L	2.38	3.25	2.44	2.56	1.22
orange juice, frozen concentrate	/355ml	330 ml	2.30	2.09	2.44	2.33	1.48
fresh tomatoes	/kg	560 g	2.13	2.06	1.97	7.67	1.45
canned whole tomatoes	/796 ml	240 ml	0.80	0.68	0.68	1.18	0.42
tomato juice, canned	/1.36L	165 ml	0.51	0.64	0.50	1.13	0.26
Other Fruits							
apples, Macintosh	/kg	1.8 kg	5.30	5.88	6.68	12.86	5.49
bananas	/kg	2.3 kg	6.83	7.02	7.01	13.27	3.97
grapes, green seedless	/kg	480 g	3.61	3.01	3.47	5.43	2.63
pear	/kg	755 g	2.63	2.55	2.48	2.55	2.14
raisins, seedless	/750g	100 g	0.68	0.62	0.73	1.16	0.44
canned fruit cocktail, canned in juice (not syrup)	/398ml	335 g	2.13	2.13	1.95	3.40	1.64
Potatoes							
fresh potatoes	/4.54kg	5.5 kg	8.19	8.36	3.93	24.51	6.02
french fried potatoes, frozen	/kg	615 g	2.87	2.36	2.67	2.93	1.03
Other Vegetables							
broccoli	/kg	585 g	3.69	3.69	3.15	6.92	1.66
cabbage	/kg	255 g	0.51	0.51	0.44	0.94	0.33
carrots	/kg	885 g	3.31	2.33	2.83	4.10	1.53

Food Item	Purchase unit	Average weekly quantity needed	Ecozone 1 (n=4 stores)	Ecozone 2 (n=2 stores)	Ecozone 3 (n=4 stores)	Ecozone 4 (n=1 store)	Winnipeg
	Price per purchase unit in dollars						
celery	/kg	345 g	1.34	0.90	1.64	1.30	1.28
cucumber	/kg	455 g	2.11	2.15	2.02	9.43	1.78
iceberg lettuce	/kg	450 g	2.07	1.70	2.06	3.57	1.08
romaine lettuce	/kg	595 g	3.18	3.18	2.92	4.73	1.26
onions, cooking	/kg	740 g	1.61	1.17	2.14	4.00	1.44
green peppers	/kg	305 g	1.08	2.03	1.60	2.21	1.20
turnips, yellow (rutabaga)	/kg	360 g	1.36	1.36	1.36	2.23	0.38
frozen mixed vegetables	/kg	330 g	1.08	1.23	1.35	1.22	0.92
canned kernel corn	/341ml	565 ml	2.14	3.02	1.77	2.46	0.99
canned green peas	/540ml	215 ml	1.00	1.01	0.94	1.21	0.35
Fats and Oils							
tub, margarine, non-hydrogre-nated	/454g	365 g	1.87	2.28	2.75	2.40	1.99
butter, salted	/454g	190 g	2.06	2.07	2.81	0.00	1.66
canola oil	/1 L	230 ml	1.19	1.26	1.02	1.37	0.70
salad dressing, mayonnaise-type	/500ml	195 ml	1.49	1.63	1.51	2.16	1.40
Sugar							
sugar, white	/2 kg	845 g	2.16	2.13	1.76	3.23	1.69
strawberry jam with pectin	/500ml	155 ml	1.31	1.41	1.35	2.14	0.93
		Subtotal:	197.21	204.98	192.46	311.39	137.88
		Miscellaneous at 5% of subtotal:	9.86	10.25	9.62	15.57	6.89
		Average food basket price in dollars (Cdn):	**207.07**	**215.22**	**202.09**	**326.96**	**144.78**

Figure 31. Percent of Manitoba First Nations living on-reserve who noticed any significant climate change in their traditional territory in the last 10 years

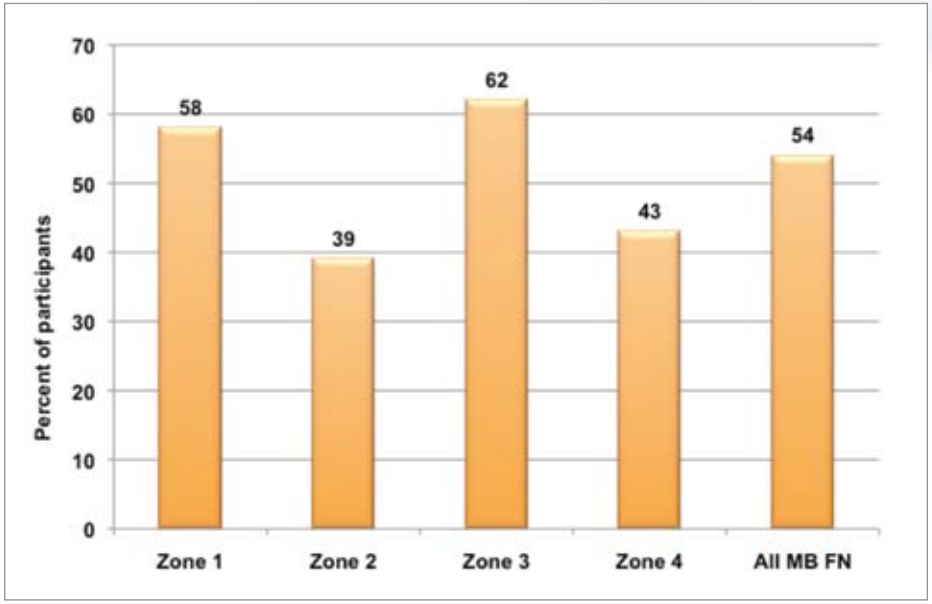
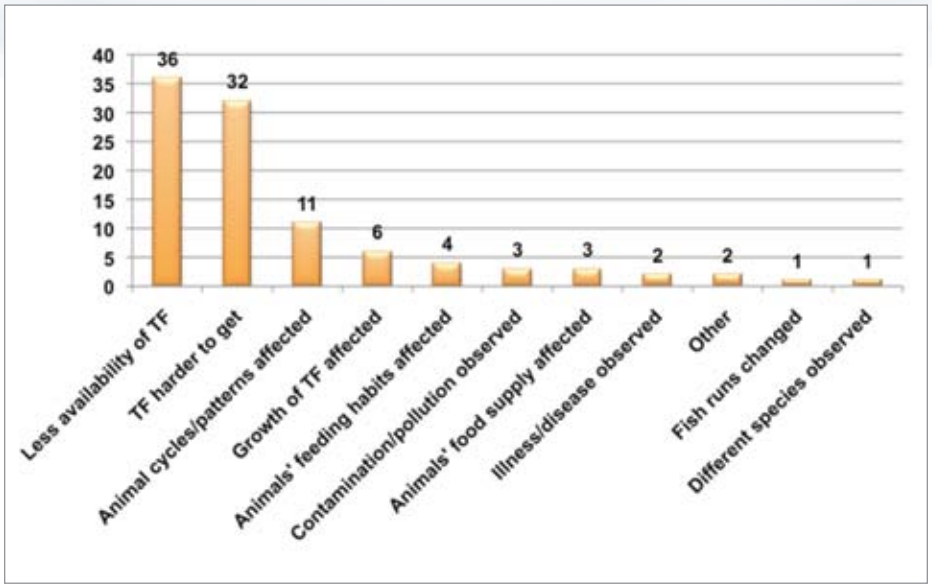


Figure 32. How climate change has affected traditional food availability in Manitoba FN on-reserve households (n=217 valid responses)



Tap Water Analyses

Table 22. Characteristics of homes and plumbing, Manitoba First Nations living on-reserve

Characteristic	Answer
Average year home was built (Range) (n=419)	1993 (1939, 2010)
Percent of HH with upgraded plumbing (n=706)	20%
Average year plumbing upgraded (Range) (n=121)	2006 (1980, 2010)
Percent of HH that treat water (e.g. with filters) (n=705)	22%
Percent of HH with a water storage system (n=705)	37%
Location of water storage system (n=246):	
Inside	17%
Outside	83%
Type of water storage system (n=173):	
Able to be carried (bucket)	8%
Fixed in place	92%
Percent of type of pipes under kitchen sink (n=665)	
Metal	31%
Plastic	46%
Plastic with metal fittings	19%

Figure 33. Household water source and use, Manitoba First Nations living on-reserve (n=706)

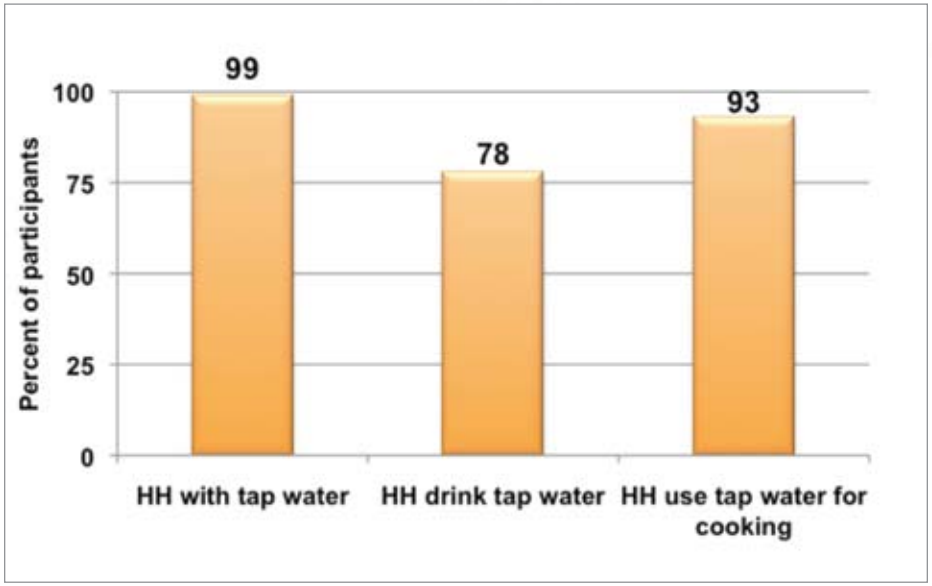
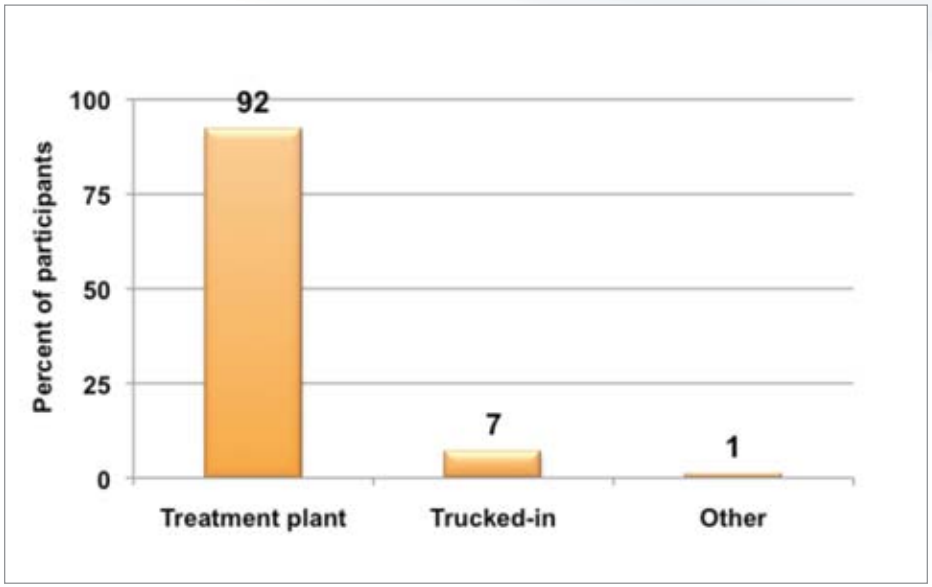
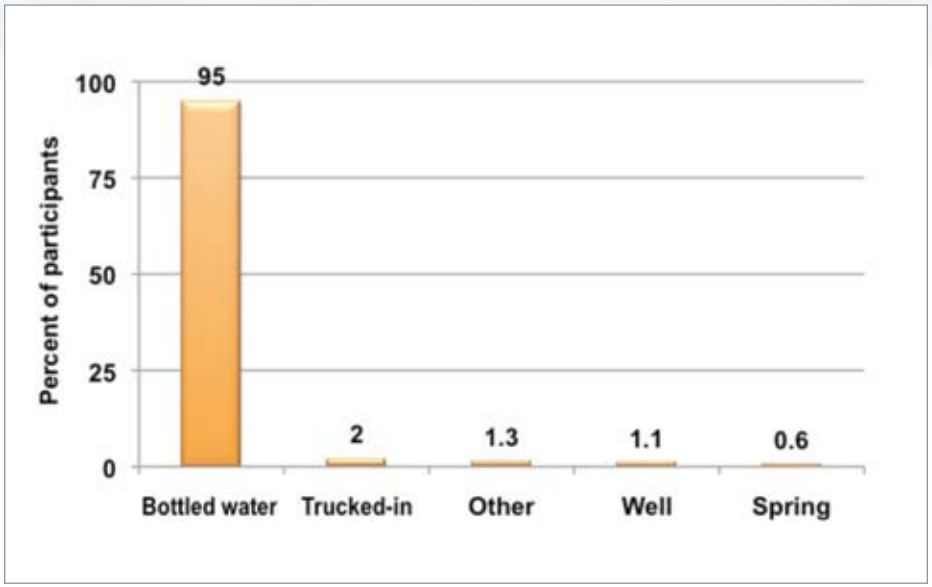


Figure 34. Source of tap water, Manitoba First Nations living on-reserve (n=688)



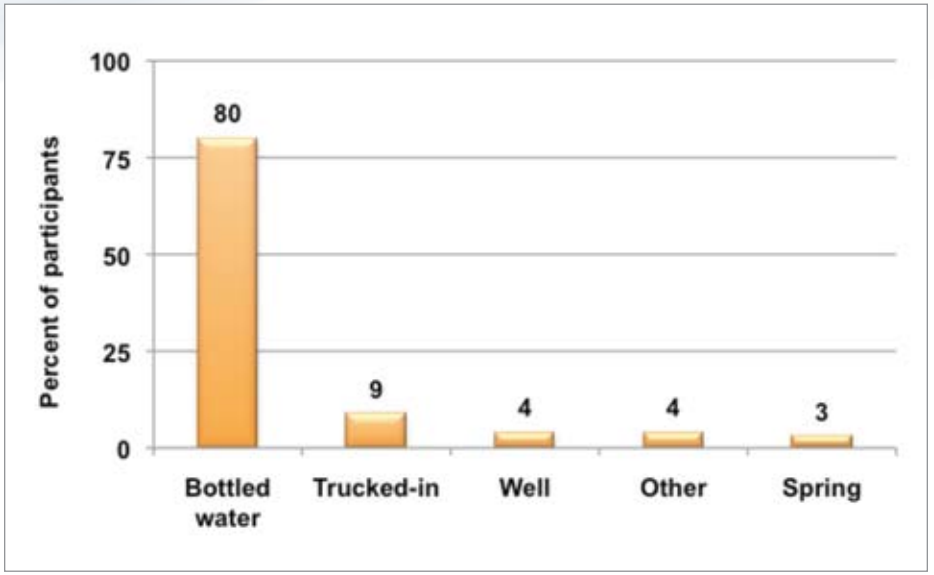
*other=well and rainwater cistern

Figure 35. Source of drinking water if no tap water or don't use tap water, Manitoba First Nations living on-reserve (n=153)



*other sources not specified

Figure 36. Source of water for preparation of food/beverages if no tap water or don't use tap water, Manitoba First Nations living on-reserve (n=53)



*other sources not specified

Figure 37. Does the taste of chlorine prevent you from drinking the tap water?

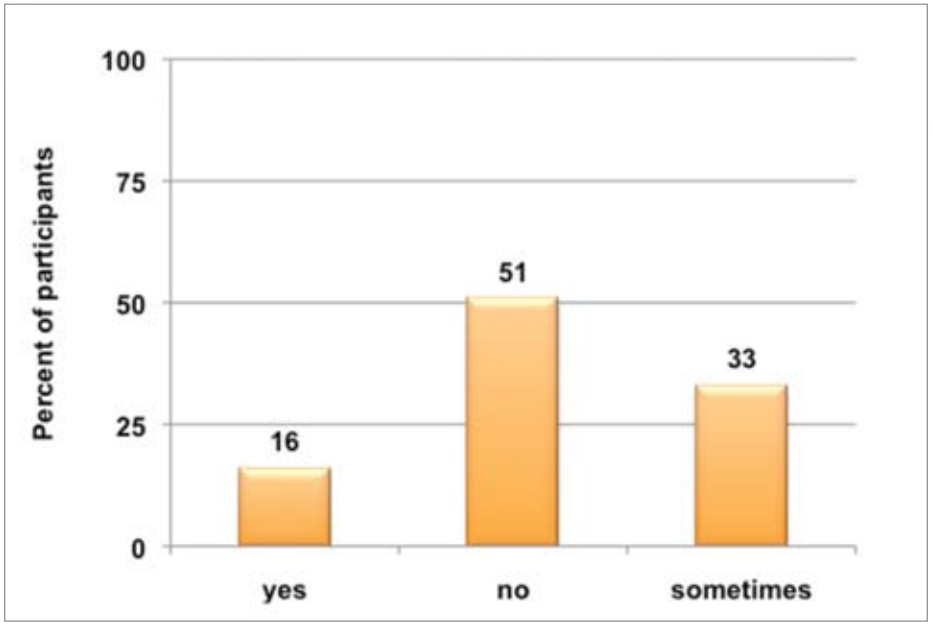


Table 23: Trace metals analysis results for parameters of health concern

Trace Metal Detected	Maximum Detected (µg/L)	Detection Limit (DL) - µg/L	MAC - Maximum Allowable Concentration -GCDWQ, 2008- (µg/L)	Total Number of Samples in Excess			Comments
				First Draw	Flushed (5 Min)	Duplicate	
All Ecozones Combined							
Antimony, Sb	0.8	<0.2	**6**	0	0	0	Below guideline value.
Arsenic, As	2.4	<0.2	**10**	0	0	0	Below guideline value.
Barium, Ba	317	<0.2	**1,000**	0	0	0	Below guideline value.
Boron, B	1450	<10	**5,000**	0	0	0	Below guideline value.
Cadmium, Cd	2.8	<0.04	**5**	0	0	0	Below guideline value.
Chromium, Cr	9.8	<0.2	**50**	0	0	0	Below guideline value.
Lead, Pb	50.7	<0.2	**10**	13	1	1	Flushed or Resampled. Below guideline value.
Selenium, Se	3.5	<0.2	**10**	0	0	0	Below guideline value.
Uranium, U	9.6	<0.1	**20**	0	0	0	Below guideline value.
Ecozones							
Prairies/Plains							
Antimony, Sb	0.3	<0.2	**6**	0	0	0	Below guideline value.
Arsenic, As	1.2	<0.2	**10**	0	0	0	Below guideline value.
Barium, Ba	204	<0.2	**1,000**	0	0	0	Below guideline value.
Boron, B	1450	<10	**5,000**	0	0	0	Below guideline value.
Cadmium, Cd	0.1	<0.04	**5**	0	0	0	Below guideline value.
Chromium, Cr	1.2	<0.2	**50**	0	0	0	Below guideline value.
Lead, Pb	12.3	<0.2	**10**	1	0	0	Flushed sample below guideline value.
Selenium, Se	3.5	<0.2	**10**	0	0	0	Below guideline value.
Uranium, U	7.5	<0.1	**20**	0	0	0	Below guideline value.

