

Food Security Status of Indigenous Peoples in Canada According to the 4 Pillars of Food Security: A Scoping Review

Mojtaba Shafiee,¹ Pardis Keshavarz,¹ Ginny Lane,² Punam Pahwa,^{3,4} Michael Szafron,⁵ Derek Jennings,³ and Hassan Vatanparast^{1,5}

¹College of Pharmacy and Nutrition, University of Saskatchewan, Saskatoon, Saskatchewan, Canada; ²Margaret Ritchie School of Family and Consumer Sciences, University of Idaho, Moscow, ID, USA; ³Department of Community Health and Epidemiology, University of Saskatchewan, Saskatoon, Saskatchewan, Canada; ⁴Canadian Centre for Health and Safety in Agriculture, University of Saskatchewan, Saskatoon, Saskatchewan, Canada; and ⁵School of Public Health, University of Saskatchewan, Saskatoon, Saskatchewan, Canada

ABSTRACT

Food insecurity is a significant public health problem for Indigenous peoples in Canada. A comprehensive literature review is needed to organize the evidence according to the 4 pillars of food security (i.e., availability, access, utilization, and stability) and identify gaps in the published literature on this topic. Therefore, in this scoping review we aimed to summarize the published research discussing any of the 4 pillars of food security among Indigenous peoples in Canada. We conducted a literature search of the following databases: Ovid Medline, EMBASE, Web of Science (Web of Knowledge), and CINAHL, as well as the Indigenous Studies Portal (up to June 19, 2021). Population-based studies of any design were included, except for review-style articles. Articles published in languages other than English were also excluded. Of the 4687 studies identified by the database searches, 91 met our inclusion criteria. Evidence from these studies indicates that all dimensions of food security among Indigenous peoples in Canada have been impacted. Lack of availability of both traditional and market foods is highlighted among Inuit and First Nation communities. Economic disadvantages, high food prices, and lack of access to transportation are major factors affecting the accessibility pillar of food security. Major factors affecting the utilization pillar of food security are the loss of traditional knowledge and skills, lack of knowledge on market foods, low quality of market foods, and food safety issues. Climate change has affected all 4 pillars of food security among Indigenous peoples. These findings suggest that resolving food insecurity issues among Indigenous peoples in Canada, especially those living in remote communities, requires a culturally specific integrated approach targeting food availability, food cost, food knowledge, food safety, and food quality. *Adv Nutr* 2022;13:2537–2558.

Statement of Significance: This article is, to our knowledge, the first scoping review in the literature that was performed with the aim of summarizing the published research discussing any of the 4 pillars of food security among Indigenous peoples in Canada.

Keywords: Indigenous peoples, food security, availability, accessibility, utilization, stability, Canada

Introduction

In Canada, Indigenous peoples include First Nations, Métis, and Inuit peoples (the original inhabitants of Canada) and their descendants (1). The term “First Nations” refers to

status and nonstatus Indian peoples living in Canada (1). Métis are people of mixed First Nation and European ancestry, while the Inuit are a group of Indigenous people who originally inhabited areas within the Arctic region of Canada (2). In 2016, ~1.7 million people in Canada identified as an Indigenous person, which represented 4.9% of the total population (3). According to Statistics Canada data, the Indigenous population has increased by 42.5% since 2006, which is more than 4 times the growth rate for the rest of the Canadian population (3). The Métis population increased by 51.2% from 2006 to 2016, making it the fastest growing population in Canada, followed by First Nations (39.9%) and Inuit (29.1%) (3). Higher fertility and changes

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Supplementary Box 1 data are available from the “Supplementary data” link in the online posting of the article and from the same link in the online table of contents at <https://academic.oup.com/advances/>.

Address correspondence to HV (e-mail: vatan.h@usask.ca).

Abbreviations used: APS, Aboriginal Peoples Survey; HFSSM, Household Food Security Survey Module; PRISMA-ScR, Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews; CFP, community food programs; POP, persistent organic pollutant; COVID-19, coronavirus disease 2019.

in the self-reporting of Indigenous identity over a person's lifetime are the main reasons behind the higher growth rate of the Indigenous population (4). The Indigenous population is projected to exceed 2.5 million persons by 2036 (3). However, despite this fast growth, Indigenous populations continue to experience challenges with meeting their basic needs, such as access to safe and nutritious food (5, 6).

According to the FAO of the UN, food security exists when "all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (7). Food insecurity ranges from worrying about food running out to severe levels of hunger (8). Food security is often conceptualized as resting on 4 pillars: availability, accessibility, utilization, and stability (9, 10). The availability pillar of food security addresses the production and supply of food and refers to the presence of safe and nutritious food in a given place (e.g., at a local market in winter) and at a given time (9, 10). The access pillar of food security is concerned with the ability of an individual or household to gain access to available food. This pillar addresses the ability to purchase food (i.e., economic access) or exchange goods for foods, as well as physical and familial access to food (e.g., sharing country food) (9, 10). The utilization dimension addresses adequate dietary intake and the body's ability to use the nutrients in food. This pillar takes into account cultural considerations and food safety, storage, and cooking skills (9, 10). Food stability refers to the stability of the other 3 pillars over time, and food stability is attained when everyone at the individual, household, community, and population levels has sustained access to sufficient, safe, and nutritious food at all times (10, 11).

Food insecurity is a significant public health problem for Indigenous peoples in Canada (9). Depending on living circumstances and geographic region, the prevalence and severity of household food insecurity among Indigenous households in Canada are ~2–6 times greater than those for other Canadian households (12). During 2017–2018, the prevalence of food insecurity among Indigenous households living off the reservation was more than twice the prevalence of food insecurity among other Canadian households (28.2% compared with 12.7%) (13). According to data from the First Nations Food, Nutrition, and Environment Study (2008–2018), almost half of First Nations households living on-reserve were food insecure, and the prevalence was higher in the Western regions of Canada (14). Furthermore, the 2012 Aboriginal Peoples Survey found that more than half of Inuit people (52%) in the Inuit homeland aged ≥ 25 y lived in households in which the residents had experienced some level of food insecurity in the previous 12 mo (15).

The Household Food Security Survey Module (HFSSM) is a tool commonly used to measure food security status in the Aboriginal Peoples Survey (APS), a national survey on the social and economic conditions of First Nations people living off-reserve [Métis and Inuit (16)]. The HFSSM focuses solely on inadequate food availability, access, and utilization due to limited financial resources and does not take into

account other nonfinancial aspects (17). The HFSSM also does not incorporate traditional food practices, which are crucial to Indigenous peoples' cultural identity and health (9, 18). The use of local and traditional foods, however, has the potential to combat food insecurity problems, as these foods are healthier, sustainably sourced, and more culturally appropriate than market foods (19). Thus, according to Power (8) it is necessary to consider both the market and traditional food systems when measuring and conceptualizing Indigenous food security. However, it is important to note that historical trauma associated with the colonization of Indigenous peoples has disrupted traditional food systems and cultural practices (20).

Currently there is no comprehensive review that organizes the literature on the food security status of Indigenous peoples according to the 4 pillars of food security. Therefore, this scoping review aims to summarize the published research discussing any of the 4 pillars of food security (i.e., availability, access, utilization, and stability) among Indigenous peoples in Canada to support future efforts to develop effective approaches to improve their food security.

Methods

The multidisciplinary and complex nature of the literature touching on the pillars of food security among Indigenous peoples in Canada prompted us to use a scoping review approach to map the existing literature on this topic to identify key concepts and research gaps across diverse disciplines (21, 22). This scoping review was guided by processes described by Levac and colleagues (22) and Arskey and O'Malley (23), and also followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) checklist (24).

Study selection

We searched the Ovid MEDLINE, EMBASE, Web of Science (Web of Knowledge), and CINAHL databases. The Indigenous Studies Portal, which is a database of articles and gray literature, was searched to identify additional relevant studies. The search retrieved articles published in English up to June 19, 2021. The search strategies were adapted as required for each database. The search strategy was formulated and tested with assistance from a University of Saskatchewan librarian with expertise in scoping and systematic reviews. **Supplementary Box 1** presents a Science Citation Index (Web of Science) search strategy.

Inclusion criteria

We included population-based original studies of any design (including cross-sectional studies, prospective cohort studies, qualitative studies, and intervention trials) if they provided useful information on one of the 4 pillars of food security (i.e., availability, access, utilization, and stability) among Indigenous peoples living on- and off-reserve in Canada. **Table 1** presents the inclusion criteria.

TABLE 1 Inclusion criteria

Characteristic	Source inclusion criteria
Date published	Published up to June 19, 2021
Publication status	Population-based studies of any design (including cross-sectional studies, prospective cohort studies, qualitative studies, and intervention trials). Excluded review style articles such as systematic reviews, meta-analyses, and scoping reviews
Language	Published in English
Study population	Indigenous peoples living on- and off-reserve in Canada
Research context—food security	Reports providing information relevant to each of the 4 pillars of food security (i.e., availability, access, utilization, and stability)
Research context—availability	Reports on availability of traditional/country and store-bought foods
Research context—accessibility	Reports on physical, familial, and financial access to traditional/country and store-bought foods
Research context—utilization	Reports on knowledge and understanding of an adequate diet, preference and cultural acceptability, and food safety/quality
Research context—stability	Reports on the stability of other 3 dimensions (i.e., availability, access, utilization) over time
Research context—location	Reports on research in Canada or in a Canadian context
Access	Available as full text online

Exclusion criteria

Articles written in any other language besides English and those that were not available with full-text were excluded. We also excluded review papers of any type, such as systematic reviews, meta-analyses, or scoping reviews.

