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Systematic Review

Seeking Sweetness: A Systematic Scoping Review of Factors Influencing Sugar-Sweetened Beverage Consumption in Remote Indigenous Communities Worldwide

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Abstract: It is well-established that remote Indigenous communities have higher rates of sugar-sweetened beverage (SSB) consumption than non-Indigenous counterparts, which results in higher rates of chronic diseases such as type 2 diabetes mellitus (T2DM), obesity, and kidney disease. The aetiology leading to this behaviour remains understudied and overlooked. Therefore, the aim of this literature review is to understand the underpinning factors that contribute to SSB consumption in remote Indigenous communities. Studies were identified through five databases (n = 2529) and grey literature searching (n = 54). Following the PRISMA guidelines, each paper was assessed for eligibility, which left 34 studies for inclusion in the review. Within these papers, 37 different factors were found to influence SSB consumption in remote Indigenous communities. These were organised according to the Determinants of Nutrition and Eating (DONE) framework. SSB consumption was found to influence intake through each main level of the framework; individual (n = 9), interpersonal (n = 18), environmental (n = 9), and policy (n = 3). Preference was identified to be the most common factor to influence intake (n = 19), followed by health literacy (n = 15) and community availability (n = 12). Despite this, interventions to reduce SSB intake have never targeted this factor. This paper highlights the importance of a multi-level whole-of-system approach and suggests that an individual's taste/preference should shape the direction of future research and intervention in this area.

Keywords: sugar-sweetened beverages; indigenous; remote; international; factors; type 2 diabetes; children

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1. Introduction

International epidemiological research has established a persistent health gap to exist between Indigenous and non-Indigenous populations [1]. Indigenous peoples worldwide have higher morbidity and mortality rates, poorer nutrition, a life expectancy of up to 20 years less than non-Indigenous counterparts [2]. Globally, over 50% of Indigenous adults over 35 years of age have a Type 2 Diabetes Mellitus (T2DM) diagnosis, reaching epidemic proportions in some communities [2]. T2DM is one of the fastest growing diseases in Indigenous communities, with rates up to six times higher than the general population [3]. Despite some improvements in recent years, there is still a profound health gap that exists between these two populations [4], thus rationalising ongoing research in this area.

In 2004, The World Health Organisation (WHO) strategy on diet, physical activity, and health highlighted a strong link between sugar and non-communicable chronic disease (NCCD) risk [5]. Later, Johnson et al. [6] also found undeniable associations between sugar consumption and T2DM prevalence, noting a steady increase in sugar consumption over the past 200 years was paralleled with a similar increase in T2DM rates. Concurrent rises in soft-drink sales are suggested to have contributed substantially to overall sugar

consumption [7]. Multiple factors influence the development of NCCDs in these communities [8]; however, in recent years, international research has identified SSB consumption to be directly associated with NCCDs, including T2DM [9,10]. Similar conclusions can be drawn from looking specifically at Indigenous populations. For example, studies in First Nations Australians, Alaskans, and American children have found SSB consumption to be significantly associated with dental caries severity and prevalence, as well as childhood obesity, T2DM, and other adult NCCDs [11,12]. This suggests that high SSB consumption can predispose NCCDs.

Indigenous populations have notoriously high rates of SSB consumption. Over 75% of beverages consumed by Native Alaskan children were some forms of SSB [13], and approximately four in five African American people consume SSBs [14]. Inuvialuit, American Indian, and American Indian children consumed approximately 300 kcal per day of SSB [13–15], contributing almost 20% to their recommended total daily energy intake [14,16]. Without even considering free sugar in food, this is already exceeding the WHO recommendation that intake of free sugars should be limited to less than 10% of dietary energy [17]. Alarmingly, a quarter of First Nations Children in Australia aged 6–24 months old have also been exposed to, and consumed SSBs [18], despite the overwhelming evidence shaping guidelines to advocate against this [19,20]. Furthermore, according to the Australian Aboriginal and Torres Strait Islander Health Survey in 4109 people, First Nations Australian people consumed 15 g more free sugars than non-Indigenous people and derived a higher proportion of free sugars from beverages than non-Indigenous people (67% compared to 51%) [17]. This is a substantial difference and is worthy of further investigation given the effect of sugar intake on the development of NCCDs.