Trace Metal Detected	Maximum Detected (µg/L)	Detection Limit (DL) - µg/L	MAC - Maximum Allowable Concentration -GCDWQ, 2008- (µg/L)	Total Number of Samples in Excess			Comments
				First Draw	Flushed (5 Min)	Duplicate	
Prairies/Subarctic							
Antimony, Sb	0.5	<0.2	**6**	0	0	0	Below guideline value.
Arsenic, As	2.4	<0.2	**10**	0	0	0	Below guideline value.
Barium, Ba	100	<0.2	**1,000**	0	0	0	Below guideline value.
Boron, B	223	<10	**5,000**	0	0	0	Below guideline value.
Cadmium, Cd	0.1	<0.04	**5**	0	0	0	Below guideline value.
Chromium, Cr	0.3	<0.2	**50**	0	0	0	Below guideline value.
Lead, Pb	9.9	<0.2	**10**	0	0	0	Below guideline value.
Selenium, Se	0.5	<0.2	**10**	0	0	0	Below guideline value.
Uranium, U	9.6	<0.1	**20**	0	0	0	Below guideline value.
Boreal Plains/Plains							
Antimony, Sb	<0.2	<0.2	**6**	0	0	0	Below guideline value.
Arsenic, As	2.4	<0.2	**10**	0	0	0	Below guideline value.
Barium, Ba	97.3	<0.2	**1,000**	0	0	0	Below guideline value.
Boron, B	398	<10	**5,000**	0	0	0	Below guideline value.
Cadmium, Cd	0	<0.04	**5**	0	0	0	Below guideline value.
Chromium, Cr	0.2	<0.2	**50**	0	0	0	Below guideline value.
Lead, Pb	8	<0.2	**10**	0	0	0	Below guideline value.
Selenium, Se	<0.2	<0.2	**10**	0	0	0	Below guideline value.
Uranium, U	1.0	<0.1	**20**	0	0	0	Below guideline value.
Boreal Plains/Subarctic							
Antimony, Sb	<0.2	<0.2	**6**	0	0	0	Below guideline value.
Arsenic, As	1.3	<0.2	**10**	0	0	0	Below guideline value.
Barium, Ba	35.3	<0.2	**1,000**	0	0	0	Below guideline value.
Boron, B	38	<10	**5,000**	0	0	0	Below guideline value.

Table 23: Trace metals analysis results for parameters of health concern (continued)

Trace Metal Detected	Maximum Detected (µg/L)	Detection Limit (DL) - µg/L	MAC - Maximum Allowable Concentration -GCDWQ, 2008- (µg/L)	Total Number of Samples in Excess			Comments
				First Draw	Flushed (5 Min)	Duplicate	
Cadmium, Cd	2.8	<0.04	**5**	0	0	0	Below guideline value.
Chromium, Cr	2.6	<0.2	**50**	0	0	0	Below guideline value.
Lead, Pb	50.7	<0.2	**10**	7	1	1	Flushed or Resampled. Below guideline value.
Selenium, Se	<0.2	<0.2	**10**	0	0	0	Below guideline value.
Uranium, U	0.3	<0.1	**20**	0	0	0	Below guideline value.
Boreal Shield/Subarctic							
Antimony, Sb	<0.2	<0.2	**6**	0	0	0	Below guideline value.
Arsenic, As	1.3	<0.2	**10**	0	0	0	Below guideline value.
Barium, Ba	35.3	<0.2	**1,000**	0	0	0	Below guideline value.
Boron, B	38	<10	**5,000**	0	0	0	Below guideline value.
Cadmium, Cd	2.8	<0.04	**5**	0	0	0	Below guideline value.
Chromium, Cr	2.6	<0.2	**50**	0	0	0	Below guideline value.
Lead, Pb	50.7	<0.2	**10**	7	1	1	Flushed or Resampled. Below guideline value.
Selenium, Se	<0.2	<0.2	**10**	0	0	0	Below guideline value.
Uranium, U	0.3	<0.1	**20**	0	0	0	Below guideline value.
Taiga Shield/Subarctic							
Antimony, Sb	<0.2	<0.2	**6**	0	0	0	Below guideline value.
Arsenic, As	<0.2	<0.2	**10**	0	0	0	Below guideline value.
Barium, Ba	5.3	<0.2	**1,000**	0	0	0	Below guideline value.
Boron, B	<10	<10	**5,000**	0	0	0	Below guideline value.
Cadmium, Cd	<0.04	<0.04	**5**	0	0	0	Below guideline value.
Chromium, Cr	<0.2	<0.2	**50**	0	0	0	Below guideline value.
Lead, Pb	11.2	<0.2	**10**	1	0	0	Flushed sample below guideline value.
Selenium, Se	<0.2	<0.2	**10**	0	0	0	Below guideline value.
Uranium, U	<0.1	<0.1	**20**	0	0	0	Below guideline value.

Table 24: Trace metals analysis results for parameters of aesthetic or operational concern

Trace Metal Detected	Maximum Detected (µg/L)	Detection Limit (DL) - µg/L	AO - Aesthetic Objective -GCDWQ, 2008- (µg/L)	Total Number of Samples in Excess			Comments
				First Draw	Flushed (5 Min)	Duplicate	
All Ecozones Combined							
Aluminum, Al	33,100	<1	**100/200***	82	77	18	Resampled above guideline. Elevated levels pose no health concern.
Copper, Cu	6,540	<0.2	**1,000**	12	2	0	Flushed or Resampled. Below guideline value.
Iron, Fe	1,700	<10	**300**	6	2	1	Resampled above guideline. Elevated levels pose no health concern.
Manganese, Mn	444	<0.2	**50**	27	26	5	Resampled above guideline. Elevated levels pose no health concern.
Sodium, Na	392,000	<10	**200,000**	23	22	4	Resampled above guideline. Elevated levels pose no health concern.
Zinc, Zn	6,460	<1	**5,000**	2	0	0	Flushed samples below guideline value.
Ecozones							
Prairies/Plains							
Aluminum, Al	31	<1	**100/200***	0	0	0	Below guideline value.
Copper, Cu	1,890	<0.2	**1,000**	1	0	0	Flushed samples below guideline value.
Iron, Fe	234	<10	**300**	0	0	0	Below guideline value.
Manganese, Mn	81	<0.2	**50**	6	5	0	Resampled above guideline. Elevated levels pose no health concern.
Sodium, Na	208,000	<10	**200,000**	1	1	0	Resampled above guideline. Elevated levels pose no health concern.
Zinc, Zn	472	<1	**5,000**	0	0	0	Below guideline value.

Table 24: Trace metals analysis results for parameters of aesthetic or operational concern (continued)

Trace Metal Detected	Maximum Detected (µg/L)	Detection Limit (DL) - µg/L	AO - Aesthetic Objective -GCDWQ, 2008- (µg/L)	Total Number of Samples in Excess			Comments
				First Draw	Flushed (5 Min)	Duplicate	
Prairies/Subarctic							
Aluminum, Al	290	<1	**100/200***	17	14	5	Resampled above guideline. Elevated levels pose no health concern.
Copper, Cu	465	<0.2	**1,000**	0	0	0	Below guideline value.
Iron, Fe	217	<10	**300**	0	0	0	Below guideline value.
Manganese, Mn	22	<0.2	**50**	0	0	0	Below guideline value.
Sodium, Na	215,000	<10	**200,000**	2	2	0	Resampled below guideline.
Zinc, Zn	275	<1	**5,000**	0	0	0	Below guideline value.
Boreal Plains/Plains							
Aluminum, Al	152	<1	**100/200***	20	18	4	Resampled above guideline. Elevated levels pose no health concern.
Copper, Cu	1,820	<0.2	**1,000**	3	0	0	Flushed samples below guideline value.
Iron, Fe	1,700	<10	**300**	2	2	1	Resampled above guideline. Elevated levels pose no health concern.
Manganese, Mn	191	<0.2	**50**	1	1	1	Resampled above guideline. Elevated levels pose no health concern.
Sodium, Na	392,000	<10	**200,000**	20	19	4	Resampled below guideline.
Zinc, Zn	1,460	<1	**5,000**	0	0	0	Below guideline value.
Boreal Plains/Subarctic							
Aluminum, Al	17	<1	**100/200***	0	0	0	Below guideline value.
Copper, Cu	721	<0.2	**1,000**	0	0	0	Below guideline value.
Iron, Fe	26	<10	**300**	0	0	0	Below guideline value.

Trace Metal Detected	Maximum Detected (µg/L)	Detection Limit (DL) - µg/L	AO - Aesthetic Objective -GCDWQ, 2008- (µg/L)	Total Number of Samples in Excess			Comments
				First Draw	Flushed (5 Min)	Duplicate	
Manganese, Mn	27	<0.2	**50**	0	0	0	Below guideline value.
Sodium, Na	4,480	<10	**200,000**	0	0	0	Below guideline value.
Zinc, Zn	4,240	<1	**5,000**	0	0	0	Below guideline value.
Boreal Shield/Subarctic							
Aluminum, Al	33,100	<1	**100/200***	30	30	6	Resampled above guideline. Elevated levels pose no health concern.
Copper, Cu	6,540	<0.2	**1,000**	7	2	0	Flushed or Resampled. Below guideline value.
Iron, Fe	964	<10	**300**	4	0	0	Resampled above guideline. Elevated levels pose no health concern.
Manganese, Mn	444	<0.2	**50**	20	20	4	Resampled above guideline. Elevated levels pose no health concern.
Sodium, Na	25,400	<10	**200,000**	0	0	0	Below guideline value.
Zinc, Zn	6,460	<1	**5,000**	2	0	0	Resampled below guideline.
Taiga Shield/Subarctic							
Aluminum, Al	1,060	<1	**100/200***	15	15	3	Resampled above guideline. Elevated levels pose no health concern.
Copper, Cu	1,260	<0.2	**1,000**	1	0	0	Flushed samples below guideline value.
Iron, Fe	189	<10	**300**	0	0	0	Below guideline value.
Manganese, Mn	6	<0.2	**50**	0	0	0	Below guideline value.
Sodium, Na	10,800	<10	**200,000**	0	0	0	Below guideline value.
Zinc, Zn	2,030	<1	**5,000**	0	0	0	Below guideline value.

* This is an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants. The operational guidance values of 0.1 mg/L applies to conventional treatment plants (as is the case in the Manitoba First Nations communities participating in this study), and 0.2 mg/L

Table 25. Pharmaceuticals tested for in surface water from Manitoba FN on-reserve communities

Pharmaceutical	Human	Veterinary	Aquaculture	Primary Use
Acetaminophen	X			Analgesic/anti-inflammatory
Atenolol	X			Beta-blocker, antihypertensive
Atorvastatin	X			Statin, lowers cholesterol
Bezafibrate	X			Lipid regulator
Caffeine	X			Stimulant
Carbamazepine	X			Anticonvulsant
Chlortetracycline		X		Antibiotic
Cimetidine	X			Antacid, peptic ulcers
Ciprofloxacin	X			Antibiotic
Clarithromycin	X			Antibiotic
Codeine	X			Analgesic
Cotinine	X			Metabolite of nicotine (smoking cessation)
Clofibric acid	X	X		Lipid regulator
Dehydronifedipine	X			Antianginal metabolite
Diclofenac	X			Analgesic/anti-inflammatory
Diltiazem	X			Antihypertensive
Diphenhydramine	X			Antihistamine
17a-Ethinylestradiol	X			Oral contraceptive
Erythromycin	X	X		Antibiotic
Fluoxetine	X	X		Antidepressant
Furosemide	X			Diuretic

Pharmaceutical	Human	Veterinary	Aquaculture	Primary Use
Gemfibrozil	X			Lipid regulator
Hydrochlorothiazide	X			Diuretic
Ibuprofen	X			Analgesic/anti-inflammatory
Indomethacin	X			Analgesic/anti-inflammatory
Ketoprofen	X	X		Analgesic/anti-inflammatory
Lincomycin		X		Antibiotic
Metformin	X			Antidiabetic
Metoprolol	X			Beta-blocker, antihypertensive
Monensin		X		Antibiotic
Naproxen	X			Analgesic/anti-inflammatory
Oxytetracycline		X	X	Antibiotic
Pentoxyfylline	X	X		Antidiabetic
Ranitidine	X			Antacid
Roxithromycin	X			Antibiotic
Sulfamethazine		X		Antibiotic
Sulfamethoxazole	X			Antibiotic
Tetracycline	X	X		Antibiotic
alpha-Trenbolone		X		Steroid
beta-Trenbolone		X		Steroid
Trimethoprim	X	X	X	Antibiotic
Warfarin	X	X		Anticoagulant

Table 26. Pharmaceuticals quantified in Manitoba FN on-reserve communities

Pharmaceutical	Human	Veterinary	Aquaculture	Primary Use
Caffeine	X			stimulant
Carbamazepine	X			anticonvulsant
Cotinine	X			metabolite of nicotine (smoking cessation)
17a-Ethinylestradiol	X			oral contraceptive
Metformin	X			antidiabetic
Sulfamethoxazole	X			antibiotic

Table 27: Number of pharmaceuticals detected by number of Manitoba First Nations on-reserve communities and number of sites

	Pharmaceutical	# of Communities	# of Sites	FNFNES Max Concentration ng/L	Canadian & US Studies ng/L	Reference
1	Caffeine	4	7	26.6	1,470	Waiser et al., 2011
2	Carbamazepine	1	3	4.74	7,100	Wu et al., 2009
3	Cotinine	2	3	5.1	189	Glassmeyer et al. 2005
4	17α-Ethinylestradiol	1	1	0.45	831	Kolpin et al., 2002
5	Metformin	5	9	46.1	150	Kolpin et al., 2002
6	Sulfamethoxazole	1	3	4.5	871	Yargeau et al., 2007

Table 28: Level of pharmaceuticals in surface water, by total and by ecozone

Pharmaceutical Detected	Max (ng/L)	Detection Limit (ng/L)	Number of Samples Collected	Number of Samples Non-detected
All Ecozones Combined: Pharmaceuticals Detected in Surface Water				
Caffeine	26.6	<5	36	29
Carbamazepine	4.74	<0.5	36	33
Cotinine	5.1	<5	36	33
17α-Ethinylestradiol	0.45	<0.2	36	35
Metformin	46.1	<10	36	27
Sulfamethoxazole	4.5	<2	36	33
Prairies/Plains: Pharmaceuticals Detected in Surface Water				
Caffeine	<5	<5	3	3
Carbamazepine	<0.5	<0.5	3	3
Cotinine	<5	<5	3	3
17α-Ethinylestradiol	<0.2	<0.2	3	3
Metformin	<10	<10	3	3
Sulfamethoxazole	<2	<2	3	3
Prairies/Subarctic: Pharmaceuticals Detected in Surface Water				
Caffeine	<5	<5	3	3
Carbamazepine	<0.5	<0.5	3	3
Cotinine	5.1	<5	3	2
17α-Ethinylestradiol	<0.2	<0.2	3	3
Metformin	<10	<10	3	3
Sulfamethoxazole	<2	<2	3	3

Pharmaceutical Detected	Max (ng/L)	Detection Limit (ng/L)	Number of Samples Collected	Number of Samples Non-detected
Boreal Plains/Plains: Pharmaceuticals Detected in Surface Water				
Caffeine	17.7	<5	3	0
Carbamazepine	<0.5	<0.5	3	3
Cotinine	<5	<5	3	3
17α-Ethinylestradiol	<0.2	<0.2	3	3
Metformin	<10	<10	3	3
Sulfamethoxazole	<2	<2	3	3
Boreal Plains/Subarctic: Pharmaceuticals Detected in Surface Water				
Caffeine	<5	<5	3	3
Carbamazepine	4.74	<0.5	3	0
Cotinine	5.1	<5	3	1
17α-Ethinylestradiol	<0.2	<0.2	3	3
Metformin	14.1	<10	3	0
Sulfamethoxazole	4.5	<2	3	0
Boreal Shield/Subarctic: Pharmaceuticals Detected in Surface Water				
Caffeine	26.6	<5	15	11
Carbamazepine	<0.5	<0.5	15	15
Cotinine	<5	<5	15	15
17α-Ethinylestradiol	0.45	<0.2	15	14
Metformin	46.1	<10	15	9
Sulfamethoxazole	<2	<2	15	15

Table 28: Level of pharmaceuticals in surface water, by total and by ecozone (continued)

Pharmaceutical Detected	Max (ng/L)	Detection Limit (ng/L)	Number of Samples Collected	Number of Samples Non-detected
Taiga Shield/Subarctic: Pharmaceuticals Detected in Surface Water				
Caffeine	<5	<5	6	6
Carbamazepine	<0.5	<0.5	6	6
Cotinine	<5	<5	6	6
17α-Ethinylestradiol	<0.2	<0.2	6	6
Metformin	<10	<10	6	6
Sulfamethoxazole	<2	<2	6	6
Hudson Plains/Subarctic: Pharmaceuticals Detected in Surface Water				
Caffeine	<5	<5	3	3
Carbamazepine	<0.5	<0.5	3	3
Cotinine	<5	<5	3	3
17α-Ethinylestradiol	<0.2	<0.2	3	3
Metformin	<10	<10	3	3
Sulfamethoxazole	<2	<2	3	3

Mercury in Hair Analyses

Figure 38a. Mercury concentration in hair for all participants, Prairies Ecozone (Manitoba)

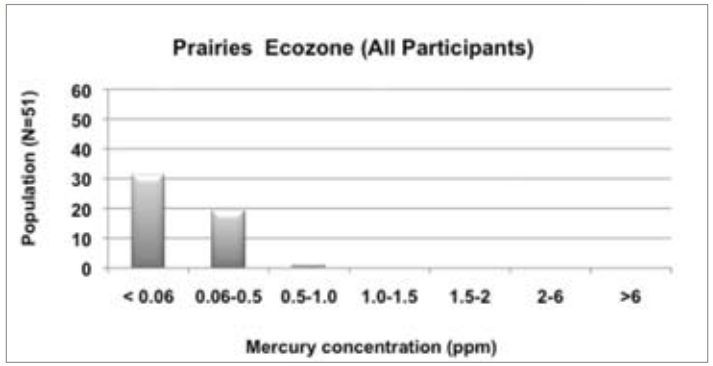


Figure 38b. Mercury concentration in hair for all participants, Boreal Plains Ecozone (Manitoba)

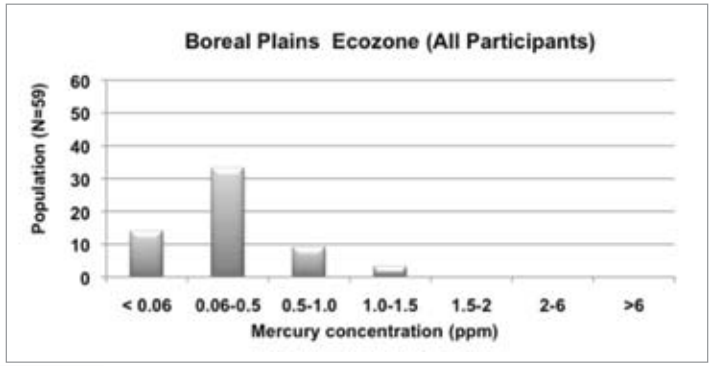


Figure 38c. Mercury concentration in hair for all participants, Boreal Shield Ecozone (Manitoba)