Screening process

We exported the final search results into EndNote and removed duplicate sources. Two independent reviewers (M.S. and P.K.) conducted the first screening, during which titles and abstracts were screened for relevance using an eligibility form. The initial screening resulted in the exclusion of 2732 records. Records meeting the screening criteria ($n = 118$) proceeded to the second screening, where the 2 independent reviewers assessed the full-text of each article. Reviewers met during the screening process to share their comments and resolve conflicts. All discrepancies between reviewers were resolved by a third reviewer (H.V.). The reference lists of retrieved articles were hand-searched to identify additional related studies not captured in the initial search. In total, 91 articles proceeded to data extraction and analysis.

Data extraction and synthesis

Two reviewers extracted data independently. **Table 2** presents the study characteristics of each article. We summarized the literature according to how the literature fits within each pillar of food security. A word cloud was generated from the 91 eligible articles to show the most frequently repeated words appearing in their title and results sections (**Figure 1**). Prepositions, conjunctions, and collective nouns were excluded from the word cloud.

Results and Discussion

Characteristics of included articles

The search strategy identified 4687 articles, and after removing duplicates, 2982 articles remained. A total of 91 peer-reviewed articles met the inclusion criteria and were included in the scoping review (**Figure 2**). **Figure 3** presents

the included articles by year. Of the 91 eligible articles, the largest proportion was published in 2018 (12.1%). Research carried out among First Nations people living on-reserve was most common (46.2%), followed by research carried out among the Inuit (41.8%) (**Figure 4**). Research was commonly conducted in the territory of Nunavut ($n = 29$), followed by the province of Ontario ($n = 26$) (**Figure 5**).

Description of pillars of food security

This description and discussion of all pillars of food security among Indigenous peoples in Canada includes a discussion of the availability of traditional/country and store-bought foods; physical, familial, and financial access to traditional/country and store-bought foods; and knowledge and understanding of an adequate diet, dietary preferences and cultural acceptability; and food safety and quality.

Availability.

Availability of traditional foods. A common observation noted by Indigenous people living in the Arctic and subarctic regions of Canada was the reduced population size or quantity of wildlife, which negatively affects the availability of country foods (25–31). Inuits living in Cambridge Bay and Pond Inlet reported reduced population size of harvested wildlife, especially caribou, muskox, and narwhal, as one of the major determinants of low-yield harvests (25). Wildlife migration patterns and proximity to hunting grounds also affected the availability of wildlife to Indigenous hunters and limited their ability to harvest country foods (25). Most households in 2 First Nations communities in the Yukon (Old Crow and Teslin) reported consuming fewer traditional foods than they had 15 y ago. The main reason for decreased consumption of some traditional foods was decreased availability or unavailability of specific foods (32). The low Pacific salmon population has created a number of food security challenges for First Nations peoples in British Columbia (26). Residents of Sioux Lookout, a northern Ontario community, reported limited opportunities to buy

TABLE 2 Identification and characteristics of studies conducted with Indigenous populations in Canada¹

Reference	Author	Publication year	Location	Target population	Pillars of food security	Climate change
(14)	Batal et al	2021	British Columbia (2008–2009), Manitoba (2010), Ontario (2011–2012), Alberta (2013), Atlantic region (New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland (excluding Labrador) (2014), Saskatchewan (2015), and Quebec/Labrador (2016)	On-reserve First Nations	Accessibility, utilization	Yes
(18)	Skinner et al	2014	Sub-Arctic community within the Mushkegowuk Territory, Ontario	On-reserve First Nations	Accessibility	
(25)	Gilbert et al	2021	Nunavut	Inuit	Availability, accessibility	Yes
(26)	Steel et al	2021	British Columbia, Heiltsuk First Nation	On-reserve First Nations	Availability, accessibility	
(27)	Bruner et al	2014	Saskatchewan	On-reserve First Nations	Availability, accessibility, utilization	
(28)	Campbell et al	1997	Three Northern Manitoba Cree Communities	On-reserve First Nations	Availability, accessibility	
(29)	Baskin et al	2007	Toronto, Ontario	Off-reserve First Nations	Availability, accessibility	
(30)	Panikkar et al	2020	Nunavut	Inuit	Availability, accessibility, utilization	Yes
(31)	Douglas et al	2014	Old Crow, Yukon	On-reserve First Nations	Availability, accessibility, utilization	
(32)	Schuster et al	2011	Two First Nations communities in the Yukon	On-reserve First Nations	Availability	
(33)	Parker et al	2018	Sioux Lookout, Ontario	On-reserve First Nations	Availability, accessibility, utilization	
(34)	Wendimu et al	2018	Northern Manitoba	On-reserve First Nations	Availability, accessibility	
(35)	Elliott et al	2012	Urban Areas - Vancouver, British Columbia	Off-reserve First Nations	Availability, accessibility, utilization	
(36)	Randazzo	2018	Wapekeka Ontario - Gitxaala British Columbia	On-reserve First Nations	Availability, accessibility, utilization	
(37)	Beaumier et al	2010	Igloolik, Nunavut	Inuit	Availability, accessibility	Yes
(38)	Kristin et al	2017	The provincial Norths, Yukon, NWT, Nunavut, Nunavik, or Labrador	On-reserve First Nations	Availability, accessibility, utilization	
(39)	Egeland et al	2011	16 Nunavut communities	Inuit	Accessibility	
(40)	Huet et al	2012	ISR, Nunavut, and Nunatsiavut	Inuit	Accessibility	
(41)	Lambden et al	2006	44 communities across Arctic Canada - NWT and Yukon	First Nations, Dene/Métis & Inuit	Accessibility	
(42)	Delormier et al	2017	Quebec, Kahnawake community	On-reserve First Nations	Accessibility	
(43)	Shannon Greenwood et al	2014	Remote Aboriginal communities on Haida Gwaii, British Columbia	On-reserve First Nations	Accessibility	
(44)	Laberge et al	2015	Cree community of Mistissini, Northern Quebec	On-reserve First Nations	Accessibility, utilization	

(Continued)

TABLE 2 (Continued)

Reference	Author	Publication year	Location	Target population	Pillars of food security	Climate change
(45)	Skinner et al	2013	Remote Indigenous community in sub-Arctic Ontario, Fort Albany First Nation on the west coast of James Bay in the Mushkegowuk Territory along the Albany River in northern Ontario, Canada	On-reserve First Nations	Accessibility, utilization	Yes
(46)	Deaton et al	2020	All provinces and territories, excluding Nunavut	On-reserve First Nations	Accessibility	
(47)	Skinner et al	2006	Remote sub-Arctic community, Fort Albany First Nation, Ontario	On-reserve First Nations	Accessibility, utilization	
(48)	Domingo et al	2021	First Nations communities in British Columbia, Manitoba, Alberta, and Ontario	On-reserve First Nations	Accessibility	
(49)	Huet et al	2017	Manitoba, Nunavut	Inuit	Accessibility	
(50)	Guo et al	2015	Iqaluit, Nunavut	Inuit	Accessibility	
(51)	Ruiz-Castell et al	2015	Iqaluit, Nunavut	Inuit	Accessibility	
(52)	Ford et al	2012	Iqaluit, Nunavut	Inuit	Accessibility	
(53)	Findlay et al	2013	10 provinces and 3 territories	Inuit	Accessibility	
(54)	Egeland et al	2010	16 Nunavut communities	Inuit	Accessibility	
(55)	Chan et al	2006	Nunavut, 6 Inuit communities, Kitikmeot, Kivalliq and Qikiqtaaluk (Baffin) regions	Inuit	Accessibility, utilization	
(56)	Bhawra et al	2015	Midland-Penetanguishene and London, Ontario	Off-reserve First Nations & Métis	Accessibility, utilization	
(57)	Richmond et al	2020	Southwestern Ontario, London, and First Nation reserve ~30 km from city center	On- and Off-reserve First Nations	Accessibility	
(58)	Richmond et al	2021	Community-based study with Southwest Ontario Aboriginal Health Access Centre, London, Ontario	On- and Off-reserve First Nations	Accessibility, utilization	
(59)	Socha et al	2011	Thunder Bay, Ontario	On-reserve First Nations	Accessibility	
(60)	Fidler	2012	Northern First Nations community, Ontario	On-reserve First Nations	Accessibility	
(61)	Genuis et al	2015	Alexander First Nation, Alberta	On-reserve First Nations	Accessibility, utilization	Yes
(62)	Domingo et al	2021	Williams Treaties First Nations, southern Ontario	On-reserve First Nations	Accessibility, utilization	Yes
(63)	Wein	1994	4 Yukon communities	On-reserve First Nations	Accessibility	
(64)	Ford and Beaumier	2011	Igloodik, Nunavut	Inuit	Accessibility, utilization	Yes
(65)	Akande et al	2021	Iqaluit, Nunavut	Inuit	Accessibility	Yes
(66)	Kenny et al	2018	ISR	Inuit	Accessibility	
(67)	Mead et al	2010	Nunavut	Inuit	Accessibility, utilization	
(68)	Rosol et al	2011	36 communities in 3 jurisdictions (ISR, Nunavut, Nunatsiavut region)	Inuit	Accessibility	
(69)	Lardeau et al	2011	Iqaluit, Nunavut	Inuit	Accessibility	

(Continued)