The issue is exacerbated further in remote Indigenous communities where a plethora of additional challenges related to the "tyranny of distance" impact the costs of fresh food, leading to fragility of the food supply, dependency on the local store to receive food and drink, and ultimately, food insecurity [21,22]. This may allude to why previous literature has reported soft drink consumption in remote Indigenous areas to be higher than in an urban Indigenous setting [23,24]. Therefore, this literature review encompasses studies completed in the remote context in First Nations populations.

There is a gap in the published literature and poor clarity around the reason/s for the high rates of SSB consumption in remote Indigenous communities. The focal point of many studies in this area centres around interventions to reduce SSB intake [25], thereby highlighting the community's 'deficits' have been researched on [26]. Past attempts to decrease SSB consumption in remote Indigenous communities in Australia have involved increasing access to a safe water supply, removing top selling SSBs from store shelves, introducing price discounts to artificially sweetened beverages, altering store marketing techniques, educating communities of the risks of high SSB consumption and altering/creating policies [8,25]. Despite these concerted efforts, and noted achievements such as decreased intake of sugar, increased availability and affordability of healthy foods, and consequent improvement in some nutrient intakes, Lee et al. [21] have found that there has still been an overall decrease in diet quality in First Nations people since 1986.

An understanding of factors that influence high rates of SSB consumption in remote Indigenous communities is lacking in the published literature. This is leading to ineffective interventions, trial and error, and much confusion and speculation about the best approach to decrease SSB consumption and improve Indigenous health. By having a clearer understanding of the root cause/s for SSB consumption in Indigenous communities, future research in this area has a greater likelihood of empowering these communities to improve their health. If the situation remains unaddressed, trends will continue along their current trajectory; increased burden of disease and increased SSB consumption. The United Nations (UN) recognise that Indigenous peoples' health merits special attention, and have urged local, national, and international action to address the root economic, social, and environmental causes impacting Indigenous people's health [2]. This is also echoed by The Lancet, which recommends recognition of social determinants, specifically local

social, cultural, and historical contexts, prior to intervening in Indigenous communities [27]. Moreover, one of the four key objectives of the WHO Global Strategy on diet and physical activity is to monitor key influences on diet [5], and The UN Sustainable Development Goals for 2030 declaration explicitly calls for action in empowering, educating, and engaging Indigenous peoples [28]. Therefore, the aim of this scoping review is to understand the most frequently reported factors that contribute to SSB consumption in remote Indigenous communities. The implications of this literature review are far-reaching as the determinants for SSB consumption can form the basis of future health empowerment strategies in these remote communities and may be the missing puzzle piece in closing the gap.

2. Materials and Methods

2.1. Information Sources and Search Strategy

Eligible studies were identified through the following databases: Embase, Medline, Cinahl, Web of Science, and PsycInfo. The review protocol was developed according to the PRISMA framework [29]. The search string in the Browne et al. [25] paper was used as a guide, and to ensure all specific and relevant vocabulary choices and terminologies were captured. Medical Subject Headings (MeSH) terms for keywords were also incorporated into the search string, where the database permitted. To finalise the search string, it was edited and reviewed by all authors. These steps optimised the comprehensiveness of the review. The search and MeSH terms were initially developed for Medline, then adjusted using the SR-Accelerator polyglot function for Embase, Cinahl and Web of Science [30]. The PsycInfo translation was completed manually. These search strings can be found in Table 1. Eligible studies were also identified through grey literature by conducting organisation searches and citation searching. A Google search was completed, paralleled with discussions within the research team to identify relevant authorities, organisations, and stakeholders. Subsequently, four organisation websites were searched using key words and phrases. Each retrieved result containing all three keywords (SSB, Indigenous, remote) and/or synonyms in the title and/or abstract where appropriate were selected for screening. Citations within several relevant literature reviews were also screened. Relevant articles were then added to the screening pool.