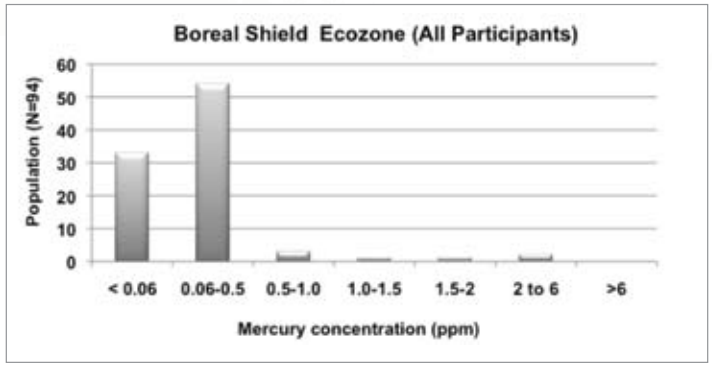


Figure 38d. Mercury concentration in hair for all participants, Taiga Shield Ecozone (Manitoba)

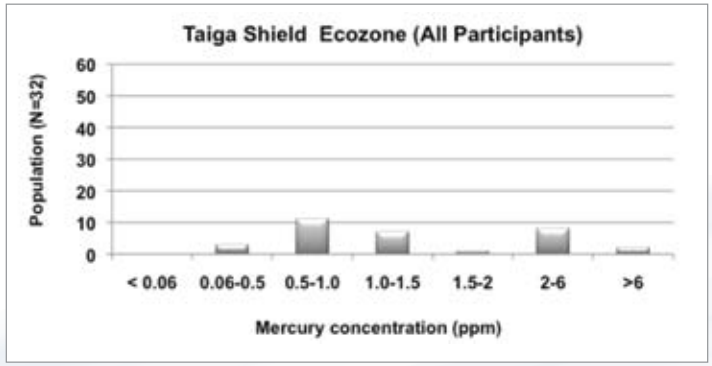


Figure 39a. Mercury concentration in hair for all women, Prairies Ecozone (Manitoba)

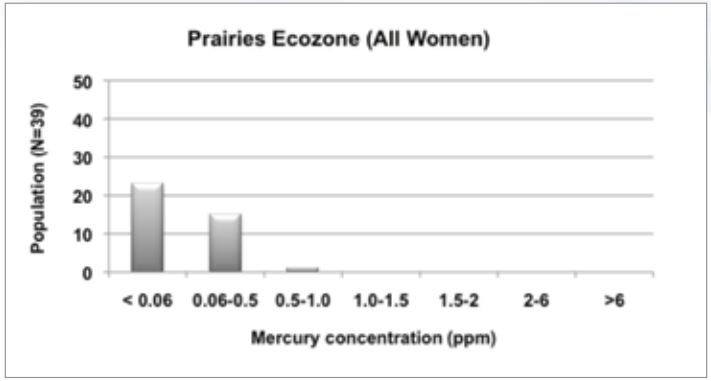


Figure 39b. Mercury concentration in hair for all women, Boreal Plains Ecozone (Manitoba)

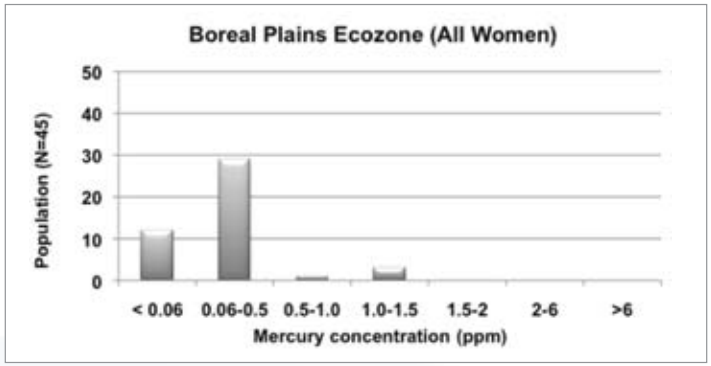


Figure 39c. Mercury concentration in hair for all women, Boreal Shield Ecozone (Manitoba)

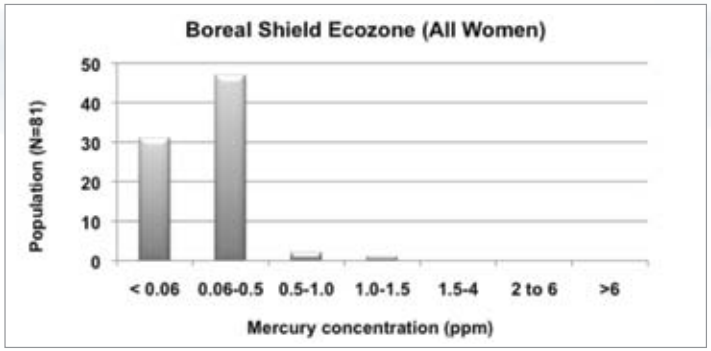


Figure 39d. Mercury concentration in hair for all women, Taiga Shield Ecozone (Manitoba)

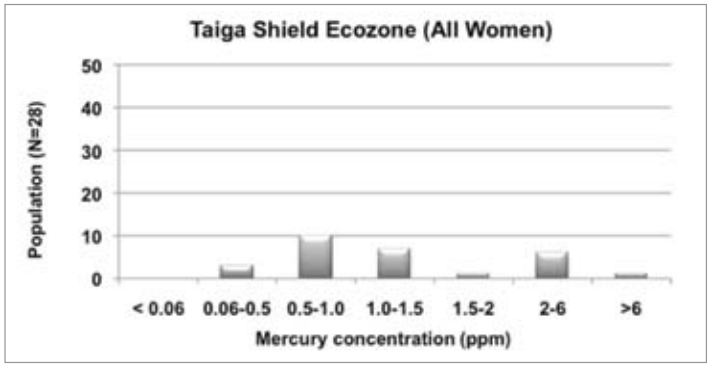


Table 29. Arithmetic (A.M.) and geometric (G.M.) means of average mercury in hair concentration (µg/g or ppm) in First Nations population older than 19, living on First Nations reserves in Manitoba. First Nations Food Nutrition and Environment Study 2010, sample data weighted and age-sex adjusted.

Gender	Age Group	Sample Size	Weighted Size	A.M.	A.M.-LOW (95% CI)	A.M.-Up (95% CI)	G.M.	G.M.-LOW (95% CI)	G.M.-UP (95% CI)	C.V.%
Total	19-30	46	18136	0.13	0.06	0.21	0.08	0.04	0.14	32
Total	31-50	119	20011							41
Total	51+	71	10004							34
Total	Total	236	48151	0.33	0.09	0.57	0.13	0.08	0.22	27
M	19-30	6	9321							54
M	31-50	21	10296							66
M	51+	11	5014							67
M	Total	38	24631							42
F	19-30	40	8815	0.14	0.08	0.2	0.08	0.05	0.12	24
F	31-50	98	9715	0.22	0.11	0.33	0.11	0.07	0.17	22
F	51+	60	4990	0.34	0.22	0.46	0.23	0.16	0.33	19
F	Total	198	23520	0.22	0.15	0.28	0.11	0.08	0.16	17
F	19-50	138	18530	0.18	0.11	0.25	0.09	0.07	0.13	18

Notes: Sample sizes for males are too low for sampling theory to apply, and should not be used.
Estimates have been adjusted for non-response and post-stratified to population counts within age/sex group.
All figures should be used with caution due to high c.v.'s. Note c.v.'s do not reflect bias, only sampling error.
All figures shaded in orange will not be released due to very high c.v.'s.

Figure 40a. Mercury concentration in hair for women aged 19-50 years old, Prairies Ecozone (Manitoba)

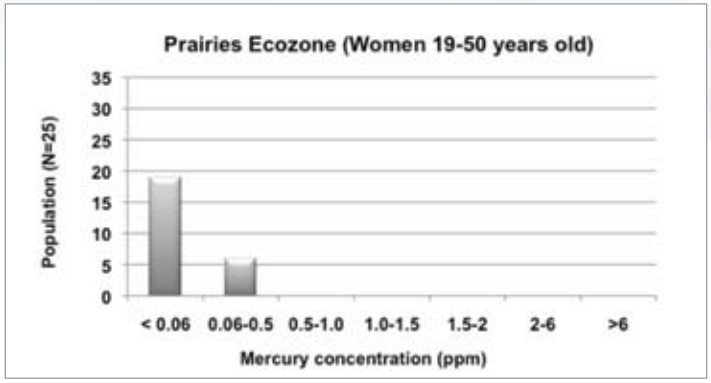


Figure 40b. Mercury concentration in hair for women aged 19-50 years old, Boreal Plains Ecozone (Manitoba)

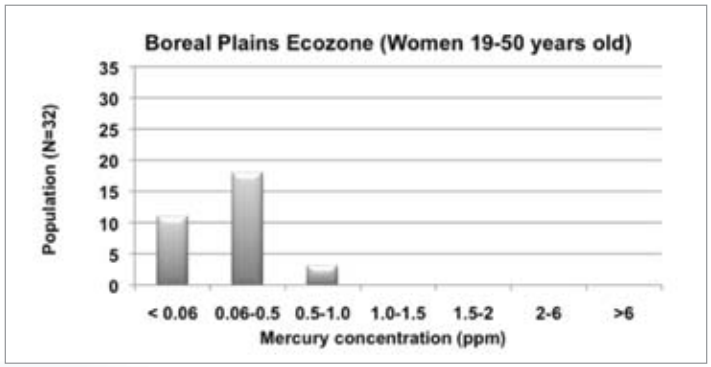


Figure 40c. Mercury concentration in hair for women aged 19-50 years old, Boreal Shield Ecozone (Manitoba)

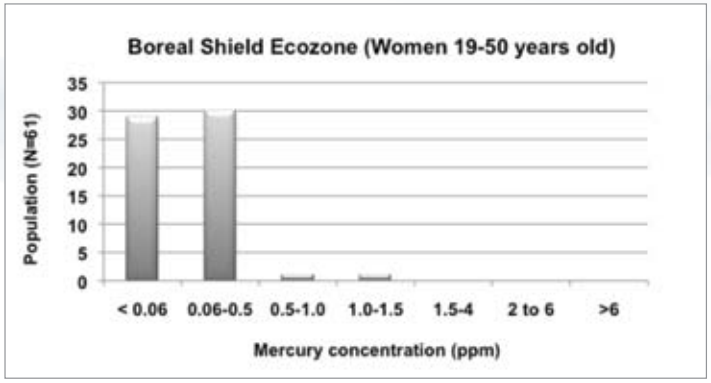


Figure 40d. Mercury concentration in hair for women aged 19-50 years old, Taiga Shield Ecozone (Manitoba)

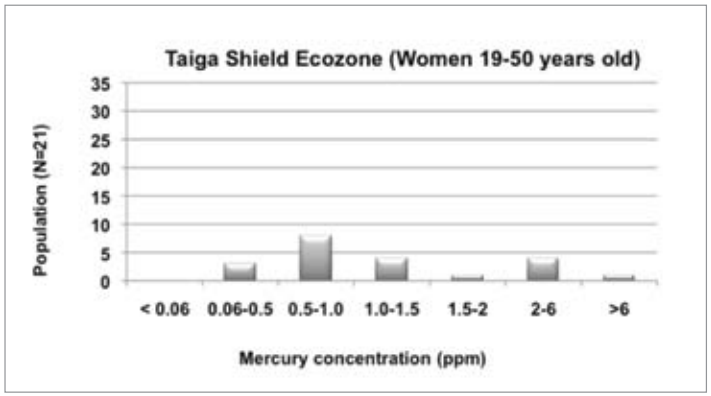


Table 30. Mean portion size of traditional food categories, by gender and age group, as reported from 24hr recalls, Manitoba First Nations living on-reserve, unweighted

Traditional food category	Women			Men		
	Age 19-50	Age 51-70	Age 71+	Age 19-50	Age 51-70	Age 71+
	Mean grams/serving			Mean grams/serving		
Fish	170	50	70	197	141	177
Land mammals	202	158	145	307	181	243
Land mammal fat (caribou and bear)	15	12*	10	103	103*	103*
Wild birds	119	196	174*	353	353*	353*
Bird egg**	107	107	107	107	107	107
Wild berries	69	141	184	436	74	195*
Wild rice	329	247*	83	329*	329	329*
Wild plants, roots, shoots or greens	50	0.3	17*	0.3	0.3*	0.3*
Tree foods***	1	1	1	1	1	1
Mushrooms***	48	48	48	48	48	48
Tree foods	1*	1	1*	1*	1	1*
Mushrooms	48	48*	48*	48*	48*	48*

Note: daily portion sizes were imputed when no foods from a food category were reported on any 24hr recall or from a specific gender or age group.
*imputed portion size from average intake by gender; for example: the portion size for land mammal fat for Manitoba First Nations women in the 51-70 age group was obtained by calculating the average portion size for this food category from all Manitoba First Nations women.
**imputed portion size from Canadian nutrient file values (mean of duck and goose eggs); Health Canada, 2010.
***imputed values from Chan et al, 2011.

Table 31. Estimated average intake of major traditional food (g/person/day), using traditional food frequency results

Traditional food	Mean grams/person/day						
	Women			Men			Total Manitoba First Nations (n=706)
	Age 19-50 (n=347)	Age 51-70 (n=114)	Age 71+ (n=15)	Age 19-50 (n=163)	Age 51-70 (n=57)	Age 71+ (n=9)	
Total TF	**21.07**	**35.49**	**46.22**	**88.83**	**69.42**	**58.56**	**45.26**
Moose meat	3.82	5.34	4.07	17.27	7.9	6.14	7.74
Walleye/Pickerel	3.49	1.55	2.87	8.89	6.62	5.19	4.78
Deer meat	2.39	4.8	0.87	9.18	2.6	0.06	4.37
Ducks	0.91	2.21	2.91	7.07	12.93	10.25	3.85
Blueberries	1.07	3.96	10.66	4.05	1.37	1.24	2.5
Geese	0.5	1.29	2.42	5.35	5.34	5.7	2.36
Elk meat	0.6	1.06	0.18	5.71	1.68	0	1.99
Raspberries	1.01	1.15	2.95	3.56	0.96	2.43	1.72
Wild rice	0.89	4.8	0.94	1.63	1.43	0	1.72
Lake whitefish	0.9	0.22	3.38	2.61	3.94	6.71	1.63
Wild strawberry	0.48	1.31	3	3.68	0.34	1.35	1.46
Caribou meat	1.97	0.88	0.05	1.22	0.32	0.2	1.4
Northern pike	0.5	0.28	3.82	1.41	2.87	4.76	1.05
Rabbit	0.43	0.56	0.69	1.63	1.67	2.11	0.89
Moose liver	0.03	0.1	0.09	2.09	0.83	1.3	0.64
Crabapples	0.08	0.18	0.08	0.94	2.2	0	0.48
Trout, any	0.16	0.14	1.17	0.48	2.63	0	0.46
Lake trout	0.16	0.05	0.81	0.45	2.62	0	0.43
Deer liver	0.15	0.74	0.03	0.75	0.38	0	0.41

Traditional food	Mean grams/person/day						
	Women			Men			Total Manitoba First Nations (n=706)
	Age 19-50 (n=347)	Age 51-70 (n=114)	Age 71+ (n=15)	Age 19-50 (n=163)	Age 51-70 (n=57)	Age 71+ (n=9)	
Low bush cranberries	0.07	0.15	1.92	0.85	0.43	2.05	0.39
Saskatoon berries	0.11	0.28	0.47	0.95	0.27	0.99	0.38
Chokecherries	0.07	0.21	0.33	1.05	0.13	0.92	0.36
Highbush cranberries	0.04	1.08	0	0.51	0.07	0.99	0.34
Muskrat meat	0.04	0.49	0.07	0.35	0.34	2.3	0.26
Grouse	0.02	0.09	0.34	0.32	1.57	0.48	0.25
Prairie chicken	0.04	0.18	0.05	0.5	0.99	0	0.25
White sucker	0.21	0.09	0	0.12	1	0	0.23
Deer kidney	0.02	0.49	0.03	0.57	0.04	0	0.23
Bison meat	0.04	0.08	0.61	0.24	1.33	0	0.21
Beaver meat	0.01	0.12	0	0.16	0.98	2.3	0.19
Hazelnut	0.02	0.1	0.01	0.63	0.06	0	0.18
Gray partridge	0.01	0.17	0	0.27	0.88	0	0.17
Yellow perch	0.07	0.1	0.1	0.38	0.11	0	0.15
Lake sturgeon	0.07	0.06	0.15	0.26	0.19	0.32	0.13
Goldeneye	0	0	0	0.43	0.22	0	0.13
Moose kidney	0.03	0.05	0.2	0.25	0.29	0.19	0.11
Elk liver	0.02	0.02	0	0.25	0.06	0	0.08
Caribou kidney	0.11	0.02	0	0.1	0.04	0	0.08
Seagull eggs	0	0.03	0.2	0.15	0.2	0.51	0.08

Table 31. Estimated average intake of major traditional food (g/person/day), using traditional food frequency results (continued)

Traditional food	Mean grams/person/day						
	Women			Men			Total Manitoba First Nations (n=706)
	Age 19-50 (n=347)	Age 51-70 (n=114)	Age 71+ (n=15)	Age 19-50 (n=163)	Age 51-70 (n=57)	Age 71+ (n=9)	
Elk kidney	0.01	0.02	0	0.25	0.02	0	0.07
Gooseberries	0.02	0.04	0	0.2	0.04	0	0.07
Sunfish	0.02	0.14	0.08	0.14	0	0	0.06
Largemouth bass	0	0	0.05	0.04	0.53	0	0.05
Wild turkey	0.01	0.02	0	0.16	0.01	0	0.05
Blackberries, large	0	0	0	0.19	0	0	0.05
Sauger	0.01	0.01	0	0.12	0.05	0	0.04
Burbot	0.02	0	0	0.11	0	0	0.04
Red longnose sucker	0.01	0	0	0.08	0.2	0	0.04
Labrador tea leaves	0.03	0.06	0.01	0.01	0.01	0	0.03
Rainbow trout	0	0.09	0	0.02	0	0	0.02
Round whitefish	0.03	0.01	0	0.01	0.1	0	0.02
White perch/bass	0.03	0	0	0.02	0.02	0	0.02
Muskie	0	0	0	0.07	0	0	0.02
Bigmouth buffalo sucker	0	0	0	0.06	0	0	0.02
Caribou liver	0.03	0	0	0.03	0.04	0.01	0.02
Juniper berries	0	0	0	0.04	0.05	0	0.02
Mint leaves	0.01	0	0.01	0.05	0.02	0	0.02
Kokanee trout	0	0	0.36	0.01	0	0	0.01
Channel catfish	0	0.01	0	0.02	0.03	0	0.01