TABLE 2 (Continued)

Reference	Author	Publication year	Location	Target population	Pillars of food security	Climate change
(70)	Pal et al	2013	Remote Northern Ontario First Nations communities Wapekeka (Angling Lake) First Nation and Kasabonika First Nation	On-reserve First Nations	Accessibility	
(71)	Neufeld et al	2017	City of London, Ontario, and nearby First Nations reserves	On- and Off-reserve First Nations	Accessibility, utilization	
(72)	Brown et al	2008	Urban areas, Manitoba	Off-reserve First Nations	Accessibility, utilization	
(73)	Cidro et al	2015	Urban areas, Manitoba	Off-reserve First Nations	Accessibility	
(74)	Lowitt et al	2018	Saugeen Ojibway Nation, Lake Huron, Ontario	On-reserve First Nations	Accessibility	
(75)	Collings et al	2016	Hamlet of Ulukhaktok, Victoria Island, NWT	Inuit	Accessibility	
(76)	Kenny et al	2018	36 communities, spanning 3 regions (ISR, Nunavut; Nunatsiavut) of Canadian North	Inuit	Accessibility	
(77)	Ayers et al	2012	Cowichan Tribes, Stz'uminus First Nation (formerly Chemainus First Nation), Halalt First Nation, Penelakut Tribe, Lyackson First Nation, and Lake Cowichan First Nation, British Columbia	On-reserve First Nations	Accessibility	
(78)	Beaumier et al	2015	Arviat, Nunavut	Inuit	Accessibility, utilization	Yes
(79)	Hanemaayer et al	2020	Haudenosaunee community, Southern Ontario	On-reserve First Nations	Utilization	
(80)	Calder et al	2019	3 Inuit communities, Labrador, Nunatsiavut	Inuit	Utilization	
(81)	Bordeleau et al	2016	Abitibi-Témiscamingue and Northern Quebec, on traditional territories of 4 Anishnaabeg (Algonquin) communities	On-reserve First Nations	Utilization	
(82)	Chan et al	1997	Qikiqtarjuaq, Baffin Island, Nunavut	Inuit	Utilization	
(83)	Seabert et al	2014	2 remote First Nations communities in Northern Ontario	On-reserve First Nations	Utilization	
(84)	Juric et al	2017	First Nations living on-reserve in Ontario	On-reserve First Nations	Utilization	
(85)	Laird et al	2018	Lakes of Dehcho Region, Mackenzie Valley, NWT	On-reserve First Nations	Utilization	
(86)	Lemire et al	2015	Nunavik, Northern Quebec	Inuit	Utilization	
(87)	Moriarity et al	2020	9 communities of the Eeyou Itchee territory, James Bay, Quebec	On-reserve First Nations	Utilization	
(88)	Moriarity et al	2020	Eeyou Itchee, James Bay, Quebec	On-reserve First Nations	Utilization	
(89)	Tian et al	2011	Nunavut	Inuit	Utilization	
(90)	Schuster et al	2011	Vuntut Gwitchin First Nation community, Old Crow, Yukon	On-reserve First Nations	Utilization	
(91)	Juric et al	2018	First Nations people living on-reserve in Ontario	On-reserve First Nations	Utilization	
(92)	McAuley et al	2018	First Nations communities in Alberta	On-reserve First Nations	Utilization	

(Continued)

TABLE 2 (Continued)

Reference	Author	Publication year	Location	Target population	Pillars of food security	Climate change
(93)	Ostertag et al	2009	Nunavut	Inuit	Utilization	
(94)	Liberda et al	2011	3 First Nations communities, James Bay Region, Ontario	On-reserve First Nations	Utilization	
(95)	Berti et al	1998	16 Dene/Métis communities, western NWT	Dene/Métis	Utilization	
(96)	Hingston et al	2020	First Nations communities in British Columbia	On-reserve First Nations	Utilization	Yes
(97)	Lambden et al	2007	44 Arctic communities, NWT and Yukon	First Nations, Dene/Métis & Inuit	Utilization	Yes
(101)	Cunsolo Willox et al	2012	Nunatsiavut	Inuit	Accessibility	Yes
(102)	Berkes et al	2002	Inuvialuit people of small community of Sachs Harbour, ISR	Inuit	Availability, accessibility, utilization	Yes
(103)	Wesche et al	2010	4 Inuit communities, ISR, Western Arctic	Inuit	Availability, accessibility, utilization	Yes
(104)	Laidler et al	2009	Igloodik, Nunavut	Inuit	Accessibility, utilization	Yes
(105)	Pearce et al	2010	Uluqhaktok and selected hunting areas, ISR, NWT	Inuit	Availability, accessibility, utilization	Yes
(106)	Guyot et al	2006	Deh Gah Got'ie and Beaver Creek, 2 northern Aboriginal communities, NWT and Yukon	On-reserve First Nations	Availability, Accessibility, utilization	Yes
(107)	Ford et al	2009	Igloodik, Nunavut	Inuit	Availability	Yes
(108)	Nancarrow and Chan	2010	Repulse Bay and Kugaaruk, Nunavut	Inuit	Availability, accessibility, utilization	Yes
(109)	Spring et al	2018	Northern Canadian boreal community of Kakisa, NWT	On-reserve First Nations	Availability, accessibility, utilization	Yes
(110)	Boulanger-Lapointe et al	2019	Canadian territories of Nunavut, Nunavik, and Nunatsiavut	Inuit	Availability	Yes
(111)	Andrachuk and Smit	2012	Tuktoyaktuk, NWT, 1 of 6 communities in the ISR	Inuit	Availability	Yes
(112)	Anderson et al	2018	Cartwright, southern Labrador, Sandwich Bay, Atlantic coast mid-Boreal Forest ecoregion, Nunatsiavut	Inuit	Availability, utilization	Yes
(113)	Bunce et al	2016	Iqaluit, Nunavut	Inuit	Availability, accessibility, utilization	Yes
(114)	Ford et al	2009	Foxe Basin and Igloodik, Nunavut community	Inuit	Availability, accessibility	Yes
(115)	Barbeau et al	2015	Fort Albany First Nation, northern Ontario	On-reserve First Nations	Availability	Yes
(116)	Golden et al	2015	10 First Nation communities, in northern Ontario	On-reserve First Nations	Accessibility	Yes

¹ISR, Inuvialuit Settlement Region; NWT, Northwest Territories.

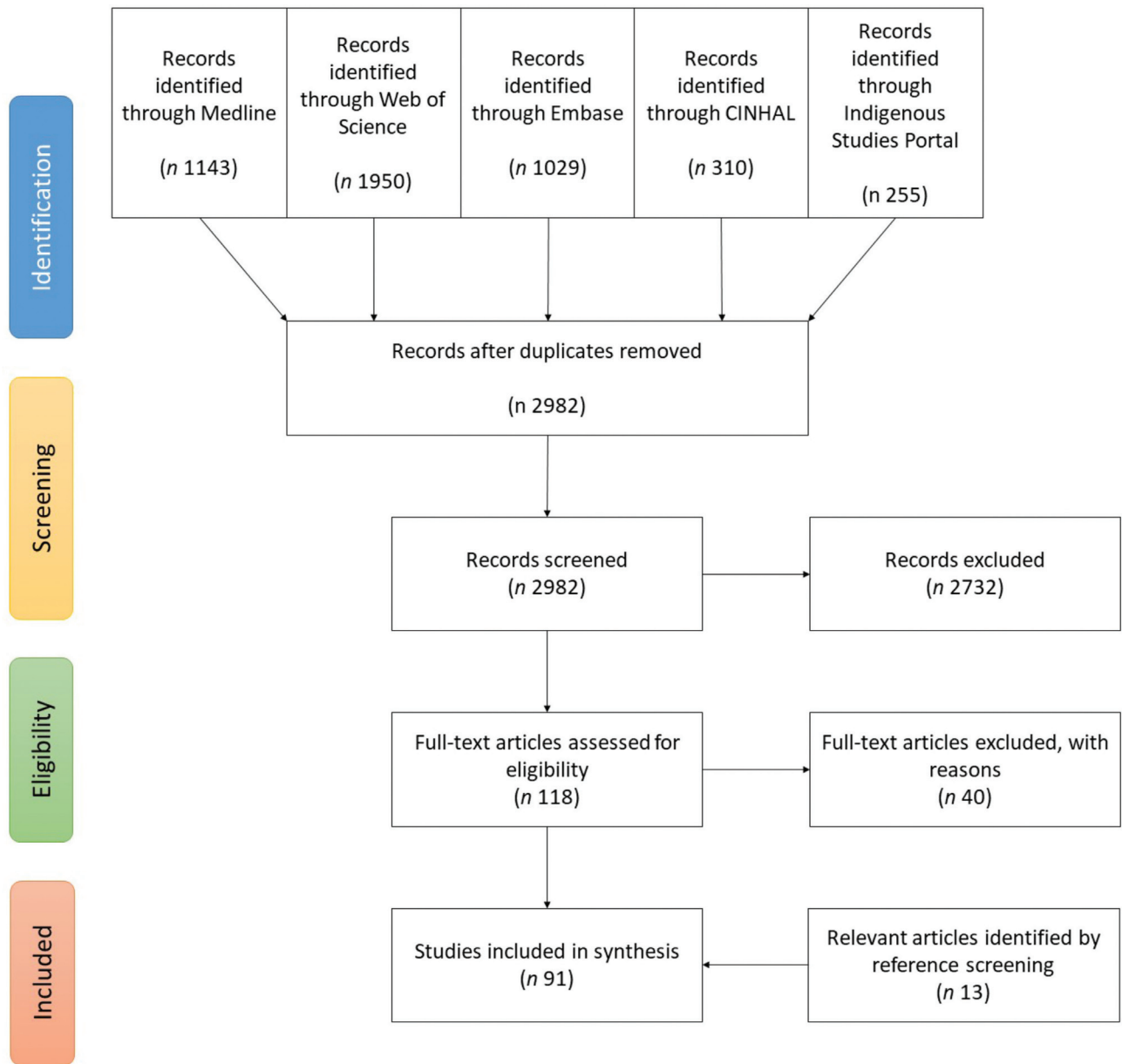


FIGURE 2 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) reporting flow diagram showing 4-stage article selection process used to identify articles on 4 pillars of food security among Indigenous peoples in Canada.

conducted among urban-based and reserve-based Indigenous peoples in southwestern Ontario also showed that income was a significant barrier to food access among urban respondents, while time was the most pressing barrier among reserve-based respondents (57). In addition, urban-based participants were more likely to report being food insecure than those living on-reserve (57). First Nations mothers with young children living in London and a nearby reserve community also identified low income as the greatest challenge to achieving food security (58).