2.2. Eligibility Criteria

Eligibility criteria for study inclusion were (i) published since 2000; (ii) written in English; (iii) performed on humans; (iv) observational or exploratory in nature; (v) discussed factors, determinants, contributors and/or influences of diet behaviours; and (vi) discussed food/diet patterns/behaviours. There did not necessarily need to be mention of SSB in the title or abstract for a study to be included as the authors did not want to disregard the potential of missing papers that only mentioned SSB in the full text, and the research team was unable to perform full-text searches on several of the databases.

The exclusion criteria were (i) literature reviews; (ii) in vitro studies; (iii) protocol papers; (iv) papers reporting solely on the health impact of SSBs; and (v) papers that only discussed the amount of SSB consumption.

Additional decisions were made during the full text review phase, which meant articles with the following characteristics were also not included (i) reporting on an intervention; (ii) no mention of SSBs; (iii) factors influencing SSB consumption were implied; (iv) not adhering to the traditional article format of introduction, methods, results, and discussion. Articles with the following characteristics remained included (i) factors discussed in the results and/or discussion section, so long as they were discovered from the findings of the paper and not supporting literature; (ii) studies where no primary data were used, but there was additional analysis performed on the already-existing findings/data sets.

Table 1. Search strings for all databases used in the review.

Database	Search String	#Papers Retrieved
Embase	(aborigin*:ti,ab OR 'torres strait island*':ti,ab OR indigen*:ti,ab OR 'first natio*':ti,ab OR maori:ti,ab OR aotearoa:ti,ab OR 'first people*':ti,ab OR 'native people*':ti,ab OR 'native born':ti,ab OR metis:ti,ab OR inuit*:ti,ab OR 'african america*':ti,ab OR 'native america*':ti,ab OR 'american india*':ti,ab OR amerindian*:ti,ab OR eskimo*:ti,ab OR 'native canad*':ti,ab OR 'first america*':ti,ab OR 'indigenous america*':ti,ab OR saami:ti,ab OR sami:ti,ab OR greenlandic*:ti,ab OR nunavut*:ti,ab OR 'first australia*':ti,ab OR 'alaska native*':ti,ab OR 'alaskan native*':ti,ab OR 'native hawaiian*':ti,ab OR natives:ti,ab OR 'alaska native'/exp OR 'american indian'/exp OR 'canadian aboriginal'/exp OR 'indigenous people'/exp/mj OR 'torres strait islander'/exp OR 'australian aborigine'/exp) AND (remote:ti,ab OR isolated:ti,ab OR rural:ti,ab OR secluded:ti,ab OR regional:ti,ab OR 'rural population'/exp) AND ((((soft OR sugar* OR fizzy OR energy OR carbonated OR discretionary OR 'sugar sweetened' OR 'sugar-sweetened' OR 'sucrose sweetened' OR 'sucrose-sweetened') NEAR/3 (beverage* OR drink*)):ti,ab) OR cordial*:ti,ab OR juice*:ti,ab OR soda*:ti,ab OR 'coca cola':ti,ab OR coke:ti,ab OR softdrink*:ti,ab OR 'sugar-sweetened beverage'/exp OR (((diet* OR food* OR drink*) NEAR/3 (qualit* OR preference* OR choice* OR pattern*)):ti,ab) OR 'food secur*':ti,ab OR 'food insecur*':ti,ab OR 'food preference'/exp)	570