Traditional food	Mean grams/person/day						
	Women			Men			Total Manitoba First Nations (n=706)
	Age 19-50 (n=347)	Age 51-70 (n=114)	Age 71+ (n=15)	Age 19-50 (n=163)	Age 51-70 (n=57)	Age 71+ (n=9)	
Lynx	0	0	0.03	0.01	0.05	0	0.01
Loon	0	0	0	0.04	0	0	0.01
Merganser	0	0	0	0.01	0.03	0	0.01
Crowberries	0	0	0	0.01	0.01	0	0.01
Thimbleberries	0	0.08	0	0	0	0	0.01
Black raspberries/thimbleberries	0.01	0.02	0	0.02	0	0	0.01
Blue huckleberries	0	0.06	0	0	0	0	0.01
Rose hips	0.02	0.01	0	0.01	0	0	0.01
Acorns	0	0	0	0.05	0	0	0.01
Walnuts	0.01	0	0	0	0.01	0	0.01
Rat root	0.01	0.01	0	0.02	0.01	0	0.01
Stinging nettles leaves	0	0.07	0	0	0	0	0.01
Pine mushrooms	0.02	0	0	0.01	0	0	0.01

Table 32. Estimated high consumption (95th percentile rate) of major traditional foods (g/person/day)

Traditional food	Mean grams/person/day						
	Women			Men			Total Manitoba First Nations (n=706)
	Age 19-50 (n=347)	Age 51-70 (n=114)	Age 71+ (n=15)	Age 19-50 (n=163)	Age 51-70 (n=57)	Age 71+ (n=9)	
Total TF	**93.13**	**198.99**	**138.38**	**335.48**	**366.33**	**162.09**	**186.75**
Moose meat	13.28	25.97	19.07	80.75	47.61	19.97	30.3
Walleye/Pickerel	16.77	8.22	9.21	34.54	37.08	11.64	22.36
Deer meat	11.07	20.78	4.77	29.44	11.9	0	20.19
Ducks	3.91	6.44	12.87	23.21	92.84	23.21	19.34
Geese	2.28	4.83	22.88	23.21	23.21	23.21	13.54
Blueberries	6.05	24.72	30.75	19.11	3.85	6.41	11.59
Raspberries	5.67	5.79	12.1	14.33	3.24	8.01	9.27
Wild rice	7.21	13.53	8.19	7.21	9.01	0	8.12
Lake whitefish	4.19	1.1	27.62	10.79	37.08	11.64	6.48
Northern pike	3.26	1.64	27.62	6.48	11.59	11.64	5.82
Rabbit	1.66	2.6	4.77	6.73	5.95	5.33	4.96
Wild strawberry	2.46	8.88	24.2	7.17	1.82	8.01	4.64
Elk meat	1.66	5.19	1.19	6.73	11.9	0	4.43
Saskatoon berries	0.57	1.16	2.52	5.97	1.82	6.41	1.93
Low bush cranberries	0.19	0.39	12.1	7.17	4.26	6.41	1.6
Chokecherries	0.38	1.16	1.01	4.78	0.81	6.41	1.19
Moose liver	0	0	0.79	2.52	5.95	4.66	1.11
Muskrat meat	0	1.3	0.79	1.68	2.48	5.33	0.99
Grouse	0	0	1.91	0.97	8.7	2.9	0.97

Traditional food	Mean grams/person/day						
	Women			Men			Total Manitoba First Nations (n=706)
	Age 19-50 (n=347)	Age 51-70 (n=114)	Age 71+ (n=15)	Age 19-50 (n=163)	Age 51-70 (n=57)	Age 71+ (n=9)	
Prairie chicken	0	1.07	0	4.84	5.8	0	0.97
Bison meat	0	0	6.36	0.84	6.45	0	0.84
Beaver meat	0	0	0	1.68	11.9	5.33	0.84
Crabapples	0.57	1.16	0.5	4.78	36.49	0	0.81
Lake sturgeon	0.47	0.14	1.15	1.08	0.77	0.97	0.77
Trout, any	0	0	9.21	6.48	37.08	0	0.47
Highbush cranberries	0	4.64	0	0	0.81	6.41	0.38
White sucker	0	0.68	0	0	6.18	0	0.27
Seagull eggs	0	0.27	0.82	1.37	1.1	1.1	0.27
Lake trout	0	0	9.21	6.48	37.08	0	0.14
Labrador tea leaves	0.07	0.57	0.14	0	0.07	0	0.04

Table 33. Average and maximum levels of toxic trace metals in Manitoba traditional food samples (µg/g fresh weight)

Traditional food sample	N	Arsenic		Cadmium		Lead		Mercury		Methyl Mercury	
		Ave	Max	Ave	Max	Ave	Max	Ave	Max	Ave	Max
Bass flesh	1	0.12	0.12	0.01	0.01	0.030	0.03	0.139	0.139	0.154	0.154
Beaver meat	3	ND	ND	0.01	0.03	0.010	0.03	ND	ND	ND	ND
Birch inner bark	2	ND	ND	0.08	0.11	0.050	0.1	0.005	0.010	NM	NM
Blackberry leaves	1	ND	ND	ND	ND	ND	ND	0.010	0.010	NM	NM
Blueberries	8	ND	ND	0.003	0.02	0.028	0.13	0.001	0.006	NM	NM
Caribou brain	1	ND	ND	ND	ND	0.040	0.04	0.002	0.002	ND	ND
Caribou fat	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Caribou gut	1	ND	ND	0.12	0.12	0.040	0.04	0.009	0.009	NM	NM
Caribou heart	1	ND	ND	0.01	0.01	ND	ND	0.005	0.005	0.004	0.004
Caribou kidney	1	ND	ND	6.42	6.42	0.300	0.3	0.905	0.905	ND	ND
Caribou liver	1	0.04	0.04	0.93	0.93	0.170	0.17	0.197	0.197	0.010	0.010
Caribou meat	2	0.02	0.02	0.003	0.01	0.570	1.08	0.010	0.012	0.011	0.014
Caribou tongue	1	ND	ND	0.01	0.01	ND	ND	0.005	0.005	NM	NM
Catfish flesh	2	0.02	0.04	ND	ND	ND	ND	0.055	0.061	0.082	0.090
Cedar tea	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Chokecherries	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Crabapples	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Cranberries	4	ND	ND	0.004	0.01	0.013	0.05	ND	ND	NM	NM
Cranberries, high bush	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Cranberry, low bush	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Dandelion tea	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Deer heart	1	ND	ND	ND	ND	0.410	0.41	ND	ND	ND	ND

Traditional food sample	N	Arsenic		Cadmium		Lead		Mercury		Methyl Mercury	
		Ave	Max	Ave	Max	Ave	Max	Ave	Max	Ave	Max
Deer kidney	2	ND	ND	2.25	3.55	0.060	0.12	0.023	0.027	ND	ND
Deer liver	2	0.03	0.05	0.32	0.49	0.025	0.05	0.004	0.008	0.003	0.005
Deer meat	7	0.01	0.03	0.005	0.03	6.114	27.2	0.001	0.003	0.001	0.005
Duck – pintail, meat	1	0.04	0.04	ND	ND	0.030	0.03	0.006	0.006	0.008	0.008
Duck heart	1	0.02	0.02	ND	ND	ND	ND	0.020	0.020	NM	NM
Duck meat	3	0.03	0.06	0.02	0.04	1.480	3.64	0.048	0.066	0.079	0.079
Elk heart	1	0.05	0.05	ND	ND	ND	ND	ND	ND	ND	ND
Elk meat	3	ND	ND	0.002	0.01	2.103	6.27	ND	ND	ND	ND
Goose meat	4	0.01	0.03	0.01	0.02	0.293	0.92	0.001	0.002	ND	ND
Gooseberries	1	ND	ND	0.004	0.00	ND	ND	ND	ND	NM	NM
Grouse meat	5	0.01	0.06	0.03	0.08	3.152	7.67	0.002	0.005	0.002	0.005
Hazelnuts	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Juniper tea	1	ND	ND	0.02	0.02	0.040	0.04	ND	ND	NM	NM
Labrador tea leaves	2	ND	ND	0.01	0.02	0.067	0.1	ND	ND	NM	NM
Lilypad plant	1	0.07	0.07	ND	ND	0.050	0.05	ND	ND	NM	NM
Mallard duck gizzard	3	56.36	169	0.01	0.01	1233.36	3700	0.030	0.071	0.042	0.093
Mallard meat	4	0.04	0.1	0.06	0.25	0.073	0.15	0.052	0.162	0.059	0.164
Mariah flesh	1	0.04	0.04	ND	ND	ND	ND	0.090	0.090	0.088	0.088
Mariah liver	2	0.11	0.14	0.01	0.02	0.335	0.67	0.020	0.025	0.044	0.060
Moose fat	1	0.02	0.02	0.03	0.03	0.090	0.09	ND	ND	NM	NM
Moose heart	2	ND	ND	0.02	0.02	0.835	1.67	0.002	0.004	ND	ND
Moose intestine	1	0.03	0.03	0.02	0.02	0.030	0.03	ND	ND	NM	NM

Table 33. Average and maximum levels of toxic trace metals in Manitoba traditional food samples (µg/g fresh weight) (continued)

Traditional food sample	N	Arsenic		Cadmium		Lead		Mercury		Methyl Mercury	
		Ave	Max	Ave	Max	Ave	Max	Ave	Max	Ave	Max
Moose kidney	5	0.05	0.21	7.86	14.80	0.604	2.98	0.022	0.049	ND	ND
Moose liver	5	0.02	0.03	1.42	2.52	0.046	0.17	0.006	0.012	0.002	0.006
Moose meat	10	0.03	0.12	0.02	0.12	1.619	15.6	0.002	0.011	0.0005	0.005
Moose tongue	2	ND	ND	0.06	0.11	0.080	0.16	ND	ND	NM	NM
Mossberries (Summerberry)	3	ND	ND	0.003	0.01	ND	ND	ND	ND	NM	NM
Mountain ash tea	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Muskrat meat	3	ND	ND	ND	ND	ND	ND	0.001	0.004	0.001	0.004
Partridge meat	1	0.05	0.05	0.02	0.02	152	152	ND	ND	NM	NM
Peppermint tea	1	ND	ND	0.02	0.03	0.250	0.5	ND	ND	NM	NM
Perch flesh	2	0.04	0.08	0.01	0.02	0.015	0.03	0.103	0.118	0.103	0.122
Pike, northern - flesh	10	0.05	0.07	0.001	0.01	ND	ND	0.253	0.517	0.204	0.568
Poplar tea	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Prairie chicken meat	3	0.01	0.02	0.11	0.33	0.020	0.06	ND	ND	ND	ND
Rabbit brains	1	ND	ND	0.01	0.01	ND	ND	ND	ND	NM	NM
Rabbit kidney	1	ND	ND	1.38	1.38	ND	ND	0.024	0.024	ND	ND
Rabbit liver	1	ND	ND	0.21	0.21	ND	ND	0.007	0.007	ND	ND
Rabbit meat	7	0.23	1.5	0.09	0.27	23.334	163	0.002	0.008	ND	ND
Raspberry, wild	5	ND	ND	0.002	0.01	0.040	0.2	ND	ND	NM	NM
Red willow bark	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Rhubarb stalk	2	ND	ND	0.004	0.01	ND	ND	ND	ND	NM	NM
Sage tea	1	ND	ND	0.004	0.00	ND	ND	ND	ND	NM	NM
Saskatoon berries	4	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM

Traditional food sample	N	Arsenic		Cadmium		Lead		Mercury		Methyl Mercury	
		Ave	Max	Ave	Max	Ave	Max	Ave	Max	Ave	Max
Snow goose meat	2	ND	ND	ND	ND	ND	ND	0.001	0.002	ND	ND
Spruce tea	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Sturgeon flesh	2	0.42	0.49	ND	ND	0.020	0.04	0.129	0.144	0.199	0.199
Sucker, white - head	4	0.05	0.11	ND	ND	0.008	0.03	0.016	0.027	0.026	0.036
Tamarack tea	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Trout eggs	1	0.08	0.08	ND	ND	0.140	0.14	0.006	0.006	0.007	0.007
Trout guts	1	0.22	0.22	0.01	0.01	0.470	0.47	0.264	0.264	NM	NM
Trout, lake - flesh	2	0.13	0.14	ND	ND	0.040	0.08	0.263	0.310	0.381	0.411
Walleye, flesh	12	0.07	0.1	ND	ND	0.011	0.13	0.258	0.470	0.161	0.367
Wekay root	1	0.50	0.5	ND	ND	0.200	0.2	ND	ND	NM	NM
Wekay tea	2	0.03	0.06	ND	ND	0.107	0.3	0.003	0.010	NM	NM
Whitefish eggs	1	0.11	0.11	ND	ND	ND	ND	ND	ND	ND	ND
Whitefish flesh	9	0.13	0.27	0.003	0.01	0.004	0.02	0.048	0.276	0.061	0.304
Wild plums	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Wild rice grain	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM
Willow tea	1	ND	ND	0.01	0.01	0.070	0.07	ND	ND	NM	NM
Yarrow tea	1	ND	ND	ND	ND	ND	ND	ND	ND	NM	NM

ND= not detected; NM= not measured

Table 34a. Top 10 contributors to arsenic intake, by ecozone/culture area and total

Ecozone 1		Ecozone 2		Ecozone 3		Ecozone 4		Total Manitoba First Nations	
Traditional Food	**%**	**Traditional Food**	**%**	**Traditional Food**	**%**	**Traditional Food**	**%**	**Traditional Food**	**%**
Rabbit meat	56.4	Walleye/Pickerel	41.2	Walleye/Pickerel	27.6	Caribou meat	36.2	Walleye/Pickerel	22.2
Duck meat	13.8	Duck meat	13.0	Moose meat	22.0	Whitefish flesh	32.9	Rabbit meat	18.1
Walleye/Pickerel	8.9	Moose meat	12.4	Whitefish flesh	17.2	Trout, lake - flesh	24.2	Moose meat	13.2
Deer meat	6.8	Pike flesh	8.9	Duck meat	11.8	Pike, northern - flesh	1.9	Duck meat	12.0
Goose meat	3.7	White tail deer	6.4	Sturgeon flesh	6.2	Walleye/Pickerel	1.9	Whitefish flesh	11.1
Deer liver	3.2	Whitefish flesh	6.0	Trout, lake - flesh	5.2	Caribou liver	1.5	Sturgeon flesh	4.0
Moose meat	1.7	Lake sturgeon	5.4	Pike, northern - flesh	4.6	Rat root	0.6	Trout, lake, flesh	3.9
White perch/bass	1.1	White sucker	3.1	Moose liver	2.2	Goose meat	0.4	Pike, northern, flesh	3.7
Sturgeon flesh	0.7	Gray partridge	1.5	White perch/bass	1.2	Moose kidney	0.2	Deer meat	3.0
Partridge meat	0.7	Deer liver	0.5	Wekay root	0.7	White sucker	0.1	Caribou meat	2.0

Table 34b. Top 10 contributors to cadmium intake, by ecozone/culture area and total

Ecozone 1		Ecozone 2		Ecozone 3		Ecozone 4		Total Manitoba First Nations	
Traditional Food	**%**	**Traditional Food**	**%**	**Traditional Food**	**%**	**Traditional Food**	**%**	**Traditional Food**	**%**
Moose kidney	50.5	Moose kidney	65.5	Moose liver	58.1	Caribou kidney	90.5	Moose kidney	34.4
Deer kidney	21.8	Moose liver	21.5	Moose kidney	27.7	Moose kidney	4.1	Moose liver	31.1
Moose liver	11.8	Deer kidney	3.3	Rabbit meat	6.2	Caribou liver	3.8	Caribou kidney	15.6
Deer liver	8.6	Duck meat	2.6	Moose meat	3.9	Caribou meat	1.2	Deer kidney	7.2
Prairie chicken	3.5	Deer liver	2.5	Deer kidney	1.9	Moose liver	0.1	Rabbit meat	3.3
Rabbit meat	2.2	Moose meat	2.2	Raspberries	0.4	Ruffed grouse meat	0.1	Deer liver	2.7
Duck meat	0.5	Goose meat	1.4	Pike, northern - flesh	0.4	Goose meat	0.04	Moose meat	2.0
Spruce chicken	0.3	Gray partridge	0.3	Prairie chicken	0.3	Moose meat	0.04	Prairie chicken	1.1
Moose meat	0.2	Rabbit meat	0.2	Blueberries	0.3	Rabbit meat	0.01	Caribou liver	0.7
Elk meat	0.2	Beaver meat	0.1	Elk meat	0.1	Prairie chicken	0.01	Duck meat	0.5

Table 34c. Top 10 contributors to lead intake, by ecozone/culture area and total

Ecozone 1		Ecozone 2		Ecozone 3		Ecozone 4		Total Manitoba First Nations	
Traditional Food	**%**	**Traditional Food**	**%**	**Traditional Food**	**%**	**Traditional Food**	**%**	**Traditional Food**	**%**
Deer meat	40.1	Deer meat	30.8	Partridge meat	60.4	Caribou meat	40.1	Deer meat	32.7
Rabbit meat	39.7	Moose meat	30.6	Elk meat	17.9	Ruffed grouse meat	33.0	Rabbit meat	24.3
Partridge meat	13.5	Partridge	27.9	Moose meat	10.8	Caribou kidney	13.6	Partridge meat	22.9
Duck meat	5.4	Elk meat	7.0	Duck meat	7.0	Goose meat	5.7	Moose meat	9.5
Goose meat	0.7	Duck meat	3.5	Spruce chicken	1.4	Caribou liver	2.3	Duck meat	5.1
Spruce chicken	0.4	Goose meat	0.04	Caribou meat	1.2	Deer meat	1.3	Elk meat	4.0
Moose kidney	0.1	Grouse meat	0.04	Blueberries	0.6	Duck meat	1.1	Goose meat	0.5
Deer kidney	0.04	Caribou meat	0.02	Raspberries	0.3	Moose kidney	1.0	Spruce chicken	0.5
Deer liver	0.02	Moose liver	0.01	Trout, lake - flesh	0.2	Blueberries	1.0	Caribou meat	0.2
Elk meat	0.01	Deer liver	0.003	Moose liver	0.1	Labrador tea leaves	0.5	Blueberries	0.1

Table 34d. Top 10 contributors to mercury intake, by ecozone/culture area and total

Ecozone 1		Ecozone 2		Ecozone 3		Ecozone 4		Total Manitoba First Nations	
Traditional Food	**%**	**Traditional Food**	**%**	**Traditional Food**	**%**	**Traditional Food**	**%**	**Traditional Food**	**%**
Walleye/Pickerel	49.63	Walleye/Pickerel	48.2	Walleye/Pickerel	73.6	Caribou kidney	50.0	Walleye/Pickerel	61.2
Duck meat	24.31	Pike flesh	38.7	Duck meat	7.8	Trout, lake - flesh	24.1	Pike, northern – flesh	13.4
Yellow perch	7.45	Duck meat	8.8	Pike, northern - flesh	7.5	Walleye/Pickerel	10.4	Duck meat	8.7
Pike, northern - flesh	4.19	White sucker	1.2	Trout, lake - flesh	5.6	Caribou meat	6.5	Trout, lake - flesh	5.5
White perch/bass	3.67	Lake sturgeon	0.8	Whitefish flesh	2.0	Whitefish flesh	3.5	Caribou kidney	4.1
Whitefish flesh	2.67	Yellow perch	0.5	Sturgeon flesh	1.1	Caribou liver	3.2	Whitefish flesh	1.9
Deer kidney	2.53	Whitefish flesh	0.5	White perch/bass	0.8	Pike, northern - flesh	2.1	Sturgeon flesh	0.9
Mariah flesh	1.74	Lake trout	0.3	Blueberries	0.6	Moose meat	0.1	White perch/bass	0.9
Deer liver	1.50	Moose meat	0.3	Moose liver	0.4	Moose kidney	0.05	Yellow perch	0.7
Moose kidney	0.89	White perch/bass	0.2	Caribou meat	0.2	Duck meat	0.04	Caribou meat	0.6