Food prices. The high prices of fresh store-bought and traditional foods in remote First Nations (27, 31, 33, 34,

36, 38, 43, 47, 59–63) and Inuit communities (37, 38, 64–69) significantly compromise food access. Members of some remote northern First Nations Communities rely on the local Northern Store (North West Company) to obtain most of their food, except when winter roads are operational (59, 60). However, the prices of fresh foods are often not affordable for a significant proportion of community members (59, 60). In addition, a food cost survey showed that prices in the Northern Store were significantly greater than in Thunder Bay, Ontario (59). Findings from a comparative mixed-methods study revealed that First Nations communities living in rural Manitoba were paying significantly higher prices for food than non-First Nations groups living in urban

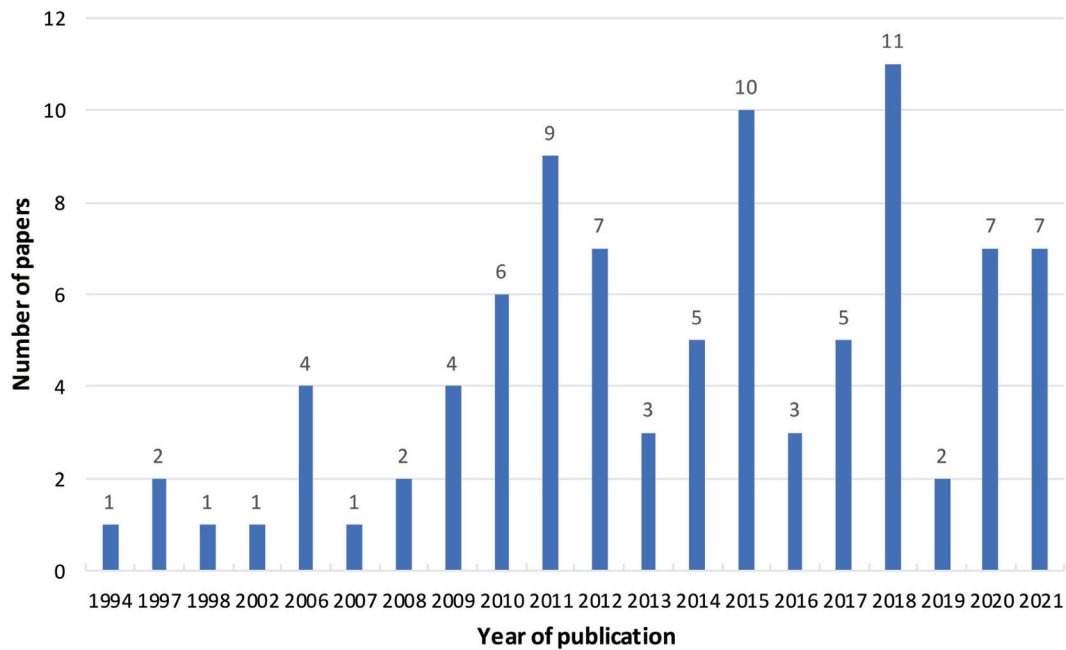


FIGURE 3 Number of relevant articles discussing the pillars of food security among Indigenous peoples in Canada by year of publication.

centers (34). Similarly, a comparison of food prices between a Woodland Cree community in northern Saskatchewan and an urban center showed that foods were generally more expensive in the community, and the cost of some fresh foods (i.e., milk, bananas, oranges) was almost double the price paid in an urban center (27).

A participatory food-costing study conducted in 6 communities of the western Canadian Arctic reported that regional food prices were significantly higher than the national average (66). In addition, there was a significant price differential between energy-dense foods and nutrient-rich foods, which may limit Indigenous peoples' options to purchase healthy foods (66). Inuit community members in Igloolik and Iqaluit raised some concerns about the high price of both store-bought (e.g., milk, eggs, beef, fruits, and vegetables) and traditional foods (e.g., arctic char, caribou meat, seal meat, etc.), which affected their ability to afford food at certain times (37, 64, 65). In 2008, the cost of a food basket in Igloolik was more than twice the price of the same basket in Montreal (64). Thus, high food prices threaten the food security of both First Nations and Inuit peoples in Canada.

There are several challenges to providing fresh and affordable food options in remote Inuit and First Nations communities, such as harsh climatic conditions that may cause spoilage and long transportation routes that increase costs (59, 67). Moreover, country foods are becoming increasingly expensive due to the lower availability of hunters and the high cost of hunting equipment (65, 70). Lack of access to all-weather roads is another important factor that contributes to high food prices and threatens the food security of remote Indigenous communities (48). For example, Campbell et al. (1997) showed that the differences between Northern

Manitoba market food prices and Winnipeg prices were greater in communities without all-weather road access than in those with road access (28). In addition, members of First Nations communities with access to an all-weather road could drive to nearby cities that provide more food choices with lower prices and higher quality (34).

Distance to grocery stores. One of the key barriers to food access by Indigenous peoples is the distance to and from grocery stores (33, 34, 57, 58). Some rural and remote Indigenous communities in Canada do not have grocery stores but instead have convenience stores and local gas stations, which serve as the local option for purchasing food (58). Almost all community members in God's River in Northern Manitoba rely on the local community store year round, since the nearest grocery store is >500 km away (28). Gitxaala also does not have a grocery store, and First Nations people living in this community must travel to Prince Rupert to purchase groceries (36). More than 20% of reserve- and urban-based First Nations respondents who participated in a cross-sectional study reported that lack of access to transportation and distance to grocery stores made it difficult to access preferred foods (57). First Nations people from Sioux Lookout noted that distance to a grocery store and lack of public transportation were among the non-income-related barriers to food access (33).

Access to transportation. Lack of access to transportation and increased transportation costs compromise the ability of Indigenous peoples to obtain affordable and healthy foods (33, 34, 43, 46, 47, 58, 62). For Indigenous people with access to transportation, traveling to larger urban centers to shop at grocery stores with better prices and a wider food

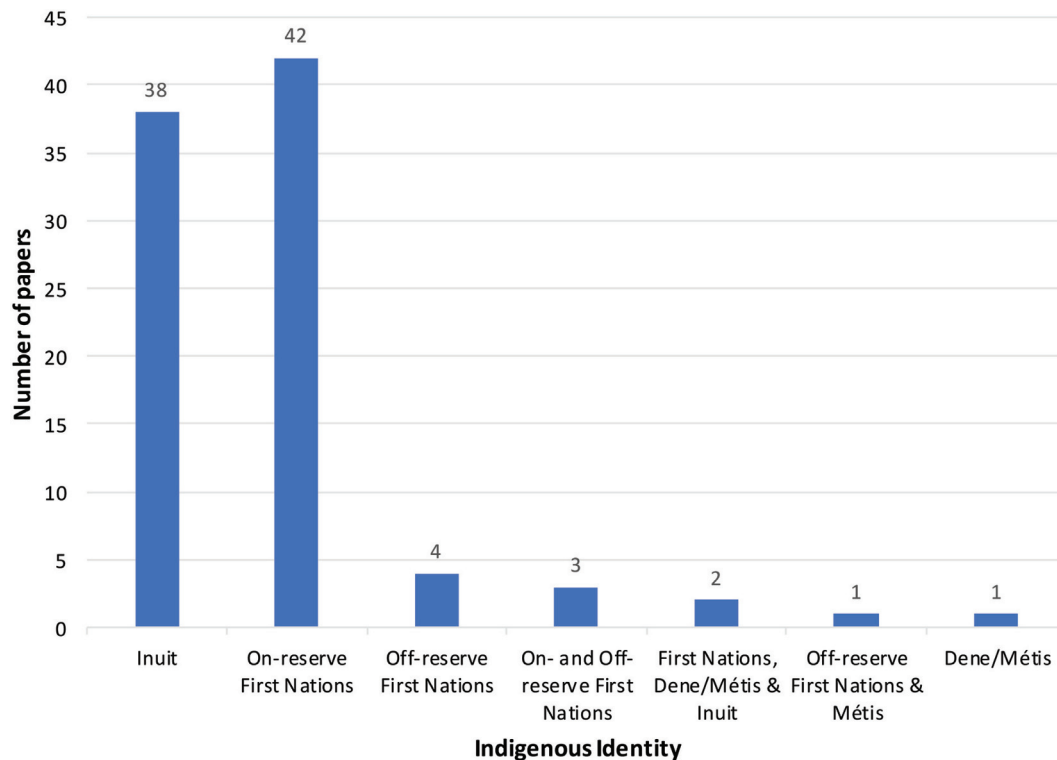


FIGURE 4 Number of relevant articles discussing the pillars of food security among Indigenous peoples in Canada by Indigenous identity.

selection is viewed as a solution to overcome the limited availability of food in the community (33, 58). In the absence of reliable transportation, community members have to shop at local convenience stores, which offer more expensive and less healthy foods (i.e., mainly canned, processed, and junk foods) (33, 58). People from Williams Treaties First Nations communities expressed concerns about the high cost of food within the community and high transportation costs to grocery stores outside the community (62). Results from a cross-sectional survey of on-reserve First Nations in Canada showed that increasing remoteness is positively associated with food insecurity in communities without year-round access to ground transportation (46). Lack of access to public transportation is a key challenge for out-of-community food shopping, especially among Indigenous peoples who do not own vehicles (33, 34). However, the consequence of relying on public transit is that people can only buy a limited number of products (58).