CINAHL	(((TI Aborigin* OR AB Aborigin*) OR (TI "torres strait island*" OR AB "torres strait island*") OR (TI Indigen* OR AB Indigen*) OR (TI "first natio*" OR AB "first natio*") OR (TI Maori OR AB Maori) OR (TI Aotearoa OR AB Aotearoa) OR (TI "first people*" OR AB "first people*") OR (TI "native people*" OR AB "native people*") OR (TI "native born" OR AB "native born") OR (TI Metis OR AB Metis) OR (TI Inuit* OR AB Inuit*) OR (TI "African America*" OR AB "African America*") OR (TI "Native America*" OR AB "Native America*") OR (TI "American India*" OR AB "American India*") OR (TI Amerindian* OR AB Amerindian*) OR (TI Eskimo* OR AB Eskimo*) OR (TI "Native Canad*" OR AB "Native Canad*") OR (TI "First America*" OR AB "First America*") OR (TI "Indigenous America*" OR AB "Indigenous America*") OR (TI Saami OR AB Saami) OR (TI Sami OR AB Sami) OR (TI Greenlandic* OR AB Greenlandic*) OR (TI Nunavut* OR AB Nunavut*) OR (TI "first Australia*" OR AB "first Australia*") OR (TI "Alaska Native*" OR AB "Alaska Native*") OR (TI "Alaskan Native*" OR AB "Alaskan Native*") OR (TI "Native Hawaiian*" OR AB "Native Hawaiian*") OR (TI natives OR AB natives)) OR (MH "Native Americans+") OR (MM "Alaska Natives") OR (MH "Aboriginal Canadians+") OR (MH "Indigenous Peoples+") OR (MM "Torres Strait Islanders") OR (MM "Aboriginal Australians") OR (MH "First Nations of Australia+")) AND (((TI Remote OR AB Remote) OR (TI Isolated OR AB Isolated) OR (TI rural OR AB rural) OR (TI secluded OR AB secluded) OR (TI regional OR AB regional)) OR (MM "Rural Population")) AND (((((TI soft OR AB soft) OR (TI sugar* OR AB sugar*) OR (TI fizzy OR AB fizzy) OR (TI energy OR AB energy) OR (TI carbonated OR AB carbonated) OR (TI discretionary OR AB discretionary) OR (TI "sugar sweetened" OR AB "sugar sweetened") OR (TI "sucrose sweetened" OR AB "sucrose sweetened") OR (TI sucrose-sweetened OR AB sucrose-sweetened) OR (TI sugar-sweetened OR AB sugar-sweetened)) N3 ((TI beverage* OR AB beverage*) OR (TI drink* OR AB drink*))) OR ((TI cordial* OR AB cordial*) OR (TI juice* OR AB juice*) OR (TI soda* OR AB soda*) OR (TI "coca cola" OR AB "coca cola") OR (TI coke OR AB coke) OR (TI softdrink* OR AB softdrink*))) OR (MM "Sweetened Beverages") OR (((((TI Diet* OR AB Diet*) OR (TI food* OR AB food*) OR (TI drink* OR AB drink*)) N3 ((TI qualit* OR AB qualit*) OR (TI preference* OR AB preference*) OR (TI choice* OR AB choice*) OR (TI pattern* OR AB pattern*))) OR ((TI "Food secur*" OR AB "Food secur*") OR (TI "food insecur*" OR AB "food insecur*"))) OR (MM "Food preferences")))	253