Table 35. Average and maximum levels of Polycyclic Aromatic Hydrocarbons (PAHs) in Manitoba traditional food samples (ng TEQ/g fresh weight)

Traditional Food Sample	n	Total PAHs ng TEQ/g	
		Ave	Max
Bass flesh	1	ND	ND
Beaver meat	3	0.165	0.493
Caribou meat	2	0.001	0.002
Catfish flesh	2	0.005	0.009
Deer meat	6	0.001	0.004
Duck - pintail meat	1	7.951	7.951
Duck meat	3	2.887	8.617
Elk meat	3	0.0004	0.001
Goose meat	4	1.061	4.233
Mallard meat	3	0.003	0.009
Moose meat	9	0.066	0.484
Muskrat meat	3	0.001	0.002
Partridge meat	1	ND	ND
Perch flesh	2	ND	ND
Pike, northern - flesh	10	0.003	0.032
Prairie chicken meat	3	ND	ND
Rabbit meat	6	0.0004	0.001
Snow goose meat	2	0.003	0.003
Spruce chicken	5	0.001	0.004
Sturgeon flesh	2	0.001	0.003
Sucker, white - flesh	3	ND	ND
Trout, lake - flesh	2	0.226	0.451
Walleye flesh	10	0.0005	0.003
Whitefish eggs	1	0.003	0.003
Whitefish flesh	9	0.023	0.200

Table 36. Average and maximum levels of organochlorines in Manitoba traditional food samples (ng/g fresh weight)

Traditional food sample	n	Hexachlorobenzene		p,p-DDE		total PCBs		trans-Nonachlor		Toxaphene	
		Ave	Max	Ave	Max	Ave	Max	Ave	Max	Ave	Max
Bass flesh	1	0.41	0.41	15.90	15.9	26.79	26.79	ND	ND	ND	ND
Beaver meat	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Caribou liver	1	0.35	0.35	ND	ND	ND	ND	NM	NM	NM	NM
Caribou meat	1	0.44	0.44	ND	ND	ND	ND	NM	NM	NM	NM
Catfish flesh	2	1.28	2.55	12.75	13.2	11.91	12.06	ND	ND	ND	ND
Deer kidney	1	0.64	0.64	ND	ND	ND	ND	ND	ND	ND	ND
Deer liver	2	0.60	0.90	5.75	11.5	0.55	1.10	ND	ND	ND	ND
Deer meat	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Duck meat	2	ND	ND	0.79	1.58	ND	ND	ND	ND	ND	ND
Elk meat	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Goose meat	4	0.14	0.55	ND	ND	ND	ND	ND	ND	ND	ND
Mallard meat	4	0.45	1.78	25.71	102	31.93	127.71	ND	ND	ND	ND
Mariah flesh	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Moose liver	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Moose meat	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Muskrat meat	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Partridge meat	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perch flesh	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pike, northern – flesh	10	ND	ND	0.15	0.89	0.03	0.34	ND	ND	ND	ND
Prairie chicken meat	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Traditional food sample	n	Hexachlorobenzene		p,p-DDE		total PCBs		trans-Nonachlor		Toxaphene	
		Ave	Max	Ave	Max	Ave	Max	Ave	Max	Ave	Max
Rabbit meat	6	0.06	0.34	ND	ND	0.12	0.69	ND	ND	ND	ND
Snow goose meat	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Spruce chicken	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sturgeon flesh	2	0.44	0.88	4.90	8.58	7.37	14.73	ND	ND	ND	ND
Sucker, white - head	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trout eggs	1	0.55	0.55	0.57	0.57	ND	ND	NM	NM	NM	NM
Trout, lake - flesh	2	1.47	1.66	11.73	15.8	9.24	11.06	2.41	2.41	3.46	3.46
Walleye flesh	12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Whitefish flesh	9	0.35	1.02	1.28	2.44	0.21	0.67	ND	ND	ND	ND

Table 37. Average levels of organophosphate pesticides in Manitoba traditional food samples (ng/g fresh weight)

Traditional food sample	n	Phorate	Phorate sulfone	Phosalone	Phosmet	Terbuphos	Tetrachlorvinphos
Blueberries	8	ND	ND	ND	ND	ND	ND
Chokecherries	1	ND	ND	ND	ND	ND	ND
Crabapples	1	ND	ND	ND	ND	ND	ND
Cranberries	4	ND	ND	ND	ND	ND	ND
Cranberries, high bush	1	ND	ND	ND	ND	ND	ND
Cranberry, low bush	1	ND	ND	ND	ND	ND	ND
Gooseberries	1	ND	ND	ND	ND	ND	ND
Lilypad plant	1	ND	ND	ND	ND	ND	ND
Mossberries (Summerberry)	3	ND	ND	ND	ND	ND	ND
Raspberry, wild	5	ND	ND	ND	ND	ND	ND
Rhubarb stalk	2	ND	ND	ND	ND	ND	ND
Saskatoon berries	4	ND	ND	ND	ND	ND	ND
Wild plums	1	ND	ND	ND	ND	ND	ND
Wild rice grain	1	ND	ND	ND	ND	ND	ND

Table 38. Average and maximum levels of Polybrominated Diphenyl Ethers (PBDEs) in Manitoba traditional food samples (ng/g fresh weight)

Traditional Food Sample	n	Average total PBDEs	Max total PBDEs
Bass flesh	1	12.73	12.73
Beaver meat	3	2.53	5.74
Birch inner bark	1	0.13	0.13
Caribou fat	1	0.48	0.48
Caribou liver	1	0.19	0.19
Caribou meat	1	1.64	1.64
Catfish flesh	2	7.37	14.04
Deer kidney	1	0.11	0.11
Deer liver	2	0.83	1.47
Deer meat	7	21.43	147.02
Duck - pintail meat	1	0.49	0.49
Duck meat	2	1.18	1.44
Elk meat	3	0.11	0.18
Goose meat	4	3.43	12.66
Mallard meat	4	4.08	9.99
Mariah flesh	1	0.06	0.06
Moose fat	1	18.47	18.47
Moose liver	1	0.26	0.26
Moose meat	10	0.80	2.31
Muskrat meat	3	0.22	0.28
Partridge meat	1	0.32	0.32
Perch flesh	2	1.32	2.40
Pike, northern - flesh	10	1.19	6.67
Prairie chicken meat	2	0.27	0.36
Rabbit meat	6	0.46	0.89
Snow goose meat	2	0.37	0.43
Spruce chicken	5	0.41	1.25
Sturgeon flesh	2	2.12	2.57
Sucker, white - flesh	3	0.11	0.17
Trout eggs	1	1.58	1.58
Trout, lake - meat	2	4.49	7.56
Walleye	12	0.65	1.76
Whitefish flesh	9	0.40	1.04

Table 39. Average and total levels of Perfluorinated Compounds (PFCs) in Manitoba traditional food samples (ng/g fresh weight)

Traditional Food Sample	n	Average total PFCs	Max total PFCs
Bass flesh	1	37.39	37.39
Beaver meat	2	ND	ND
Caribou fat	1	ND	ND
Caribou liver	1	10.89	10.89
Caribou meat	1	ND	ND
Catfish flesh	2	9.97	15.33
Deer kidney	1	ND	ND
Deer liver	2	ND	ND
Deer meat	7	ND	ND
Duck - pintail flesh	1	3.35	3.35
Duck meat	1	0.93	0.93
Elk meat	3	ND	ND
Goose meat	3	ND	ND
Mallard meat	4	18.22	70.93
Moose fat	1	ND	ND
Moose liver	1	ND	ND
Moose meat	9	ND	ND
Muskrat meat	2	ND	ND
Partridge meat	1	ND	ND
Perch flesh	2	5.32	10.63
Pike, northern - meat	9	3.85	12.28
Prairie chicken	2	ND	ND
Rabbit meat	5	ND	ND
Snow goose meat	1	ND	ND
Spruce chicken	4	ND	ND
Sturgeon flesh	2	0.78	0.96
Sucker, white - flesh	3	1.87	5.60
Trout eggs	1	28.85	28.85
Trout, lake - flesh	2	1.71	3.42
Walleye flesh	11	2.44	6.36
Whitefish flesh	8	4.08	12.79

Table 40. Levels of Dioxans and Furans in Manitoba traditional food samples (ng TEQ/kg fresh weight)

Traditional Food Sample	n	Average Dioxan and Furans	Max Dioxan and Furans
Bass flesh	1	0.19	0.19
Beaver meat	3	0.02	0.05
Caribou fat	1	9.06	9.06
Caribou meat	2	0.01	0.02
Catfish flesh	2	0.42	0.71
Deer meat	6	0.02	0.05
Duck - pintail meat	1	1.49	1.49
Duck meat	3	0.04	0.10
Elk meat	3	0.01	0.03
Goose meat	4	0.06	0.21
Mallard meat	3	0.002	0.003
Moose meat	9	0.01	0.02
Muskrat meat	3	0.004	0.01
Partridge meat	1	0.18	0.18
Perch flesh	2	0.03	0.03
Pike, northern – flesh	10	0.07	0.21
Prairie chicken meat	3	0.03	0.09
Rabbit meat	6	0.03	0.10
Snow goose meat	2	0.06	0.09
Spruce chicken	5	0.01	0.05
Sturgeon flesh	2	0.08	0.08
Sucker, white – flesh	3	0.02	0.07
Trout, lake – flesh	2	0.15	0.29
Walleye flesh	10	0.12	0.90
Whitefish eggs	1	0.04	0.04
Whitefish flesh	9	0.03	0.11

Table 41. Exposure estimates (µg/kg body weight/day) for metals from traditional food for Manitoba First Nations living on-reserve using average concentrations (N=706)

Metal	PTDI (µg/kg/day)	n>PTDI	Mean	Median	95th percentile	Mean/PTDI	95th/PTDI
Arsenic	1	0	0.02	0.00	0.05	0.02	0.05
Cadmium	1	15	0.04	0.00	0.17	0.04	0.17
Mercury	0.5	3	0.02	0.01	0.09	0.04	0.17
Lead	3.6	55	1.35	0.02	5.39	0.38	1.50

Table 42. Exposure estimates (µg/kg body weight/day) for metals from traditional food for Manitoba First Nations living on-reserve using maximum concentrations (N=706)

Metal	PTDI (µg/kg/day)	n>PTDI	Mean	Median	95th percentile	Mean/PTDI	95th/PTDI
Arsenic	1	2	0.02	0.00	0.07	0.02	0.07
Cadmium	1	18	0.05	0.00	0.17	0.05	0.17
Mercury	0.5	3	0.02	0.01	0.09	0.05	0.17
Lead	3.6	60	1.78	0.03	5.89	0.49	1.64

Table 43. Exposure estimates (µg/kg body weight/day) for mercury from traditional food (using average and maximum concentrations) among Manitoba FN women of child bearing age, living on-reserve (N=347)

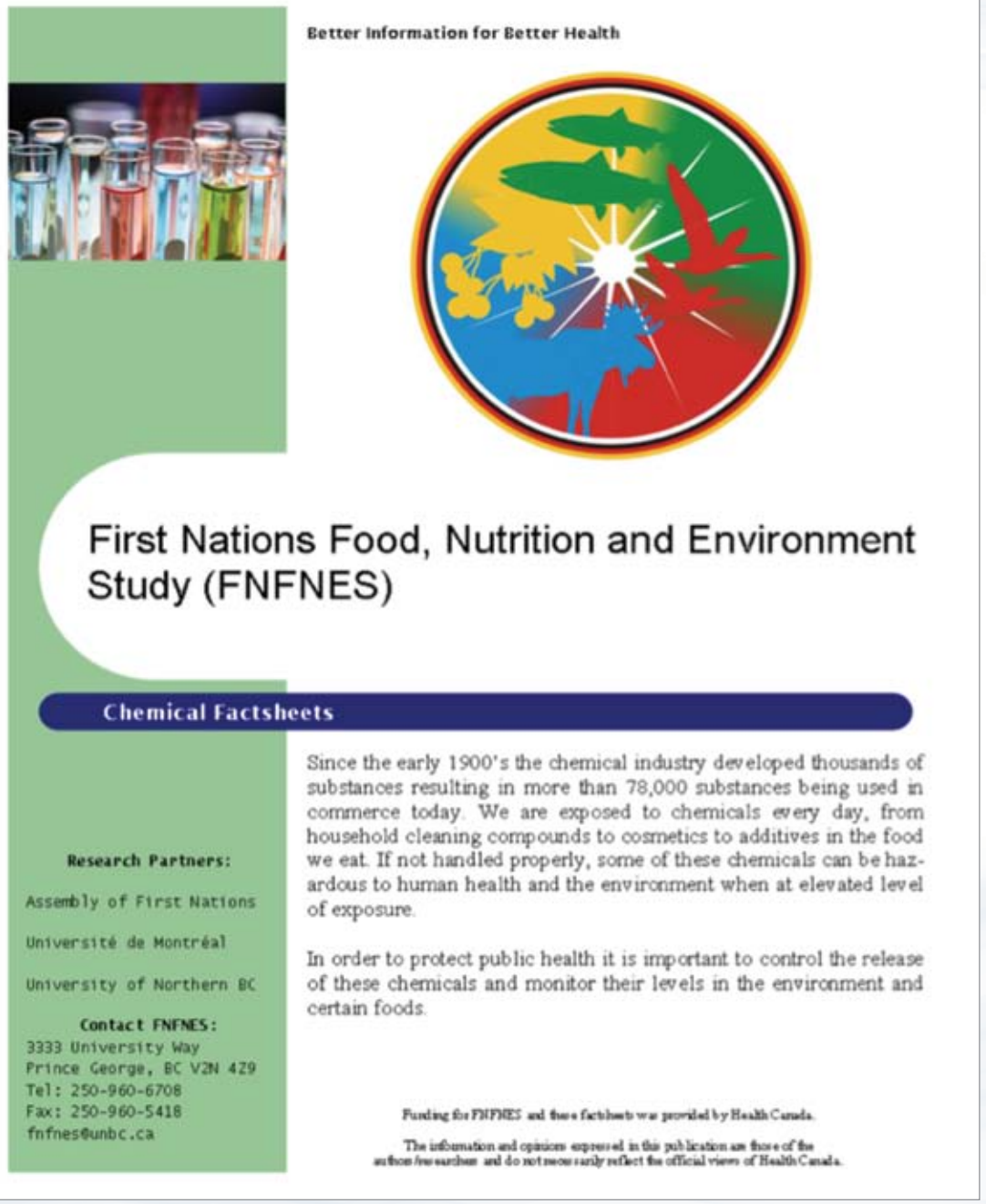
Level of mercury concentration	PTDI (µg/kg/day)	n>PTDI	Mean	Median	95th percentile	Mean/PTDI	95th/PTDI
Average	0.2	8	0.0224	0.00799	0.086	0.112	0.432
Maximum	0.2	8	0.0227	0.0084	0.087	0.114	0.436

Table 44. Exposure estimates (µg/kg body weight/day) for organics from traditional food for Manitoba First Nations living on-reserve using average concentrations (N=706)

Organics	PTDI (µg/kg/day)	n>PTDI	Mean	Median	95th percentile	Mean/PTDI	95th/PTDI
HCBs	0.27	0	0.00003	0.00000	0.00010	0.00010	0.00038
DDE	20	0	0.00019	0.00000	0.00085	0.00001	0.00004
PCB	1	0	0.00011	0.00000	0.00055	0.00011	0.00055
Chlordane	0.05	0	0.00001	0.00000	0.00000	0.00024	0.00007
Toxaphene	0.2	0	0.00002	0.00000	0.00000	0.00009	0.00002
PAH	40	0	0.00022	0.00000	0.00120	0.00001	0.00003
PFOS	0.08	0	0.00045	0.00013	0.00204	0.00566	0.02554
PBDE	0.1	0	0.00065	0.00012	0.00364	0.00654	0.03644
Dioxin and Furan	2.3 pg/kg/day	0	0.00001	0.00000	0.00005	0.00001	0.00002

APPENDICES

Appendix A: Chemical fact sheets



Better Information for Better Health

First Nations Food, Nutrition and Environment Study (FNFNES)

Chemical Factsheets

Since the early 1900's the chemical industry developed thousands of substances resulting in more than 78,000 substances being used in commerce today. We are exposed to chemicals every day, from household cleaning compounds to cosmetics to additives in the food we eat. If not handled properly, some of these chemicals can be hazardous to human health and the environment when at elevated level of exposure.

In order to protect public health it is important to control the release of these chemicals and monitor their levels in the environment and certain foods.

Research Partners:

Assembly of First Nations

Université de Montréal

University of Northern BC

Contact FNFNES:
3333 University Way
Prince George, BC V2N 4Z9
Tel: 250-960-6708
Fax: 250-960-5418
fnfnes@unbc.ca

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UNDERSTANDING CHEMICAL POLLUTANTS

What chemicals in the environment are we worried about?

We often hear that we are unknowingly being exposed to chemicals in the air we breathe, food we eat and water we drink. What are they and what do they do? The following is a list of chemicals that are commonly found in the Canadian environment. The First Nations Food, Nutrition and Environment Study (FNFNES) collected traditional food and drinking water samples from First Nations communities and measured the concentrations of these chemicals to assess the risk of exposure. The results of testing are presented in the Regional Reports. These factsheets are included to provide background information to the general reader on these chemicals. Because the focus of FNFNES is on long-term low-level exposure from food and water, the acute effects of high doses such as those from occupational exposure are not presented.

Based on the evidence gathered from animal experiments and human populations accidentally exposed to these chemicals, threshold levels of many of these chemicals have been established. For public health protection, national and international guidelines have been established. When the daily intake is below these threshold values, no adverse health effects are expected among the studied population.

Included are Chemical Factsheets on the following substances:

Benefit of Traditional Foods vs Risk: Traditional foods offer many nutritional and cultural benefits. These must be weighed against the market-food alternatives and levels of contamination.

Persistent Organic Pollutants: Toxic organic chemical substances that do not break down or dissipate in the environment. They can stay in your body for a very long time.

Pesticides and Herbicides: These kill insects, weeds and fungus which harm agricultural crops. They can affect the nervous system and immune functions.

Polychlorinated biphenyls (PCBs): These industrial chemicals, while banned have been used in transformers, capacitors and as coolants and persist in the environment. They can affect the development of children.

Polybrominated Diphenyl Ethers (PBDEs): These compounds are used as flame retardants and are often found in building materials and consumer goods such as electronics and furniture. They can affect immune functions.

Dioxins and Furans: There are 210 different types of dioxins and furans, all of which are persistent organic pollutants and some of which can cause cancer.

Polycyclic Aromatic Hydrocarbons (PAHs): These are produced through burning and some PAHs can cause cancer.

Perfluorinated Compounds (PFCs): Toxic and carcinogenic in animals, PFCs lasts indefinitely in the environment. It is used in the manufacture of non-stick surfaces such as on cookware. They can affect thyroid functions.

Cadmium: A metallic chemical element used to make alloys and batteries that can damage the kidney.

Lead: A heavy blue-grey metal which affects the brain development of children.

Mercury: A silver metal that is liquid at room temperature, mercury can take a variety of forms, some of which are more easily absorbed by the human body and can affect child development.