In the urban context, lack of transportation or increased transportation costs compromise the ability of Indigenous peoples to connect with family to obtain traditional and wild foods harvested on reserves (58, 71–73). Furthermore, similar to on-reserve Indigenous peoples, the lack of access to transportation reported by urban-based Indigenous peoples resulted in difficulty accessing healthy food for their households (56, 57).

Equipment costs. Many studies suggested that increasing gasoline costs together with the high costs of hunting or fishing equipment, such as boats, snowmobiles, and rifles, limit the ability of First Nations (26, 33, 36, 45, 62) and Inuit peoples (37, 55, 64, 67) to access country foods. Results from a qualitative study in 2 communities in Nunavut revealed that financial or equipment-related challenges such as inadequate access to transportation, high cost of gasoline, and high cost of hunting or fishing equipment limit the ability of Inuit to harvest wild game (25). In a study conducted in Yukon First Nations, Dene/Métis, and Inuit women; half of the participants reported inadequate access to hunting and fishing equipment, and nearly 50% indicated they could not afford to go fishing or hunting (41). The cost of hunting is considered a significant barrier to accessing traditional food, primarily because hunters have to travel longer distances to harvest game (31). Using data collected from 2 Saugeen Ojibway Nation communities, Lowitt et al. (2018) found that inadequate infrastructure, difficulties in recruiting labor, and rising fishing costs, such as purchase amounts for boats, gear, and fuel, created barriers to fish access (74). Further, increased transportation and equipment costs also affect Indigenous families living in urban areas by limiting their ability to afford the transportation, gas, or equipment needed to fish, hunt, or gather food (35).

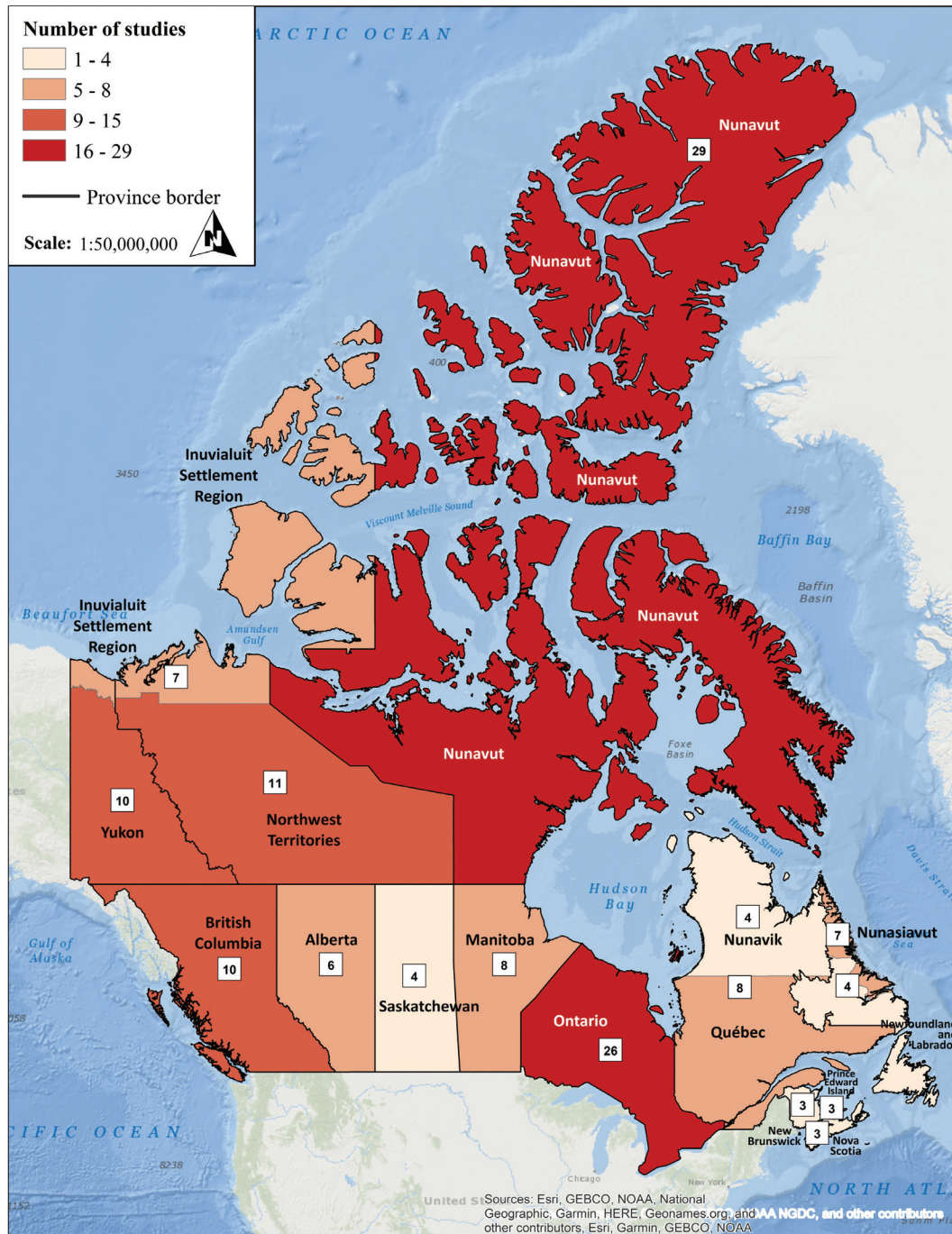


FIGURE 5 Number of relevant articles discussing the pillars of food security among Indigenous peoples in Canada by location of study.

Household size and composition. Several studies suggested that more crowded households (40, 51, 53), single-adult households (40, 42, 58, 75), and households with children (14, 48, 49) are at greater risk of experiencing food insecurity. More than 60% of Inuit families in the Canadian Arctic reported living in more crowded households, putting them at risk for food insecurity (51). The likelihood of reducing children's meal portions was also greater in more crowded households (51). Results from a survey of Inuit children revealed that children who had experienced hunger more

commonly lived in households with lower mean incomes, had parents with lower levels of education, and had a greater household size than children who never experienced hunger (53). Huet et al. (2012) reported that not only crowded households, but also single-adult households, were at higher risk of food insecurity among Inuit (40). The authors suggested that crowded households and having only a single adult in the household are indicators of socioeconomic disadvantage (40). Similarly, people from Kahnawake identified single women with young children as a vulnerable

group at risk of food insecurity (42). Single-adult households experienced limited access to country food, partly explaining the greater risk of food insecurity among these households (75). Further, Inuit and First Nations households with children were more likely to report food insecurity than households without children (48, 49).

Government restrictions. Government policies and regulations that ban or restrict harvests negatively impact Indigenous peoples' access to country foods (25, 65, 74, 76, 77). Nunavut Inuit commented that some government regulations restrict the number of animals that can be harvested in certain parts of the territory (65). For example, in Pond Inlet some hunters and trappers indicated that their ability to harvest their desired number of caribou was restricted by specific regulations on caribou hunting (25). Kenny et al. (2018) reported that restrictions on Inuit subsistence harvests were implemented for at least 6 northern caribou populations/herds, with potential consequences for country food access (76). In the Saugeen Ojibway Nation, government-imposed fishing restrictions significantly reduced fishing activity by the beginning of the 20th century (74). Furthermore, laws and regulations can affect traditional food consumption in other ways. For example, in Quebec, public institutions cannot serve traditional foods, and Cree and public entities are prohibited from selling traditional foods (44). Licensing fees are also making fishing and hunting more expensive, which negatively impacts the ability of Indigenous peoples to afford and share traditional foods (35).

Lack of an active hunter in the household. Indigenous families who lack an active hunter in their household may experience constrained access to country foods (28, 37, 40, 52, 75). Inuit households with active hunters are better positioned within their local country food-sharing network (75). Inuit women from Igloolik indicated that not having a hunter in their household resulted in less access to country foods than households with an active hunter (37). In another study, ~75% of Inuit reported living in a household without a hunter, making it difficult for them to regularly obtain traditional foods (52). In line with these findings, a cross-sectional survey of Inuit households showed that food insecure households were less likely to have an active hunter in the home than food-secure households (40).

Decline in harvesting activities. A decline in harvesting activities in terms of the number of harvesters and frequency of harvests may have implications for the availability and accessibility (i.e., harvesting costs, affordability, and food sharing) of traditional foods (25, 30, 37, 45, 64). Nunavut Inuit noted that harvesting activities, including less frequent harvests or fewer harvesters, have declined at both the community and personal levels (25). Work or school commitments were limiting factors at the personal level (25). Fewer hunters, particularly in younger generations, and a reduction in the number of hunts were limiting

factors at the community level (25). Similarly, the Inuit from Igloolik stated that both the number of full-time hunters and the number of outpost camps in the Igloolik region have decreased (64). First Nations adults living in a remote community in northern Ontario commented that the reasons for reduced hunting were loss of culture, concerns about environmental contaminants in hunted food, and less time due to employment (45). Furthermore, living in the city limited the ability of off-reserve First Nations people to hunt or gather food in their surroundings (72).

Weakening of food sharing networks. Traditional food sharing plays a vital role in the social networks of Indigenous communities and increases the availability and accessibility of country foods (45, 75). Several studies reported that traditional country food sharing is now less common, but buying and selling country food is becoming popular among Inuit (30, 35, 37, 64) and First Nations (58, 60) communities. More than 70% of community members in Iqaluit reported accessing traditional foods through sharing, which was dependent on the hunting success of family members and their willingness to share (52). Intercommunity country food sharing was also important among community members in Igloolik who had families in other communities (64). In Igloolik, community members noted that country food sharing has decreased in recent years within the extended family household and with others in the community (37, 64). Although sharing store-bought foods such as sugar, pasta, and rice was reported to occur more regularly than sharing country food, it lacks the cultural significance of sharing country foods (64). Participants in Kugluktuk raised concerns about less food sharing and the monetization of country foods (30). Members of a northern First Nations community also noted that the traditional practice of food-sharing is disappearing and has been replaced by storing food in freezers (60). Increasing hunting costs, rising commodity prices, changing social relations, lack of interest in traditional ways among youth, and population growth were among the factors resulting in less country food sharing (30, 31, 37, 64). Lack of sharing has also been observed among First Nations people living in urban areas (72).

Urbanization, decreased access to land, increased cost of living, consumerism, seasonal variation, contamination concerns, lack of time for food acquisition and preparation, limited access to emergency food services, and substance abuse were among other factors limiting the access of Indigenous peoples (on- or off-reserve) to traditional or market foods (33, 35, 43, 52, 69, 78).

Utilization.

Loss of traditional knowledge and skills. Many studies suggest that loss of knowledge and skills related to growing, acquiring, and preparing traditional foods has negatively affected the ability of First Nations (31, 33, 36, 47, 62, 79) and Inuit (30, 55, 67) peoples to use traditional foods. A study conducted in the Haudenosaunee community demonstrated that while First Nations female youth enjoy

the taste of traditional foods, they usually have limited knowledge regarding how to prepare them (79). Nunavut Inuit also noted the loss of traditional knowledge and skills related to hunting and gathering practices as one of the main barriers to healthy eating in the community (67). Loss of traditional knowledge and skills has been attributed to colonial encroachment, forced assimilation, restrictive land management, residential school education, reduced harvesting activities, and disrupted intergenerational transfer of knowledge (30, 35, 45, 62, 67).

Further, First Nations peoples living in urban areas stated that growing up in a “mixed culture” reduced their ability to maintain traditional ways of living such as gathering and preparing traditional foods (35, 58, 71, 72). They also commented that this loss of traditional knowledge results from social and cultural marginalization from their home communities and scant opportunities to learn from Elders (35, 58).

Limited knowledge of store-purchased foods. Limited knowledge and skills about market foods threatens food security of Indigenous peoples by constraining their ability to make informed food choices and limiting their prospects for healthy eating (64, 67, 78). Inuit from 2 communities in Nunavut stated that limited knowledge and unawareness about healthy preparation methods for market foods increased their reliance on prepared and prepackaged foods (67). Although Inuit women noted learning how to prepare market foods from family members, knowledge and interest in market foods were significantly less, particularly related to food preparation, nutritional value, and healthy eating (64).

Quality of market foods. The quality of foods available to purchase at stores is one of the main barriers to healthy eating among Indigenous peoples, especially those living in rural or remote areas (27, 31, 33, 36–38, 47, 64, 67). More than 80% of community members living in northern Canada reported that their store often sells expired food, and nearly 60% indicated that perishable foods are not usually in good condition (38). First Nations people expressed concerns about the nutritional quality of market foods, especially lack of freshness and poor quality of vegetables and fruit (31, 33). Inuit community members in Igloolik also stated that the quality of market food is often unsuitable, which makes meal planning difficult and leads to unhealthy food choices (64).

Food safety. Although the cultural, nutritional, and health benefits of traditional foods are well recognized, environmental contaminants such as heavy metals and persistent organic pollutants (POPs) challenge the safety of these food sources (80–95). Some studies indicated that traditional foods are the primary contributors to the dietary intake of mercury (Hg) (80–90) and lead (Pb) (91, 92) among First Nations and Inuit peoples. Data from a dietary survey conducted in 3 Inuit communities in Labrador showed that ~70% of all neurotoxicant methylmercury (MeHg) intake

came from traditional foods (80). Some traditional food items such as narwhal muktuk, beluga muktuk, fish (e.g., burbot, lake trout, walleye, and northern pike), ringed seal liver, ringed seal meat, and caribou meat were found to be the major sources of mercury in the diet of Inuit and First Nations peoples (85–89). Consumption of traditional foods hunted with Pb ammunition places Indigenous peoples at risk of Pb toxicity (91, 92). Moose and deer meat were the primary dietary sources of Pb among First Nations people living on-reserve in Ontario (91).

Several studies raised concerns regarding food safety among Indigenous peoples due to the presence of POPs and chemical contaminants in wild meats and fish (83, 93–95). Data collected from 2 remote First Nations communities in Northern Ontario showed that exposure to POPs and mercury were on average 3.5 times higher among First Nations adults consuming wild foods than those that did not consume these foods (83). In another study, traditional foods such as caribou contributed higher exposure to perfluorinated compounds exposure than market foods among Inuit in northern Canada (93).

Furthermore, a study aiming to investigate the safety of traditionally preserved fish and game in 4 First Nations communities revealed that their current food preservation methods do not effectively reduce microbial populations, and in some cases, could result in increased microbial loads (96).

Preference and cultural acceptability. Indigenous peoples often express a preference for traditional/country foods due to taste and familiarity, as well as cultural, spiritual, and health values of these food items (27, 33, 64, 71, 79, 97). Despite their limited knowledge and current consumption of traditional foods, First Nations female youth living in the Haudenosaunee community in southern Ontario conveyed contextual understanding and expressed preferences for the taste of traditional foods (79). However, some factors are negatively affecting the traditional food preferences of Indigenous peoples. First, due to challenges with accessing traditional foods, children do not have the opportunity to become familiar with traditional foods, and instead show an increasing preference for Western foods (56). Second, the taste of meat has changed in some wild animals due to alterations in their eating habits (44). Third, challenges with acquiring traditional foods, such as lack of active hunters in Indigenous households, accelerate the reduced preference for traditional foods (55). Finally, Indigenous peoples living in urban areas are not usually able to connect with their families to obtain traditional foods, a situation that contributes to shifting dietary preferences away from traditional foods (58).

Stability.

As mentioned earlier, the stability of food security depends on continuously maintaining the other 3 pillars (i.e., availability, access, and utilization) over time (10, 11). Some stressors such as climate variability, economic crisis, wars, natural disasters, and pandemics (e.g., COVID-19) compromise the stability of food security (10, 11). The