Arsenic: A silvery-white poisonous metal that is used to make insecticides and poisons for rodents. It is toxic to animals and humans and can cause cancer.

More factsheets are available at the First Nations Environmental Health Innovation Network (FNEHIN) website: www.fnehin.ca

Benefit of Traditional Foods vs Risk

Traditional foods should not be avoided because of suspected contamination as they are an excellent source of nutrients. The test results of contaminants found in traditional foods collected in your area are reported in the regional reports and any that are high in contaminants have been highlighted. This will provide you with local information that can be used to choose the best food to maximize the nutrient intake and lower your exposure to environmental contaminants.

Wild game has been found, on average, to be higher in protein and lower in both fat and cholesterol than domesticated meats.[i] First Nations have long relied upon traditional foods for a healthy, balanced and nutritious diet. Traditional foods are an optimal food choice that can be found locally and acquired with traditional knowledge. Studies, such as this one, show that those who consume traditional foods have a more nutritious and healthier diet than those that don't and that traditional foods can make important contributions to the intake of several important nutrients.

Persistent Organic Pollutants (POPs)

Persistent organic pollutants are organic compounds that are resistant to environmental degradation through chemical, biological, and photolytic (broken down by sunlight) processes. As they are not easily broken down, they can persist in the environment, sometimes for decades. They can be transported far from their sources by air and ocean current (e.g. from the industrialized south to the Canadian Arctic). They can be bioaccumulated in plants, animals and humans (absorbed into the body at a rate greater than is removed), and biomagnified (increase in concentrations) along the food chain. At high enough concentrations POPs can have harmful effects on human health and the environment.

POPs include some of the most well-known and toxic environmental contaminants, such as polychlorinated biphenyls (PCBs), dioxins and furans. POPs commonly found in traditional foods and discussed in the FNFNES reports include hexachlorobenzene (HCB), 1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane (DDT) and its metabolite, 1,1-dichloro-2,2-bis(4-chlorophenyl) ethylene (DDE), PCBs, dioxins and furans. Although the levels of many of these contaminants have declined since most developed countries have restricted their use decades ago, they are persistent and remain in the environment and our bodies for long periods of time.[ii]

POPs can affect neural development and the immune system and can also disrupt hormonal balance and regulation. The developing fetus and infants are at higher risk of POPs exposure as POPs can pass through the placenta to the fetus, or be ingested by babies through breast milk. It is important to note that the benefits of breast feeding have always out-weighed the risk of contaminants in breast milk in all cases studied worldwide.

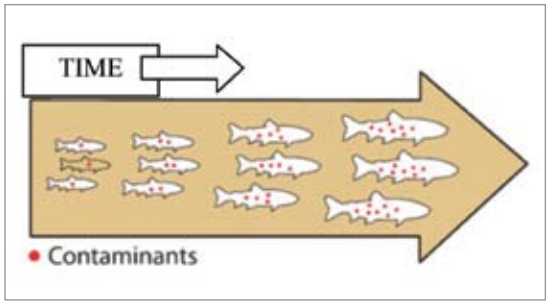

Illustration of how POPs accumulate in animals and people faster than the body can excrete the substance[iii]

Pesticides and Herbicides:

What are they? Pesticides are chemicals used to eliminate or control a variety of domestic or agricultural pests that can damage crops and livestock and reduce farm productivity. The most commonly applied pesticides are insecticides (to kill insects), herbicides (to kill weeds), rodenticides (to kill rodents), and fungicides (to control fungi, mold, and mildew). Of these pesticide classes, herbicides (weed killers) are the most widely used.

Where are they found? Pesticide residues are common food contaminants. Older pesticides such as organochlorines (like DDT) can be found in fatty tissues such as meat, fish and milk products while modern pesticides such as organophosphates are mainly found on the surface of fruits and vegetables. Since organophosphates are water soluble, they can be easily

washed away. Therefore, always wash fruits and vegetables thoroughly with water before eating. Due to surface runoff, pesticides and herbicides can also be found in surface water, if there has been heavy use in the area. This may be a concern as it could contaminate drinking water from surface supplies.

What are the major health effects? Some pesticides are toxic to the nervous and immune system, and some are endocrine (hormone) disruptors. Endocrine disruptors are substances that can interfere with the endocrine system of animals, including humans by mimicking certain hormones. Endocrine disruption is important because hormones play a critical role in controlling how the body develops. A number of environmental contaminants (as well as other substances, such as some pharmaceuticals) are endocrine disruptors. Some pesticides, such as pentachlorophenol are contaminated with dioxins, which may play a role in their toxicity[iv]. For example, daily ingestion of low doses of diquat, an extensively used herbicide, induces intestinal inflammation in rats. It has been suggested that repeated ingestion of small amounts of pesticides, as could be found in food, may have consequences for human health and may be involved in the development of gastrointestinal disorders[v]. Exposure to pesticides during the fetal stage and in childhood can cause long-term damage.

What are the guideline levels in water and food and daily intake?
The tolerable daily intake (TDI) established by Health Canada for DDT, a classic organchlorine pesticides and for chlorpyrifos, a common organophosphate pesticide, is 0.01 mg/Kg BW/day.

There is no drinking water guideline for DDT as it does not dissolve in water easily. The drinking water guideline for chlorpyrifos is 0.09 mg/L.[vi]

Polychlorinated byphenyls (PCBs)

What are they? PCBs are a class of compounds that are mixtures of up to 209 different chlorinated hydrocarbons, or congeners. Different congeners sometimes act differently from one another, and some are more resistant to break down than others in the environment. Some congeners can act like dioxins ("dioxin-like congeners") and others act in other ways ("nondioxin-like congeners"). PCBs were used in paints, lubricants and electrical equipment.

Where are they found? PCBs are generally found in higher concentrations in fatty foods of animal origin, such as some fish, meats and dairy products. Everyone living in developed countries have PCBs in their bodies and long-range transport of PCBs by global air currents have caused PCBs to be distributed globally.[vii] Most PCBs enter the environment from landfill sites and leaks from old equipment. Food is the largest source of exposure but air, water and soil can play a part as well. [viii]

What are the major health effects? Since people are never exposed to only one of these groups, people exposed to PCBs are at risk of the same health effects caused by dioxins, as well as those caused by non-dioxin-like PCB congeners. People eating large amounts of certain sports fish, wild game and marine mammals are at increased risk for higher exposures and possible adverse health effects. Long-term, high level exposure may also cause liver and kidney cancer.[ix] Fetal exposure to PCBs can cause developmental deficits such as lowering IQ among children.

What are the guideline levels in water and food and daily intake?
The tolerable daily intake (TDI) established by Health Canada is 0.001 mg/Kg BW/day.[x]

Flame Retardants - Polybrominated Diphenyl Ethers (PBDEs)

What are they? Flame retardants are chemicals that prevent the spread of fire and are persistent organic pollutants. PBDE flame retardants are added to some plastics, electrical and electronic equipment, upholstered furniture, non-clothing textiles and foam products. Because PBDEs are added to the products rather than chemically bound into them, they can be slowly and continuously released from the products during their manufacture, while in use, or after their disposal. As of 2008 the EU has banned several types of brominated flame retardants following evidence beginning in 1998 that the chemicals were accumulating in human breast milk.

Where are they found? PBDEs have been found both in the environment and in humans, including in human breast milk in Canada, the United States and Europe. PBDEs are generally found in higher concentrations in fatty foods of animal origin, such as some fish, meats and dairy products. Exposure to PBDEs is nearly impossible to avoid due to their presence in the air, indoor dust, water, food, animal fats, and breast milk. Nearly all Americans tested have trace amounts of flame retardants in their body. While the levels in humans are very low, they have been increasing with time, and are higher in North Americans than in Europeans.

What are the major health effects? Many are considered harmful, as they are linked to adverse liver, thyroid, reproductive/developmental and neurological effects. Concerns are being raised because of their persistence, bioaccumulation, and potential for toxicity, both in animals and in humans. A growing body of research in laboratory animals has linked PBDE exposure to an array of adverse health effects including thyroid hormone disruption, permanent learning and memory impairment, behavioural changes, hearing problems, delayed puberty onset, decreased sperm count, birth defects and possibly, cancer.[xi]

What are the guideline levels in water and food and daily intake?
There is no guideline level for PBDE from Health Canada.

Dioxins and Furans

What are they? There are over 200 types of polychlorinated dibenzodioxins (PCDDs), or dioxins. Polychlorinated dibenzofurans (PCDFs) are related chemicals. Some other persistent organic pollutants can act like dioxins, and are called “dioxin-like compounds.”

Where are they found? The largest source of dioxins and furans entering the environment is through large-scale waste incinerators. Emissions are also made from small-scale burning of plastics, diesel, treated wood and cigarette smoke. The primary source of exposure to dioxins and dioxin-like compounds in developed countries is via food, especially meat, milk, dairy, eggs, and fish, which together make up 93% of total exposure. Inhalation, consumption of water, vegetable oils, grains, fruits and vegetables only constitute a small percentage of overall exposure.[xii]

What are the major health effects? Dioxins are known to suppress the immune system of animals and humans,[xiii] and are likely to cause cancer.[xiv] Changes to animals’ hormone and reproduction systems and development have also been observed due to high exposure to dioxins and furans.[xv] The question of whether dioxins can influence the body’s immune system to attack its own cells causing disease, like type 1 diabetes, is still being investigated.

What are the guideline levels in water and food and daily intake?
Health Canada has set a tolerable daily intake (TDI) for PCDDs and PCDFs at 2.3 pg/Kg BW/day (Health Canada, 2005 and WHO 2010).

Polycyclic Aromatic Hydrocarbons (PAHs)

What are they? PAHs are a group encompassing over 100 different chemicals and are usually found as two or more of these compounds in a mixture. They are created through incomplete burning of many substances.

Where are they found? Exposure can be through inhalation, drinking contaminated water, or eating contaminated foods including grilled or charred meats. Air can become contaminated with PAHs by wild fires, vehicle exhaust, trash incinerators, cigarette smoke or coal tar, and water and foods can be contaminated from the soil and ground water. Waste sites where construction materials or ash are buried can also contaminate ground water. Breathing smoke which contains PAHs is the most common way people are exposed to PAHs. Eating food grown in contaminated soil can expose people to PAHs. Charring or grilling food can increase the amount of PAHs that the food contains.

What are the major health effects? Some PAHs are expected to be carcinogens and have caused cancer and reproductive problems in laboratory animals, but there is a lack of data on the effect of PAHs on humans.[xvii] PAHs can damage lungs, liver, kidneys and skin. According to the US Environmental Protection Agency, PAHs also can damage red blood cells and weaken the immune system. PAHs are a large class of chemicals which range from nontoxic to extremely toxic. Their toxicity, and therefore the amount of the PAH needed to cause a health effect, is dependent upon the type of PAH. Seven types of PAHs have been deemed probable human carcinogens by the U.S. Environmental Protection Agency.

What are the guideline levels in water and food and daily intake?
Health Canada recommended a maximum acceptable concentration of 0.01 µg/L Benzo [α] pyrene (a PAH) in drinking water. Health Canada has no guideline level for non-carcinogenic endpoints of PAHs. The oral slope factor for Benzo[a]pyrene is 2.3 mg/Kg BW/day.

Perfluorinated Compounds (PFCs)

What are they? Perfluorinated compounds (PFCs) are a family of fluorine-containing chemicals with unique properties to make materials stain and stick resistant. PFCs are incredibly resistant to breakdown and are turning up in unexpected places around the world. Although these chemicals have been used since the 1950s in countless familiar products, they've been subjected to little government testing. There are many forms of PFCs, but the two getting attention recently are: PFOA or perfluorooctanoic acid, used to make Teflon products and PFOS or perfluorooctane sulfonate, a breakdown product of chemicals formerly used to make Scotchgard products.

Where are they found? PFCs are used in a wide array of consumer products and food packaging. Grease-resistant food packaging and paper products, such as microwave popcorn bags and pizza boxes, contain PFCs. PFOS was used until 2002 in the manufacture of 3M's Scotchgard treatment and used on carpet, furniture, and clothing. PFOA is used to make DuPont's Teflon product, famous for its use in non-stick cookware. If Teflon-coated pans are overheated, PFOA is released. PFCs are in cleaning and personal-care products like shampoo, dental floss, and denture cleaners. Even Gore-Tex clothing, beloved in the Northwest for its ability to shed water, contains PFCs.

What are the major health effects? In recent studies there have been indications that PFOAs interfere with normal reproduction by adversely affecting fertility, and has caused developmental toxicity in offspring resulting in birth defects.[xix]

What are the guideline levels in water and food and daily intake?
There is no guideline level for PFCs from Health Canada.

Metals: Metals include elements like arsenic, mercury, lead and cadmium, all of which are toxic. Metals occur naturally in the environment with large variations in concentration. In modern times, economic activity has resulted in several sources of metals that are introduced to the environment via pollution. Waste-derived fuels and coal are especially prone to containing metals, so they should be a central concern in a consideration of their use. Living organisms require trace amounts of some metals, such as iron, cobalt, copper, manganese,

molybdenum, and zinc which are beneficial. However, excessive levels can be detrimental to health. Other metals such as cadmium, lead, mercury, and arsenic are considered to be toxic and have no known vital or beneficial effects and over time their accumulation in the bodies of animals can cause serious illness.

Cadmium:

What is it? Cadmium is a natural element that is found in all soils and rocks. It is a metal that resists corrosion and is used in many applications such as batteries, some plastics such as PVC, and metal coatings.

Where is it found? It can enter the environment from mining, industry, coal and household waste burning and hazardous waste sites and can travel great distances before entering the local environment through ground or water. Cadmium does not break down, can travel great distances in the environment and can change in form. Cigarette smoke is a major source of exposure to cadmium and can effectively double the average daily intake. Other sources of exposure include from foods (Cadmium is often found to be highest in shellfish and the liver and kidneys of large mammals like moose and deer) drinking water, and breathing air near a waste incinerator.

What are the major health effects? Long-term exposure to lower levels can cause kidney and lung damage, fragile bones and an increase in cancers.

What are the guideline levels in water and food and daily intake?
The drinking water guideline for Cd is 0.005 mg/L. The tolerable daily intake (TDI) established by Health Canada is 0.008 mg/Kg BW/day.

Lead:

What is it? Lead is found naturally in the environment and has many industrial uses.

Where is it found? Lead was once commonly used in gasoline, paint, pipes and lead shot ammunition, although its use has now been restricted in these areas. It can currently be found in some types of batteries (car batteries), toys, solder, and PVC plastic. Some of the most common ways to be exposed to lead include improper disposal of old lead-based paint, leaded gasoline, some ceramics or other lead containing products. Lead from these sources can find its way into drinking water in homes with old pipes containing lead solder, inhaling paint dust or ingesting broken or peeling lead paint, and through eating birds or other animals that have been killed with lead shot. If the bird survives, these fragments then stay in the bird and are absorbed by the bird, to be eaten by the next hunter who successfully hunts the bird. These fragments are usually too small to be detected by the person eating the bird. Detectable fragments contain even more lead and should be avoided when eating for everyone. Canada has banned the use of lead shot for hunting, but lead ammunition is still readily available.

What are the major health effects? Lead is well known to be a serious toxin for humans and has contributed to nervous system, kidney and reproductive system problems. Long term exposure can also cause anemia. Recent studies in children in other parts of the world are beginning to suggest that amounts of lead much lower than previously thought can contribute to impaired intelligence. This is especially true for very young children.

What are the guideline levels in water and food and daily intake?
The drinking water guideline for lead is 0.01 mg/L. The tolerable daily intake (TDI) established by Health Canada is 0.0036 mg/Kg BW/day.

Mercury:

What is it? Mercury is the only metal that is liquid at normal air temperature and pressure. Mercury occurs in deposits throughout the world mostly as cinnabar (mercuric sulfide). Mercury can exist in different forms in the environment. It can be either elemental form as liquid or vapour, dissolved inorganic form or organic form. Mercury can change forms through natural processes.

Where is it found? Mercury can be released naturally from rocks, soil and volcanoes. It is found in certain dental fillings (dental amalgam), thermometers, and compact fluorescent lights (CFLs) and its use in other applications is being phased out.

Mercury is released from waste incineration, coal and fossil fuel burning, cement production, mining and smelting. Much of the airborne mercury that settles in Canada actually originates from outside Canada. Mercury can also be released into the environment through flooding. For example, a new reservoir is created, the mercury naturally present in soils and vegetation is converted in water by bacterial action to methylmercury, a more toxic form of mercury where it enters the food chain and bioaccumulates in fish. Mercury accumulates within living organisms so that when one animal eats other animals, much of that mercury stays within the animal which has eaten the other. This process of bioaccumulation applies to humans who eat animals which contain mercury so that those higher in the food chain (predatory fish and carnivorous mammals) often have higher mercury levels. Methylmercury is most often found in large predatory and bottom feeding fish (such as mackerel, orange roughy, walleye, trout) and shellfish.

What are the major health effects? Long-term exposure to mercury can affect brain functions, weaken the immune system, and cause neurological disorders and damage. High-level exposure can also permanently damage the brain, kidneys, and developing fetus and produce tremors, changes in vision or hearing and memory problems. Children are more sensitive to mercury than adults and mercury can be passed from a mother's body to the fetus.

What are the guideline levels in water and food and daily intake?
The drinking water guideline for mercury is 0.001 mg/L. The provisional tolerable weekly intake (pTWI) for methylmercury established by the WHO is 1.6 ug/Kg BW and 4 ug/Kg BW for inorganic mercury.[xx] Health Canada has set guideline levels for methylmercury at 0.47 ug/Kg BW/day for adults and 0.2 ug/Kg BW/day for women of child bearing age, pregnant women and children.[xxi]

Arsenic:

What is it? Arsenic is a natural element found widely throughout the earth. It can be found in some drinking water, such as from deep wells, and is produced as a by-product from certain mining operations. The main use of metallic arsenic is for strengthening copper and lead alloys (for example, in automotive batteries). Arsenic is commonly found in semiconductor electronic devices. Arsenic and its compounds, especially the trioxide, are used in the production of pesticides, herbicides, insecticides and treated wood products.

Where is it found? Arsenic is found everywhere in low levels; including in air, food and water. It can even result in arsenic poisoning in certain areas of the world when ingested in drinking water. It can take on various different forms, some of which are more toxic than others, and is most often used as a preservative in pressure treated wood, and as an active ingredient in some pesticides (such as those used in orchards). Sources of contamination include cigarette smoke and coal burning facilities. Arsenic can travel great distances when in the air and water. Exposure to arsenic is most often from arsenic treated wood, small amounts from food, water and air and living within an area with high natural levels of arsenic in rock.

What are the major health effects? Arsenic can irritate the throat and lungs, cause numbness in hands and feet, nausea and vomiting, decreased production of blood cells, skin irritation on contact, loss of movement and in very high levels can cause death. Studies have shown that ingesting certain types of arsenic can increase the risk of skin, liver, bladder and lung cancer.[xxii] Long-term exposure of children may also affect development. Arsenic is considered to cause cancer.

What are the guideline levels in water and food and daily intake?
Health Canada recommended a maximum acceptable concentration of 0.01 mg/L arsenic in drinking water. Health Canada has no guideline level for non-carcinogenic endpoints. The oral slope factor for arsenic is 1.5 mg/Kg BW/day.