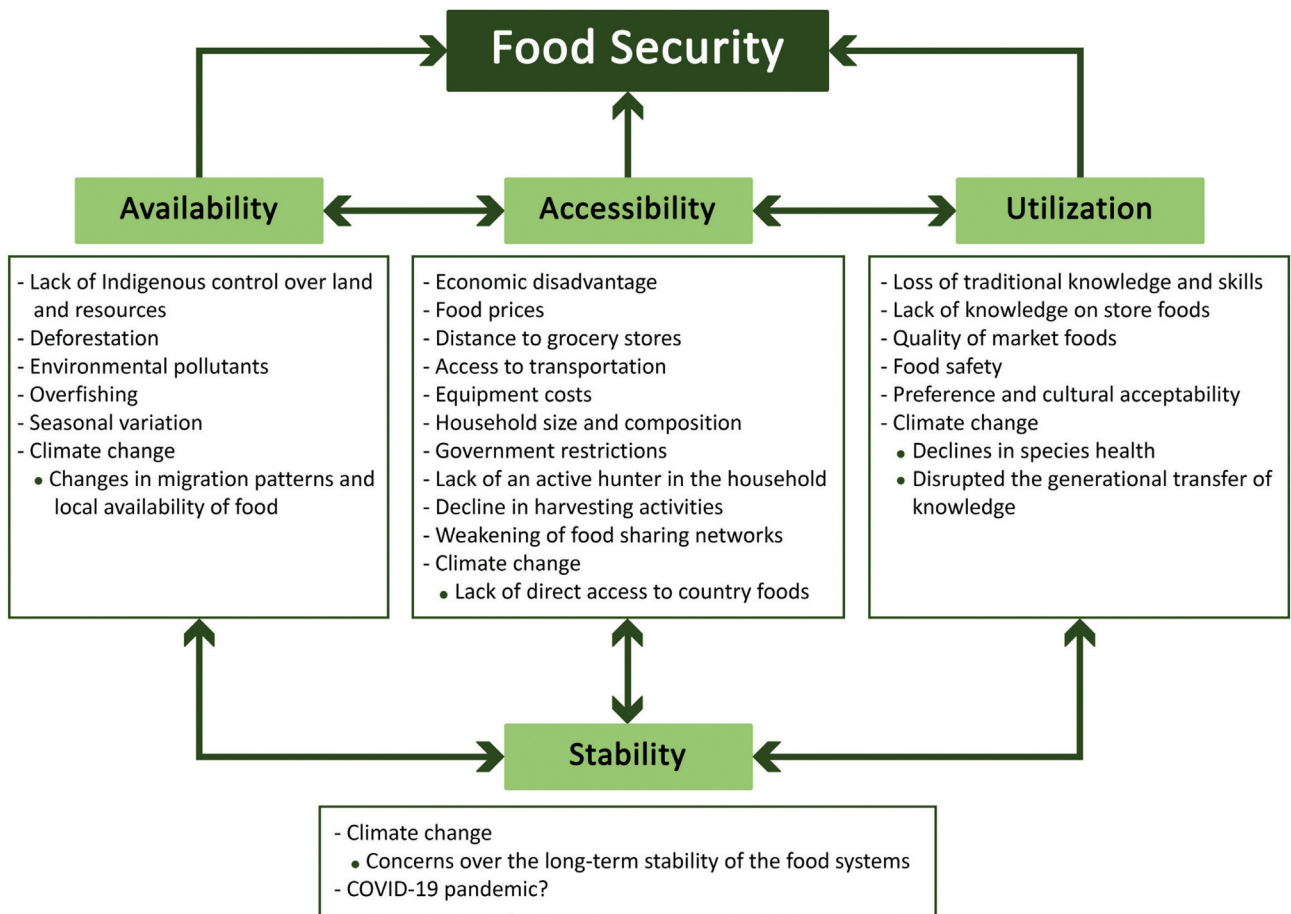


FIGURE 6 Conceptual framework of food security among Indigenous peoples in Canada.

conceptual framework of food security among Indigenous peoples in Canada is shown in **Figure 6**. In the following section, we discuss the impact of climate change on food security among Indigenous peoples in Canada.

Climate change

Global warming poses a tremendous threat to global ecosystems due to extreme weather events, decreasing biodiversity, and resource depletion (98, 99). Since 1948, Canada has warmed by more than 1.3°C, a rate of warming that is more than double the global average (100). During this time period, the rate of warming in northern Canada has been 3 times higher than the global mean, with the greatest temperature increases observed in the Yukon and Northwest Territories (100). Observations over the last decades have shown numerous environmental and climatic changes in the Arctic regions of Canada (101–104). Commonly observed changes include increased unpredictability and variability of weather patterns, increased intensity and frequency of storms, decreased snow depth and duration, decreased ice quality and stability, alterations in the timing of ice freeze-up and break-up, and decreased ice thickness (101–104). These climatic changes have contributed to compromised health status and food security, constrained access to hunting and

fishing areas, and inability to practice traditional cultural activities among Indigenous peoples (30, 103, 105–109). Most studies focusing on the impacts of climate change among Indigenous peoples were conducted in the arctic regions of Canada (30, 37, 78, 101–114). The observed climatic changes have affected all 4 pillars of food security among Indigenous populations through direct and indirect mechanisms and processes. Inuit observations of food security-related issues fall into 5 categories: 1) changes in migration patterns and local availability of food (availability); 2) limited direct access to country foods (access); 3) decline of species health (utilization); 4) disrupted intergenerational transfer of knowledge (utilization); and 6) concerns over the long-term stability of the food systems (stability).

Changes in migration patterns and local availability of food.

Climate change has altered migration pathways and timing; decreased the populations of some native plant (e.g., berries), game (e.g., caribou), and fish (e.g., Arctic char) species; and increased the number of new species appearing on the land and in the waters (e.g., cougars, deer, and pelicans) (25, 62, 106). Community members from Deh Gah Got'ie First Nation in the Northwest Territories have noticed changes in

the timing of migratory birds such as geese, and increased numbers of new bird (e.g., eagles), game (e.g., beaver), and plant species. The later arrival of geese has affected the community harvest levels by shortening the duration of the spring goose hunt (106). White River First Nation people in the Yukon have also noticed shifts in arrival timing of migratory birds and increased plant species. In addition, the population of the local caribou herd has experienced a considerable decline (106). The Inuit of Igloodik reported that the availability of important country foods, including walrus, caribou, and seal, has decreased over time and compromised the food security of Igloodik residents (37, 107, 114).

Changing migration patterns and distribution of caribou have reduced the caribou harvest across the Inuvialuit Settlement Region communities but, at the same time, has increased the availability of muskox (103). Residents of some Inuvialuit communities have indicated an eastward shift in the migration route of beluga whales and geese (103). Seal hunters in Ulukhaktok have observed a significant decline in the number of young ringed seals harvested (105). In contrast, the ringed seals were found to be more abundant in the Repulse Bay and Kugaaruk communities. The lake trout and Arctic char populations were abundant in Repulse Bay, but a decrease in 2 types of shrimp, jellyfish, and seaweed was observed (108). Members of both communities observed an increase in nonnative bird species and a decrease in native bird species. Participants in Repulse Bay noticed a decline in the availability of berries, including blackberry, blueberry, and cranberry (108). A decline in the caribou population has been observed in Tuktoyaktuk, a community located in Northwest Territories, but some harvesters have adapted by hunting other species such as muskox or moose (111). Changing migration pathways of the Qamanirjuaq caribou herd resulted in a severe caribou shortage in Arviat, Nunavut, from October 2010 to May 2011 (78). Declining caribou populations and changes to berries (i.e., smaller, seedier, and less abundant) were the environmental changes most frequently reported by women in Iqaluit, Nunavut (113). Less abundant seals and new species of birds, insects, and plants were among other environmental changes noted in Iqaluit (113). The availability of and access to berries in 3 Inuit regions (Nunavut, Nunavik, and Nunatsiavut) were threatened by recent increases in goose populations and climate change (110). Community members from Cartwright reported that cloudberries (or bakeapples in Labrador) are smaller and less abundant than previous years (112). The people of Kugluktuk and Cambridge Bay in Nunavut have noticed a decline in the availability of preferred game (e.g., caribou) and fish species (e.g., Arctic char), which has adversely affected country food-sharing networks (30).

Although the introduction of new species may add new food options for the community, lack knowledge or experience with harvesting and preparation techniques and lower acceptance of new species limits their use in community food systems (103, 109).

The indirect effects of climate change, which affected species abundance and migration patterns in the Arctic

regions of Canada, include loss of sea ice; increased freezing rain; changes in snow and ice cover; increased forest fires; loss of vegetation; increased resource extraction; low water levels; and increased predators such as cougars, grizzly bears, and wolves (64, 102, 106, 113). However, it should be noted that a warmer climate in the Arctic and subarctic also promotes the food security of northern Indigenous communities by offering opportunities to sustainably grow local foods (115).

Limited direct access to country foods.

Access to country foods and cultural resources is often related to the ability of Indigenous people to travel on land, ice, and snow and by water (102). Studies across the Arctic found that changes in local climatic and sea ice conditions are having an impact on hunting, foraging, fishing, and other subsistence activities as well as on land travel (25, 30, 37, 62, 65, 101–107, 109, 113, 114). Variable and less predictable weather, stronger/more frequent winds, changing sea ice dynamics (i.e., thinner ice, earlier break-up, later freeze-up), and lack of snowfall make travel and harvesting difficult and increasingly hazardous (30, 37, 101–107, 109, 114). For example, unpredictable weather patterns make it difficult for hunters to know when weather conditions are suitable for travel (105). Increased storminess and strong winds create unsafe conditions for community members to travel on the water (106). Later ice freeze-up results in delayed fishing season and reduces Indigenous people's access to harvesting areas because the ice is not thick enough to travel over (103, 107). Changes of astronomical positions and ice/snow conditions, as well as stronger storms, make navigation challenging and increase the risk of accidents (30, 108). Further, the increase of predators such as polar bears and orcas leads to safety concerns and affects access to preferred country foods (113).

A qualitative study explored how climate change has impacted 10 First Nations communities living across the sub-Arctic in the boreal forest through the lens of "blue ice." Blue ice is a phrase consistently used by First Nations to refer to a specific environmental condition, which is rapidly changing with significant implications for community members (116). As a result of climate change blue ice is disappearing, which negatively affects food security and traditional activities to obtain food by making travel more difficult. Diminishing winter road access, which is a vital lifeline in these remote communities, significantly decreases the availability of goods and increases their prices. Moreover, changes in animal and bird habitats and migration routes result in people traveling further to obtain traditional foods and, therefore, increase the cost of traditional activities to obtain food (116). Thus, access to country foods in the sub-Arctic and Arctic regions of Canada has been influenced by indirect effects of climate change, which adversely affect the food security of community members.

Declines in species health.

Several studies reported that indirect effects of climate change, such as increased numbers of flies, increased intensity of parasitic infections, and the poor availability of forage may have an impact on the health of wildlife, and thus on the community harvest (14, 25, 62, 102–106, 108, 109, 112, 113). Indigenous peoples have noticed recent changes in the health or quality of traditional food species including physical deformities (e.g., moose with water bubbles between their joints and hair loss), reduced animal size (e.g., fish are smaller), and taste and other sensory changes (e.g., Arctic char flesh is paler) (61, 97, 106). A common observation among Inuit living in the Arctic is that caribou are often thin, and the meat does not look as healthy due to undesirable changes in taste and texture (103, 108). In addition, caribou meat is now infested with more warble flies and parasites and their fur is not as healthy as it once was (103, 108). Two qualitative studies conducted with Inuit living in Arctic communities documented a significant decline in the quality of ringed seals. The ringed seals were extremely lean, the pelts were of lower quality, and the meat was often not suitable for human consumption and was used as dog food (105). Further, berries were less abundant, smaller, and seedier than in the past few decades (112, 113). Other observations made by Indigenous peoples include a decrease in the quality of Arctic char and meat (30, 108), white spots on beaver (106), parasites in fish (109), ticks on moose (109), and more dead muskox (30). Therefore, the observed decrease in plant and animal health in the Arctic regions has led Indigenous peoples to become more selective about the quality of country foods for consumption.

Disrupted intergenerational transfer of knowledge.

Another important component of Indigenous traditional food systems is the ability to access natural capital (land, water, air, soil, biodiversity, and ecosystem services) through cultural capital (109). This relies on traditional knowledge, experience, and skills that are passed down from elders to younger generations. Due to climate change impacting the availability of species and access to country foods, fewer elders and youth are participating in subsistence activities such as hunting (30), limiting the opportunity to pass on traditional knowledge and practices (45, 109). In addition, the disrupted intergenerational transfer of knowledge may increase the risk to younger harvesters because they do not have the required knowledge and skills to hunt safely (30, 109). Furthermore, as the land and marine ecosystems are rapidly changing, traditional harvesting knowledge and skills can no longer be reliably utilized as a guide for harvesting newly available species (103, 109).

Considering the above, there are concerns over the long-term stability of food systems. Climate variability and the increased frequency and severity of extreme climate events have affected the stability of food availability (e.g., reduced local availability of food), access (e.g., loss of access to

harvesting areas), and use (e.g., lower quality of country foods).

Food insecurity and dietary transition

The limited availability of traditional foods has resulted in a shift from consuming locally procured foods to relying more on market foods (36). Other factors responsible for changing dietary habits of Indigenous peoples are economic disadvantage, high equipment costs, government restrictions, loss of traditional knowledge, changing food preferences, decline in harvesting activities, weakening of food-sharing networks, food safety issues, and climate change. According to Kuhnlein and Receveur (1996), several cultural and ecological factors have contributed to reduced engagement in traditional subsistence activities, including the poor transfer of cultural knowledge to youth, reduced plant and animal species, climate change, environmental contamination, time and energy required for harvesting, land use, and harvesting practices (117). Little et al. (2021) suggest that a dietary transition is taking place among Inuit in the Canadian Arctic characterized by decreased consumption of country foods and increased consumption of market foods (118). The authors suggested that changing food preferences and knowledge, poverty and socioeconomic factors, climate change, and colonial processes are drivers of this transition (118). A dietary survey conducted in 18 Inuit communities at 2 time points (9 y apart) indicated a significant increase in market food consumption and a significant decrease in energy contribution from traditional foods over time (119). The intake of traditional foods, even in limited amounts, improves diet quality of Indigenous peoples (120). Kuhnlein et al. (2004) found that consumption of traditional foods was associated with consuming significantly less carbohydrate, sugar, and fat, and more protein, vitamin D, vitamin E, vitamin A, riboflavin, vitamin B6, zinc, iron, magnesium, copper, phosphorus, potassium, manganese, and selenium (121). Therefore, as the proportion of traditional foods in the diet of Indigenous people decreases, so does the diet quality, which may lead to changes in physical health status and the development of chronic diseases (117). Thus, maintaining or increasing the consumption of traditional foods is one of the primary strategies to achieving food security among Indigenous communities. Several pathways could support the restoration of Indigenous foodways and hence increase the consumption of traditional foods, such as co-management of traditional foods (122), development of community freezers (123), strengthening traditional food-sharing networks (124, 125), local and sustainable food production (126, 127), and development of country food markets (128).

As Indigenous peoples move away from consuming traditional foods to market foods as a result of disrupted traditional food systems due to colonization, several factors may drive Indigenous peoples' food choices towards low-quality and nutrient-poor market foods (36). First, in the absence of grocery stores, especially in remote communities, Indigenous

peoples usually shop at local convenience stores (87). Second, in the absence of reliable transportation, convenience stores are the only food purchase locations available to Indigenous peoples, limiting their food choices (33, 58). Third, lack of access to all-weather roads threatens the food security of remote Indigenous communities by limiting their food choices since they do not have the option to travel to nearby towns (34, 48). Finally, several factors contribute to high prices of market foods, which make them unaffordable to Indigenous peoples, such as long transportation routes, harsh climatic conditions, and lack of access to all-weather roads (48, 59, 67). A dietary survey conducted in 2 communities in Nunavut showed that Inuit consumed nutrient-poor market foods much more frequently than the traditional foods (129). Another study found that nutrient-poor market foods were the most frequently purchased foods among Inuvialuit aged ≥ 19 y (130). Thus, making nutrient-dense market foods more readily available and affordable is another important step to achieving food security among Indigenous peoples.

Knowledge Gaps

We identified several gaps in the literature that could be addressed in future investigations. A major concern was the limited number of research studies conducted among Métis communities that examine the pillars of food security. According to Statistics Canada's 2016 census, 587,545 people in Canada identified as Métis, representing 35.1% of the Indigenous population and 1.5% of the total Canadian population (131). The Métis population was the fastest-growing population in Canada, increasing 51.2% between 2006 and 2016 (3). Moreover, only a few studies examined the pillars of food security among off-reserve First Nation people. In 2016, 44.2% of First Nation people with registered or treaty Indian status lived on-reserve, while the rest (55.8%) lived off-reserve (131). Further, the number of off-reserve First Nations people rose by 49.1% from 2006 to 2016 compared with 12.8% for on-reserve First Nations people (131). These high population growth rates suggest the importance of conducting investigations on determinants of food security among Métis and off-reserve First Nation peoples.

The novel coronavirus disease 2019 (COVID-19) pandemic has unleashed an almost unprecedented global public health and economic crisis (132). The COVID-19 outbreak and the associated economic and social responses (e.g., quarantines, lockdowns, curfews, food shortages, school and university closures, business closures, and job losses) may increase food insecurity and its related health outcomes, especially among already at-risk populations (133). A growing body of evidence suggests that the COVID-19 pandemic has adversely affected the stability of food supply chains by disrupting food systems (availability), reducing economic and physical access to food (access), and altering the quality, safety, and diversity of foods available in markets (utilization) (134–136). However, we found no records in

the literature assessing the food security consequences of the COVID-19 pandemic among Indigenous peoples in Canada.

Finally, food insecurity and challenges with accessing high-quality and culturally acceptable foods have been linked to a broad range of chronic physical (e.g., obesity, diabetes mellitus, hypertension) and mental (e.g., depression) health problems (137–140). While many cross-sectional studies have examined different pillars of food security among Indigenous peoples and communities, there were no published studies specifically examining the impact of food insecurity on the health outcomes of Indigenous peoples.

To our knowledge, this scoping review was the first to synthesize published literature on the pillars of food security among Indigenous peoples in Canada. However, we acknowledge some limitations to our study. Although we identified sources from gray literature using the Indigenous Studies Portal, there is possible bias due to including Western-derived knowledge and excluding reports published by Indigenous institutions outside the academic environment. In alignment with the scoping-review methodology, no study quality assessment was performed, so the inclusion of low-quality studies may produce bias and misinformation.

In conclusion, evidence from across Canada indicates that all dimensions of food security are currently being affected among Indigenous peoples. Poor availability of both traditional and market foods is highlighted among Inuit and First Nations communities. Major factors affecting the accessibility pillar of food security among Indigenous peoples include economic disadvantage, high food prices, lack of access to transportation, high equipment costs, government restrictions, and weakening of food sharing networks. Moreover, the major factors affecting the utilization pillar of food security are the loss of traditional knowledge and skills, lack of knowledge on market foods, low quality of market foods, and food safety issues. Climate change has affected all 4 pillars of food security among Indigenous peoples over time. The findings of this study clearly suggest that solving food insecurity issues among Indigenous peoples in Canada, especially those living in remote communities, requires an integrated approach encompassing culturally specific interventions targeting food availability, food cost, food knowledge, food safety, and food quality. Further, addressing food insecurity in Indigenous people requires promoting policies that decolonize food and knowledge systems, empower Indigenous people, reconnect Indigenous people with cultural practices, and make food sovereignty possible. Further studies are required to assess different aspects of food security among off-reserve First Nations and Métis peoples since only a few studies have been conducted in these population groups. Moreover, there is a need to perform a review of adaptive strategies employed by Indigenous peoples in Canada in response to food insecurity. This work was supported by the Network Environments for Indigenous Health Research (NEIHR) (Grant number: 423220).

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The authors' responsibilities were as follows—MS, HV: study design and conceptualization; MS: first reviewer; PK: second reviewer; HV: third reviewer; MS, PK, HV: developed the search strategy and conducted the systematic search; MS: drafted the original manuscript in close communication with the team; GL, PK, PP, MS, DJ, HV: edited and reviewed original draft; HV: had primary responsibility for final content; and all authors: read and approved the final manuscript.

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