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Appendix B: Statistical tools used to obtain weighted estimates at the regional level

1 : Non-Response adjustment factor:

For each stratum h=1,…,H, and each community i=1,…,n_h, if r_h communities participated in the study out of the n_h selected, then the non-response adjustment factor is given by:

$$WADJ1_{hi} = \begin{cases} \frac{n_h}{r_h}, & \text{for participating communities} \\ 0, & \text{for non-participating communities} \end{cases}$$

2. Bootstrap method for Standard Error

i) Draw a simple random sample of m_h=n_h-1 communities with replacement from the n_h sampled communities, independently for each stratum h=1,…H.

ii) Let m^*_{hi} be the number of times the (hi)-th sample community is selected ($\sum_i m^*_{hi} = m_h$).

iii) Define the bootstrap weights as

$$w^*_{hijk} = \frac{n_h}{n_h - 1} \times m^*_{hi} \times WFINAL_{hijk}$$

If the (hi)-th community is not selected in the bootstrap sample, $m^*_{hi} = 0$ and then $w^*_{hijk} = 0$.

be the full-sample estimate for θ obtained by using the final weight and let $\hat{\theta}^*_b$, b = 1, ..., 500, be the Bootstrap replicate estimates of the same parameter of interest obtained by using the Bootstrap weights. Then, setting B = 500, the Bootstrap estimate of the sampling error of $\hat{\theta}$ is given by:

$$se_{BOOT}(\hat{\theta}) = \sqrt{\hat{V}_{BOOT}(\hat{\theta})},$$

where $\hat{V}_{BOOT}(\hat{\theta}) = \frac{1}{B}\sum_{b=1}^{B}\left(\hat{\theta}^*_b - \hat{\theta}\right) = 0.002\sum_{b=1}^{500}\left(\hat{\theta}^*_b - \hat{\theta}\right)$.

with a CV: $cv(\hat{\theta}) = \frac{se_{BOOT}(\hat{\theta})}{\hat{\theta}} \times 100\%$

Appendix C: Detection limit tables

Table C.1 OrganoChlorine Pesticides

PARAMETER	DL (ug/g)	PARAMETER	DLs (ug/g)
Chlordane, α	0.001	Chlordane, g-	0.001
Chlorpyrifos	0.001	DDE, p,p'-	0.0005
DDT, o,p'-	0.005	DDT, p,p'-	0.005
Dicofol	0.010	Dieldrin	0.005
Endosulfan I	0.010	Endosulfan II	0.030
Endosulfan sulfate	0.010	Endrin	0.010
HCB	0.0003	HCH, α	0.002
HCH, β	0.010	HCH, g-	0.001
Heptachlor	0.001	Heptachlor epoxide (exo)	0.001
Heptachlor epoxide (endo)	0.010	Methoxychlor	0.020
Oxychlordane	0.005	Nonachlor, trans-	0.001
TDE, p,p'-	0.0005	TDE, o,p'-	0.0005
Mirex	0.002	Aldrin	0.001
Toxaphene parlar 50	0.0003	Toxaphene parlar 26	0.0005
Heptachlor epoxide (exo)	0.001	DDE, p,p'-	0.001

Table C.2 OrganoPhosphate Pesticides

PARAMETER	DL (ug/g)	PARAMETER	DLs (ug/g)
Azinphos-methyl	0.020	Chlorfenvinphos 1	0.01
Coumaphos	0.010	Diazinon	0.005
Dimethoate	0.010	Disulfoton	0.005
Ethion	0.010	Fensulfothion	0.030
Fenthion	0.010	Fonofos	0.005
Malathion	0.010	Methidathion	0.030
Methyl parathion	0.020	Parathion	0.020
Phorate	0.010	Phorate sulfone	0.010
Phosalone	0.010	Phosmet	0.010
Terbuphos	0.010	Tetrachlorvinphos	0.005
Chlorfenvinphos 2	0.003		

Table C.3 PCB Congeners

Congener	DLs	Congener	DLs	Congener	DLs	Congener	DLs	Congener	DLs
28	0.001	60	0.001	118	0.0005	153	0.0003	189	0.001
33	0.001	66	0.001	128	0.0005	156	0.0005	191	0.0005
37	0.001	74	0.001	129	0.0005	157	0.0005	193	0.0005
40	0.001	87	0.001	136	0.0005	170	0.001	194	0.001
41	0.001	90	0.001	137	0.0005	180	0.0005	201	0.0005
44	0.001	99	0.001	138	0.0005	183	0.0005	203	0.0005
49	0.001	105	0.0005	141	0.0005	185	0.0005	206	0.001
								209	0.0003

Table C.4a MethylMercury in Food

ELEMENT	SYMBOL	RLs (ng/g)
Methylmercury	Me-Hg	4.0

Table C.4b Metals in Food

ELEMENT	SYMBOL	DLs (ppm) Based on Dry Weight	DLs (ppm) Based on Wet Weight
Aluminum	Al	0.5	0.1
Arsenic	As	0.1	0.02
Barium	Ba	0.1	0.02
Beryllium	Be	0.1	0.02
Bismuth	Bi	0.1	0.02
Cadmium	Cd	0.02	0.004
Calcium	Ca	5	1
Chromium	Cr	0.1	0.02
Cobalt	Co	0.1	0.02
Copper	Cu	0.1	0.02
Iron	Fe	5	1
Lead	Pb	0.1	0.02
Lanthanum	La	0.5	0.1
Magnesium	Mg	5	1
Manganese	Mn	0.1	0.02
Mercury	Hg	0.01	0.002
Molybdenum	Mo	0.1	0.02
Nickel	Ni	0.1	0.02
Phosphorous	P	15	3
Potassium	K	10	2
Selenium	Se	0.1	0.02
Silver	Ag	0.025	0.005
Sodium	Na	5	1
Strontium	Sr	0.1	0.02
Thallium	Tl	0.01	0.002
Tin	Sn	0.1	0.02
Vanadium	V	0.1	0.02
Zinc	Zn	0.5	0.1

Table C.5 Metals in Tap Water

ELEMENT	SYMBOL	DLs (ppm)
Aluminum	Al	0.001
Antimony	Sb	0.0002
Arsenic	As	0.0002
Barium	Ba	0.0002
Beryllium	Be	0.0002
Bismuth	Bi	0.0002
Boron	B	0.01
Cadmium	Cd	0.00004
Calcium	Ca	0.01
Chromium	Cr	0.0002
Cobalt	Co	0.0002
Copper	Cu	0.0002
Iron	Fe	0.01
Lead	Pb	0.0002
Lithium	Li	0.0002
Magnesium	Mg	0.01
Manganese	Mn	0.0002
Mercury (by CVASF)	Hg	0.00002

ELEMENT	SYMBOL	DLs (ppm)
Molybdenum	Mo	0.0001
Nickel	Ni	0.0002
Phosphorous	P	0.03
Potassium	K	0.02
Selenium	Se	0.0002
Silicon	Si	0.05
Silver	Ag	0.00005
Sodium	Na	0.01
Strontium	Sr	0.0002
Tellurium	Te	0.0002
Thallium	Tl	0.00002
Thorium	Th	0.0005
Tin	Sn	0.0002
Titanium	Ti	0.0002
Uranium	U	0.0001
Vanadium	V	0.0002
Zinc	Zn	0.001
Zirconium	Zr	0.002

Table C.6 PCDDs and PCDFs subcontracted to Pacific Rim Laboratories

PCDDs	DLs (ng/kg)	PCDDs	DLs (ng/kg)
1,2,3,7,8-PentaCDD	0.05	1,2,3,4,7,8-HexaCDD	0.1
1,2,3,6,7,8-HexaCDD	0.1	1,2,3,7,8,9-HexaCDD	0.1
1,2,3,4,6,7,8-HeptaCDD	0.1	OctaCDD	0.3
TCDD	0.03		

PCDFs	DLs (ng/kg)	PCDFs	DLs (ng/kg)
2,3,7,8-TetraCDF	0.03	1,2,3,7,8-PentaCDF	0.05
2,3,4,7,8-PentaCDF	0.05	1,2,3,4,7,8-HexaCDF	0.08
1,2,3,6,7,8-HexaCDF	0.08	1,2,3,7,8,9-HexaCDF	0.08
2,3,4,6,7,8-HexaCDF	0.08	1,2,3,4,6,7,8-HeptaCDF	0.10
1,2,3,4,7,8,9-HeptaCDF	0.10	OctaCDF	0.20

Table C.7 PBDEs subcontracted to Pacific Rim Laboratories

BDE congener	X No of Br.	Structure	DL(ng/kg)
47	4	2,2',4,4'	5
85	5	2,2',3,4,4'	2
99	5	2,2',4,4',5	5
100	5	2,2',4,4',6	5
153	6	2,2',4,4',5,5'	2
154	6	2,2',4,4',5,6'	2
183	7	2,2',3,4,4',5',6	2
209	10	2,2',3,3',4,4',5,5',6,6'	25

Table C.8 PFCs

PFC	Common Name	DLs (ug/g)
PFPeA	perfluoropentanoic acid	0.001
PFHxA	perfluorohexanoic acid	0.0005
PFHpA	perfluoroheptanoic acid	0.0005
PFOA	perfluorooctanoic acid	0.0005
PFNA	perfluorononanoic acid	0.0005
PFDA	perfluorodecanoic acid	0.0005
PFUnA	perfluoroundecanoic acid	0.0005
PFDoA	perfluorododecanoic acid	0.0005
PFTA	perfluorotridecanoic acid	0.0005
PFBS	perfluorobutane sulfonate	0.0005
PFHxS	perfluorohexane sulfonate	0.0005
PFOS	perfluorooctane sulfonate	0.0005
PFOSA	perfluorooctane sulfonamide	0.001

Table C.9 PAHs

Polycyclic Aromatic Hydrocarbons	DLs (ug/g)	Polycyclic Aromatic Hydrocarbons	DLs (ug/g)
Naphthalene	0.001	Acenaphthylene	0.001
Acenaphthene	0.001	Flourene	0.001
Phenanthrene	0.001	Anthracene	0.001
Flouranthene	0.001	Pyrene	0.001
Benz[α]anthracene	0.001	Chrysene	0.001
Benzo[β]fluoranthene	0.001	Benzo[k]fluoranthene	0.001
Benzo[α]pyrene	0.001	Benzo[ghi]perylene	0.001
Dibenz[α,h]anthracene	0.001	Indeno[1,2,3-cd]pyrene	0.001

Table C.10 Pharmaceuticals in Water

PARAMETER	DLs (ng/litre)	PARAMETER	DLs (ng/litre)
Acetaminophen	10	Atenolol	5
Atorvastatin	5	Bezafibrate	0.5
Caffeine	5	Carbamazepine	0.5
Chlortetracycline	10	Cimetidine	2
Ciprofloxacin	20	Clarithromycin	2
Codeine	5	Cotinine	5
Clofibric acid	1	Dehydonifedipine	2
Diclofenac	15	Diltiazem	5
Diphenhydramine	10	17α-Ethinylestradiol	0.2
Erythromycin	10	Fluoxetine	5
Furosemide	5	Gemfibrozil	1
Hydrochlorothiazide	5	Ibuprofen	20
Iso-Chlortetracycline	10	Indomethacin	15
Ketoprofen	2	Lincomycin	10
Metformin	10	Metoprolol	5
Monensin	10	Naproxen	5
Oxytetracycline	10	Pentoxyfylline	2
Ranitidine	10	Roxithromycin	5
Sulfamethazine	5	Sulfamethoxazole	2
Tetracycline	10	Alpha-Trenbolone	2
Beta-Trenbolone	2	Trimethoprim	2
Warfarin	0.5		

Appendix D: Framework for mixed dishes categorization into food groupings

Mixed Foods	Grain Products	Vegetables & Fruits	Milk Products	Meat & Alternatives	Serving Size	Examples of mixed foods
1. Grains and Meat	1			1	100g	Rice fried with meat, bannock with eggs, hamburger sandwich
2. Grains and Milk Products	1		0.5		150g	Cheese pizza, cheese tortellini, macaroni and cheese
3. Grains and Vegetables	2	1			150g	Bread raisin, potato gnocci, granola bar with blueberries
4. Grains, Vegetables and Meat	1	1		0.5	150g	Egg roll with meat, cabbage rolls, Chimichanga without cheese
5. Grains, Vegetables and Milk Products	1	1	0.5		200g	Meatless lasagna, cheese pizza with vegetables, Cannelloni with cheese and spinach,
6. Grains, Meat and Milk Products	1		0.5	0.5	200g	French toast, Quiche Lorraine, croissant with egg, cheese and sausage (fast food)
7. Vegetables and Meat		1		1	150g	Succotash, Chili con carne, meat and vegetable stew
8. Vegetables and Milk Products		1	1		150g	Tzaziki, poutine, scalloped potatoes au gratin
9. Grains, Vegetables, Meat and Milk Products	1	0.25	0.5	0.5	200g	Spinach quiche, all dressed pizza, lasagna with meat, Burrito
10. Meat and milk products			1	1	150g	Eggnog, Sausage cheesefurter, chicken parmesan
11. Vegetables, meat and milk products		0.5	1	0.5	200	Clam chowder, Mixed dishes (chicken, broccoli, cheese), Salad with egg, cheese, vegetable

Appendix E: Body Mass Index (BMI)

The Body Mass Index (BMI) uses a person's weight (in kilograms) and height (in metres) to calculate his or her risk of developing health problems.

$$\text{BMI} = \frac{\text{weight (kg)}}{\text{height (m) x height (m)}}$$

Categories of BMI and Health Risk

BMI	Classification	Risk of developing health problems
< 18.5	Underweight	Increased
18.5 - 24.9	Normal Weight	Least
25.0 - 29.9	Overweight	Increased
30.0 - 34.9	Obese class I	High
35.0 - 39.9	Obese class II	Very high
>= 40.0	Obese class III	Extremely high

Notes: The BMI is not used for pregnant or lactating women. These BMI categories are not used for children less than 18 years of age. For people aged 65 and over, the "normal weight" classification may range from a BMI of 18.5 to 29.9. Other factors such as lifestyle habits, fitness level and the presence or absence of other health risk conditions need to be taken into consideration to determine an individual's risk. Source: Health Canada. Canadian Guidelines for Body Weight Classification in Adults. Ottawa: Minister of Public Works and Government Services Canada; 2003. Available from: http://www.hc-sc.gc.ca/fn-an/nutrition/weights-poids/guide-ld-adult/bmi_chart_java-graph_imc_java-eng.php

How to calculate your BMI:

Step 1: Determine your weight in kilograms.

To convert weight from pounds to kilograms, divide by **2.2:**

$$\frac{\textbf{weight (pounds)}}{\textbf{2.2}} = \textbf{weight (kg)}$$

Step 2: Determine your height in metres.

To convert height from feet and inches to metres:
a) Multiply height in feet times **12** to get height in **inches**
b) Add any **additional height** in inches to the value obtained in a)
c) Multiply value in b) times **0.0254** to get height in **metres**

Step 3: Take your weight in kilograms (value from Step 1) and divide by your height in metres (value from Step 2) squared.

$$\frac{\textbf{weight (kg)}}{\textbf{height (m) x height (m)}} = \textbf{BMI}$$

Step 4: Compare your BMI to the classification chart to determine your health risk.

Example: *Let's calculate the BMI of someone who weighs 160 pounds and is 5'8" tall:*

$$\frac{160 \text{ pounds}}{2.2} = 72.7 \text{ kg}$$

Step 2:

To convert height from 5'8" to metres:
a) multiply 5 feet x 12 inches per foot= 60 inches
b) 60 + 8 inches= 68 inches
c) 68 x 0.0254= 1.73 metres

So 5 feet 8 inches = 1.73 metres

Step 3:

$$\frac{72.7 \text{ kg}}{(1.73\text{m} \times 1.73\text{m})} = 24.3$$

Step 4:

According to the chart, a BMI of 24.3 falls within 18.5 - 24.9, the normal weight range that has the least risk to developing health problems.

Appendix F: Types of fruits and vegetables consumed from personal or community gardens in Manitoba First Nations communities

Types of fruits and vegetable eaten from gardens	% (n=920 responses)	Types of fruits and vegetable eaten from gardens	% (n=920 responses)
Potatoes	22.3	Garlic	0.4
Carrots	15.6	Broccoli	0.3
Onions	11.0	Melons	0.3
Cucumbers	10.1	Sprouts	0.3
Tomatoes	8.4	Strawberries	0.3
Corn	6.6	Cauliflower	0.2
Beets	4.4	Crabapples	0.2
Peas	2.9	Dill	0.2
Lettuce	2.5	Spinach	0.2
Cabbage	2.1	Apples	0.1
Rhubarb	1.8	Butter Squash	0.1
Beans,string	1.7	Chokecherry	0.1
Turnips	1.3	Cranberry	0.1
Zucchini	1.3	Parsley	0.1
Peppers (sweet bell, chili)	1.2	Plums	0.1
Radishes	1.2	Rutabagas	0.1
Pumpkins	1.1	Watercress	0.1
Celery	1	Blueberries	0.04
Raspberries	0.6		

Appendix G: List of nutritional supplements taken by Manitoba First Nations participants

Types of supplements reported to be taken	% of all supplements reported (n=130)
Calcium	20.0
Multivitamin/Multi-mineral Supplement, Adults	17.69
Vitamin D	12.31
Iron	11.54
Prenatal Vitamin	8.46
Vitamin B (B1, B3, B6, B12, Complex)	7.69
Vitamin C	3.08
Multivitamin/Multi-mineral Supplement, 50+	2.31
Multivitamin/Multi-mineral Supplement, Women	2.31
Fish Oil (Cod, Salmon)	1.54
Omega 3-6-9	1.54
Vital Greens Naka	1.54
Vitamin E	1.54
Apple Cider Vinegar	0.77
CalcareaCarbonica	0.77
Columbrina	0.77
Dr. Miller's Holy Tea	0.77
Ignatia Amara	0.77
Magnesium	0.77
Metamucil	0.77
Multivitamin/Multi-mineral Supplement, Children	0.77
Potassium	0.77
Resedronate Sodium	0.77
Vitamin A	0.77

Appendix H. Healthy Food Guidelines for First Nations Communities[12]

Guidelines for Communities

Food is part of celebration, ceremony, social functions, learning functions and is one of our best ways to bring people together. With many opportunities to offer and share food, we have plenty of opportunity to promote healthy choices by ensuring that healthy foods are available almost all of the time.

Serving healthy foods in communities means having healthy food selections at all community activities that include food such as: community programs, gatherings, meetings and special events as well as at daycares and schools and even as part of fundraising events. Serving healthy foods starts with the types of food offered as well as the amount of food offered.

The following table of foods was based on the Guidelines for Food and Beverage Sales in British Columbia Schools and further adapted from a document created by the First Nations Health Council in BC. It has been modified for this report to assist communities in the promotion of healthy food choices at community events. The table is broken into Food Categories based on nutrition criteria that assess the calories and amount of sugar, fat and salt (sodium) in these foods. The first category, "Leave off the Table", contains foods that are generally high in fat and sugar and/or salt. The second category, "Better on the Table", includes foods that may be low in fat or salt (sodium) but do not meet all of the criteria of foods that fit within the third category, "Great on the Table Anytime".

In order to promote healthy eating, we encourage communities to make and serve the types of foods listed under **"Better on the Table"** and **"Great on the Table Anytime"** as often as possible. Foods listed under **"Leave off the Table"** should be offered as little as possible or only at special occasions.

[12] Adapted with permission from First Nations Health Council. 2009. Healthy Food Guidelines for First Nations Communities. The complete guidelines are available through the First Nations Health Council http://www.fnhc.ca/ in their nutrition section.

Food Category	Leave off the Table	Better on the Table	Great on the Table Anytime
Grains			
Grains must be the first or second ingredient (not counting water) Grain ingredients may include: - flours made from wheat, rye, rice, potato, soy, millet, etc. - rice, pasta, corn, amaranth, quinoa, etc	• Flavoured or Instant rice • Fried Bannock, White bread, White buns • Baked goods and pastries (ex. Commercial muffins with a diameter more than 2 inches, cakes, cookies, danishes, croissant, cinnamon buns) • High fat crackers • Commercial or home-made pasta salads made with lots of dressing • Microwave popcorn and fried snack foods eg. Potato, tortilla chips	• White rice • Baked bannock, enriched breads, buns, bagels, tortillas, English muffins, pancakes, etc • Lower fat baked goods that are small in size (2 inch muffins, mini loaves • Low-fat crackers (no trans fat) • Pasta salads made with very little dressing • Other rice noodles • Trans-fat free, low-fat baked grain and corn snacks (baked tortilla chips, popcorn)	• Brown, wild or mix of brown & white rice • Whole grain baked bannock, breads, buns, bagels, tortillas, English muffins, pancakes, etc • Some small baked lower fat items with whole grains, fibre, fruit or nuts, such as loaves, muffins • Low-fat whole grain crackers • Most whole grain pastas • Whole grain and corn snacks (cereal mix, tortilla chips, hot air popcorn with no butter)
Note: Foods high in starches and sugars (natural or added) can remain stuck on teeth and put dental health at risk. Grain food choices of concern are sugary cereals, granola and granola bars, crackers, cookies and chips (corn, wheat, rice, etc). The Canadian Dental Association suggests eating these foods only at mealtimes and not as a snack.			
Vegetables & Fruit			
A vegetable or fruit or fruit puree must be the first or second ingredient, not counting water	• Raw, canned or cooked fresh/frozen fruits and vegetables served with condiments or add-ins that don't meet Better on the Community Table/Great on the Table Anytime criteria (ex. Fruit in heavy syrup, most canned vegetables) • Fruit with a sugar based coating (e.g., yogurt- or chocolate- covered raisins) • Dried fruit (e.g., fruit roll-ups/leathers/chips) or fruit juice snacks (e.g., gummies) • Regular potato/vegetable chips • Coated/breaded and deep fried vegetables (e.g., French-fried potatoes, onion rings) • High Salt (sodium) Pickles (see Condiments)	• Raw, canned or cooked fresh/frozen fruits and vegetables (including wild greens and berries) that are cooked or prepared with low salt, low-fat sauces (e.g, low-fat milk-based) or meet Better on the Table Criteria (ex. Fruit in light syrup, low sodium canned vegetables) • Some sweetened baked fruit slices • Low-salt, baked potato/vegetable chips • Low salt (sodium) pickles	• Raw, canned or cooked fresh/frozen berries, fruit and vegetables (including wild greens and berries) that are served plain or with the minimum amount of dressing/serving recommended in the Condiment Section • Homemade salsa with fresh tomatoes or canned diced tomatoes and minimal salt
Note: Foods high in sugars and starches (natural or added) can leave particles clinging to teeth and put dental health at risk. Vegetable/fruit choices of concern include fruit leathers, dried fruit, and chips (potato or other).			

Food Category	Leave off the Table	Better on the Table	Great on the Table Anytime
Vegetable & Fruit Juices			
A vegetable or fruit juice or puree must be the first ingredient (not counting water): - may be diluted with water or carbonated water - may have added food ingredients, e.g. Fruit pulp, fruit puree - may not be fortified with vitamins other than Vitamin C, or with minerals other than calcium.	• Most "drinks", "blends", "cocktails", "splashes" and "beverages" (if sweetened with added sugars) • Most regular tomato and vegetable juices • Fruit smoothies made with leave off the community table ingredients • Slushy drinks and frozen treats (e.g., frozen fruit juice bars) with added sugars (note that concentrated fruit juice is considered an added sugar when it is not preceded by water in the ingredient list) • Juice drinks with added caffeine, guarana or yerba	• 100% fruit juice • 100% fruit + vegetable juices • Some lower-sodium tomato and vegetable juices • Fruit smoothies made with better and great on the table ingredients • Slushy drinks and frozen treats (e.g., frozen fruit juice bars) with no added sugars • Diluted or sparkly juice drinks, no added sugars	• Natural berry juices with water but no added sugar
Note: 100% juice and other fruit drinks contain sugars and acids (natural or added) that dissolve tooth enamel when sipped frequently. To avoid prolonged exposure to these sugars and acids, choose plain water over fruit juice.			
Milk-based and Calcium Containing Foods			
For milk-based foods, milk must be the first ingredient; cream is NOT considered a milk ingredient	• Candy flavoured ice creams, sundaes and many frozen yogurts • Frozen 'yogurt' not based on milk ingredients (see "Candies, Chocolates, etc" food grouping) • Most ice milks, ice creams, and frozen novelties • Some puddings/custards • Some higher fat cheeses • Most cream cheese and light cream cheeses and spreads (see condiment section) • Most processed cheese slices and spreads made without milk • Whole fat cottage cheese	• Small portions of some ice milks and frozen yogurts – simply flavoured • Small portions of sherbert • Puddings/custards made with low fat milk and limited added sugar • Pudding/custards/ice milk bars with artificial sweeteners (not for young kids) • Most flavoured yogurts • Yogurt with artificial sweeteners • Processed cheese slices made with milk • 1-2% milk fat cottage cheese	• Some flavoured yogurts (lower fat and sugar) • Plain yogurt (low-fat) • Most regular and reduced fat or light cheeses, cheese strings (unprocessed) • Low-sodium cottage cheese (1% milk fat.) • Canned salmon with bones
Note: Individuals who do not eat or drink milk products should seek advice from a health care provider.			

Food Category	Leave off the Table	Better on the Table	Great on the Table Anytime
Milk & Calcium Containing Beverages			
Milk must be the first ingredient; cream is NOT considered a milk ingredient. Fortified soy drinks contain protein and calcium and are included in this food grouping.	• Most candy flavoured milks • Most eggnogs • Most hot chocolate mixes made with water (see also "Other Beverages") • Smoothies made with Leave off the Community Table ingredients • Some blended sweetened regular and decaf coffee drinks	• Most basic flavoured milks and fortified soy drinks • Yogurt drinks • Some eggnogs if lower in sugar • Most hot chocolates made with milk • Smoothies made with Better on the Community Table ingredients	• Plain, unflavoured fortified soy and rice drinks • Skim, 1% and 2% milk • Some hot chocolates made with milk and very little added sugar • Smoothies made with ingredients from the "Great on the Table Anytime" list • Decaffeinated, unsweetened tea/coffee latté
Note: Whole milk (3.25%) is recommended for children less than 2 years of age. Lower fat milks are suitable for children older than 2 years of age. Individuals who do not eat or drink milk products should seek advice from a health care provider.			
Meat & Alternatives			
A meat or meat alternative must be the first or second ingredient (excluding nuts and seeds*). Meat and meat alternatives include: beef, pork, poultry, fish, game meats, eggs, soybeans, legumes, tofu. *See the "Nuts & Seed Mixes or Bars" category for guidelines on these items	• Many products deep fried in hydrogenated or partially hydrogenated oils or in vegetable shortening • Marbled or fatty meats • Many cold cuts and deli meats (deli chicken, deli beef, pepperoni, bologna, salami, etc) if high in salt or contain nitrates • Canned meats (Kam, Klik, corned beef, ham, etc) • Some seasoned chicken or tuna salads • Most regular wieners, sausages, smokies, bratwurst • Most Pepperoni/chicken sticks • Some jerky • Bacon	• Some breaded and baked chicken/fish/meat • Some marinated poultry • Some fish canned in oil • Some deli meats if not too salty • Some chicken or tuna salads, lightly seasoned • Some lean wieners, sausages • Lean pepperoni/chicken sticks • Some jerky, lightly seasoned • Some egg salads, lightly seasoned • Legume salads, lightly seasoned • Some refried beans	• Chicken, turkey • Fish, seafood, fresh or canned in water/broth • Lean meat (beef, bison, pork, lamb) • Game meats and birds (moose, caribou, duck, etc) • Eggs, Tofu • Some chicken salads if lower salt • Some lean wieners if lower salt • Jerky (plain) • Beans, peas, lentils • Most legume salads if lower salt • Refried beans (lower fat)
Note: Many processed meats are high in saturated fat, salt and nitrates. Choose non-processed, lean meat, poultry or fish instead. Wild game meats and fish are lower in saturated fat and contain no added salt or nitrates.			

Food Category	Leave off the Table	Better on the Table	Great on the Table Anytime
Nuts & Seeds (Mixes or Bars)			
Peanuts, nuts or seeds must be the first or second ingredient.	• Nuts with a sugar based coating (eg. Chocolate, yogurt covered nuts) • Salty or sugary nut/seed bars and mixes (e.g. sesame snap bars) • Nuts/seeds that are highly salted or flavoured and roasted in additional oil	• Nuts/seed bars and mixes with nuts/seeds or fruit as the first ingredient and no sugar based coatings	• Nut/seed bars and mixes with nuts/seeds or fruit as first ingredient • Nuts/seeds, natural or dry roasted
Mixed Entrée Foods			
Note: Some trans fats occur naturally in meats like beef, lamb, goat, deer, moose, elk, and buffalo. Naturally occurring trans fats are considered healthy	• Sandwiches with deli or processed meats • Subway style sandwiches greater than 6 inches • Some pizzas (4 cheese/double cheese, meat lover) • Pizza pockets • Meat pot pies • Sausage/vegetable rolls • Pasta with a cream based sauce	• Most sandwiches • Short (e.g. 6 inch) submarine sandwiches, and burgers made with lean roasted meats (turkey, chicken, beef), but few vegetables • Some cheese or meat pizzas with vegetables • Baked pizza pockets, pizza pretzels, pizza bagels • Some curries, moderately salted • Stir fries • Sushi • Pilaf (rice and meat) • Pasta with milk or vegetable based sauce • Hard tacos with meat or bean filing	• Sandwiches • Short 6 inch submarine sandwiches and burgers made with lean meats (turkey, chicken, beef) and plenty of vegetables and whole grain bread/buns • Some pizzas with vegetables • Stews, chillies, curries (lower sodium) • Stir fries on rice, if sauce is low in sodium • Pilaf (with vegetables) • Pasta with vegetable and meat based sauce • Burritos (bean or meat) • Soft tacos filled with “Great on the Table” ingredients • Some low sodium frozen entrees
Candies, Chocolates			
	• Most regular packages • Most very small packages of candies/chocolates • Very small portions of dessert gelatins	• Sugar-free gum or mints or cough drops • Diabetic candies (adults only)	• None

Food Category	Leave off the Table	Better on the Table	Great on the Table Anytime
Soups			
Includes dry, canned and fresh	• Some instant soups, plain or seasoned • Regular canned soups, broth or milk based • Many canned soups, broth or milk based • Ramen noodles	• Home-made soups made with soup bouillon/stock and other ingredients from the "Great on the Table Anytime" list • Hamburger soup made with regular fat meat • Some low-sodium canned or instant soups	• Home-made soups made without soup bouillon/stock • Hamburger soup made with lean meat (lean ground beef, moose or deer meat) • Some soups made with meat or beans/lentils • Some low-sodium canned or instant soups made with meat or beans/lentils
Other Beverages* (Non-Juice/Non-Milk based)			
	• Most drinks with sugars as the first ingredient (not counting water) – e.g. iced teas, fruit 'aides', pops • Most sport drinks* • Most hot chocolate mixes made with water	• Water (flavoured or not) minimally sweetened • Soda water ** • Diet decaf soft drinks and diet non-carbonated drinks (Secondary schools only) • Decaf tea • Decaf coffee	• Water, plain • Lemon/lime water • Soda water ** • Sparkling/carbonated water or water with added flavours (no added sugar and/or no artificial sweeteners) • Labrador Tea • Fruit/mint flavoured unsweetened teas

*Sport/electrolyte drinks containing added sugars are not recommended. These beverages may be useful during sports events lasting more than 1 hour on hot days. Plain water is the best beverage when exercising.

* Other Beverages may provide excess calories, caffeine, artificial sweeteners, or acids and often displace healthier food/beverage choices.
These beverages often contain acids (natural or added) that may dissolve tooth enamel when sipped frequently. To reduce risk of damage to tooth enamel, choose water most often as a beverage.
Limit portion sizes of "Other Beverages" (except plain water) to: 250 mL or less per serving for children (aged 5-12) and 360 mL or less for children aged 12 and older.

**If serving soda water, check the sodium content as some brands may have higher levels.

Food Category	Use in Moderation	Generally No Limits
Condiments & Add-Ins		
	• Soy sauce: 2 - 3 mL • Hot sauce: 5 - 10 mL • Table salt: ¼ - ½ mL • Soft margarine, butter: 5 - 10 mL • Cream: 5 - 15 mL Whipped Cream (from cream): 15 - 30 mL • Regular/light cream cheese or processed cheese spread: 5 - 15 mL • Regular sour cream: 15 - 30 mL • Low-fat sour cream: 15 – 45 mL • Fat-free sour cream: 15 – 60 mL • Low-fat/fat-free dips, dressings, spreads (e.g., mayonnaise, miracle whip, sandwich spread): 5 - 15 mL • Regular dips, dressings, spreads: 5 - 10 mL • Oil for sautéing or dressing (e.g., homemade vinegar and oil): 5 - 10 mL • Ketchup, mustard, relishes : 10 - 15 mL • Pickles (regular): 10-15 ml (Low sodium pickles: no limit) • Horseradish: 10 - 45 mL • Jarred salsa, sauerkraut: 10 - 30 mL (fresh salsa can fit into the Vegetables and Fruit food grouping) • Salad toppers (e.g. Bacon bits): 5 - 10 mL Croutons: 25 - 50 mL • Sugars, honey, jams/jellies, molasses, syrups (e.g., pancake): 15 mL • Flavoured syrups (e.g. for lattes): 1 pump (10 mL)	• Herbs and salt-free seasonings, garlic, pepper, lemon juice, Mrs. Dash
Condiments and add-ins can be used to enhance the flavour of Better on the Table and Great on the Table Anytime items. Condiments and add-ins should be served on the side whenever possible.		

Appendix I: Summary of Results for Manitoba

First Nations Food, Nutrition and Environment Study (FNFNES)

University of Northern British Columbia
Université de Montréal
Assembly of First Nations

Summary of Results: Manitoba

What was the study about?

A study was conducted in **9 Manitoba First Nations** communities during the fall of 2010 to find out:

- What kinds of traditional and market foods are people eating?
- How well are people eating?
- Is the water safe to drink?
- Are the levels of pharmaceuticals in the water safe?
- Are people being exposed to harmful levels of mercury?
- Is traditional food safe to eat?

Who participated?

- 706 adults from Manitoba
- 477 women and 229 men
- average age:
  42 years old (women)
  41 years old (men)

Which communities participated?

- Swan Lake First Nation
- Sandy Bay Ojibway First Nation
- Pine Creek First Nation
- Chemawawin Cree Nation
- Sagkeeng First Nation
- Hollow Water First Nation
- Cross Lake Band of Indians
- Sayisi Dene First Nation
- Northlands Denesuline First Nation

What kinds of traditional and market foods are people eating?

Top 5* traditional foods eaten in Manitoba:	Top 5* market foods eaten in Manitoba:
1. Moose	1. Soups
2. Wild rice	2. Pasta
3. Walleye	3. Eggs
4. Ducks	4. Potatoes
5. Deer	5. White bread

*based on grams per person per day





Thank you to everyone who participated!

How well are Manitoba First Nations eating compared to the recommendations?

Food Group	Gender	Manitoba FNs Current Diet	Canada's Food Guide Recommendations
		Servings/day	
Vegetables and Fruit	men:	5	7-10
	women:	4	7-8
Suggestion for change: Eat more vegetables and fruits. 1 serving= 1/2 cup of dark green or orange vegetables, or 1/2 cup of wild plants, or 1/2 cup of berries or fruits			
Grain Products	men:	6	7-8
	women:	5	6-7
Suggestion for change: Eat more whole grains. 1 serving= 1 slice of whole wheat bread or bannock, or 1/2 cup of whole wheat pasta, or 1/2 cup of wild or brown rice			
Milk and Alternatives*	men:	1	2-3
	women:	1	2-3
Suggestion for change: Eat more milk products. 1 serving= 1 cup of milk or fortified soy milk, or 3/4 cup of yogurt, or 50 grams (1 1/2 oz) of cheese *Individuals who do not eat or drink milk products should seek advice from a health care provider.			
Meat and Alternatives	men:	4	3
	women:	3	2
Suggestion for change: Choose non-processed, leaner meats and fish. 1 serving =1/2 cup of meat, wild game, fish or shellfish, or 2 eggs, or 3/4 cup of beans			

Intake of foods high in salt and fat is excessive.

Depending on age, 64-91% of Manitoba First Nations women and 79-89% of Manitoba First Nations men are overweight or obese.

23% of MB First Nations adults have diabetes

Food insecurity is a serious problem in Manitoba First Nations communities.

- **38%** of Manitoba First Nations households experience food insecurity.
- **35%** worried that their food would run out before they could buy more.
- **32%** said that food they bought didn't last and there wasn't any money to buy more.

Average weekly cost of groceries to feed a family of four:

MB First Nation community

Winnipeg

Is the water safe to drink?

The results from the 311 water samples collected from Manitoba (including re-testing of 1 household) showed that the water is safe to drink.

Are the levels of pharmaceuticals in the water safe?

The levels of pharmaceuticals found in the water sources near the communities are not harmful to human health.

Are people being exposed to harmful levels of mercury?

Only 8 out of the 236 hair samples had levels of mercury that were above Health Canada's guideline normal acceptable range. Letters were sent to these 8 participants with suggestions on how to reduce their exposure to mercury.

Is traditional food safe to eat?

Traditional food is safe to eat and healthy for you.

- A total of 651 food samples representing 83 different types of traditional food were collected for contaminant analyses.
- Levels of contaminants in traditional food are within levels that are typically found in this region.
- Intake of contaminants (except lead) from traditional food is below the guideline levels and is not a cause for concern.

Recommendation: Use steel shot instead of lead shot. Eating wild game contaminated by lead shot can be harmful to the brain, especially in children.

Key Results For All Manitoba First Nations Communities:

1. Overall, the nutritional quality of food intake is below what is required for optimal health but it is improved when traditional food is eaten.
2. Overweight/obesity, smoking and diabetes are major health issues.
3. Food insecurity is a serious problem.
4. Water quality is overall satisfactory but close monitoring is recommended.
5. Mercury exposure, as measured by mercury levels in hair and food intake, is not a health concern.
6. Chemical contamination of traditional food does not warrant any health concern, but it is important to have the information that was collected in this study to monitor any future changes.

More information can be found on the FNFNES website: www.fnfnes.ca

If you have any questions about these results or the project itself, please contact:

Judy Mitchell, FNFNES coordinator
Phone: (250) 960-6708
Email: fnfnes@unbc.ca

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UNBC UNIVERSITY OF NORTHERN BRITISH COLUMBIA

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