Table 1. *Cont.*

Database	Search String	#Papers Retrieved
	((((title: (Aborigin*)) OR (title: (“torres strait island*”)) OR (title: (Indigen*)) OR (title: (“first natio*”)) OR (title: (Maori)) OR (title: (Aotearoa)) OR (title: (“first people*”)) OR (title: (“native people*”)) OR (title: (“native born”)) OR (title: (Metis)) OR (title: (Inuit*)) OR (title: (“African America*”)) OR (title: (“Native America*”)) OR (title: (“American India*”)) OR (title: (Amerindian*)) OR (title: (Eskimo*)) OR (title: (“Native Canad*”)) OR (title: (“First America*”)) OR (title: (“Indigenous America*”)) OR (title: (Saami)) OR (title: (Sami)) OR (title: (Greenlandic*)) OR (title: (Nunavut*)) OR (title: (“first Australia*”)) OR (title: (“Alaska Native*”)) OR (title: (“Alaskan Native*”)) OR (title: (“Native Hawaiian*”)) OR (title: (natives))) OR ((abstract: (Aborigin*)) OR (abstract: (“torres strait island*”)) OR (abstract: (Indigen*)) OR (abstract: (“first natio*”)) OR (abstract: (Maori)) OR (abstract: (Aotearoa)) OR (abstract: (“first people*”)) OR (abstract: (“native people*”)) OR (abstract: (“native born”)) OR (abstract: (Metis)) OR (abstract: (Inuit*)) OR (abstract: (“African America*”)) OR (abstract: (“Native America*”)) OR (abstract: (“American India*”)) OR (abstract: (Amerindian*)) OR (abstract: (Eskimo*)) OR (abstract: (“Native Canad*”)) OR (abstract: (“First America*”)) OR (abstract: (“Indigenous America*”)) OR (abstract: (Saami)) OR (abstract: (Sami)) OR (abstract: (Greenlandic*)) OR (abstract: (Nunavut*)) OR (abstract: (“first Australia*”)) OR (abstract: (“Alaska Native*”)) OR (abstract: (“Alaskan Native*”)) OR (abstract: (“Native Hawaiian*”)) OR (abstract: (natives)))) OR (((IndexTermsFilt: (“American Indians”)) OR (IndexTermsFilt: (“Alaska Natives”)) OR (IndexTermsFilt: (“Hawaii Natives”)) OR (IndexTermsFilt: (“Indigenous Populations”)))))	
PsycInfo	AND ((title: (Remote) OR title: (Isolated) OR title: (rural) OR title: (secluded) OR title: (regional)) OR (abstract: (Remote) OR abstract: (Isolated) OR abstract: (rural) OR abstract: (secluded) OR abstract: (regional))) AND ((((((title: (soft))) OR ((title: (sugar*))) OR ((title: (fizzy))) OR ((title: (energy))) OR ((title: (carbonated))) OR ((title: (discretionary))) OR ((title: (“sucrose sweetened”))) OR ((title: (sucrose-sweetened))) OR ((title: (“sugar sweetened”))) OR ((title: (sugar-sweetened)))) NEAR/3 (((title: (beverage*))) OR ((title: (drink*)))) OR (((abstract: (soft))) OR ((abstract: (sugar*))) OR ((abstract: (fizzy))) OR ((abstract: (energy))) OR ((abstract: (carbonated))) OR ((abstract: (discretionary))) OR ((abstract: (“sucrose sweetened”))) OR ((abstract: (sucrose-sweetened))) ((abstract: (“sugar sweetened”))) OR ((abstract: (sugar-sweetened)))) NEAR/3 (((abstract: (beverage*))) OR ((abstract: (drink*))))) OR ((((title: (cordial*))) OR ((title: (juice*))) OR ((title: (soda*))) OR ((title: (“coca cola”))) OR ((title: (coke))) OR ((title: (softdrink*)))) OR (((abstract: (cordial*))) OR ((abstract: (juice*))) OR ((abstract: (soda*))) OR ((abstract: (“coca cola”))) OR ((abstract: (coke))) OR ((abstract: (softdrink*)))))) OR (((((title: (diet*))) OR ((title: (food*))) OR ((title: (drink*)))) NEAR/3 (((title: (qualit*))) OR ((title: (preference*))) OR ((title: (choice*))) OR ((title: (pattern*)))) OR (((abstract: (diet*))) OR ((abstract: (food*))) OR ((abstract: (drink*)))) NEAR/3 (((abstract: (qualit*))) OR ((abstract: (preference*))) OR ((abstract: (choice*))) OR ((abstract: (pattern*))))) OR ((((title: (“Food secur*”))) OR ((title: (“food insecur*”)))) OR (((abstract: (“Food secur*”))) OR ((abstract: (“food insecur*”)))) OR ((((IndexTermsFilt: (“Food Preferences”)))))))	138

Table 1. *Cont.*

Database	Search String	#Papers Retrieved
Web of Science	(TI = (Aborigin* OR "torres strait island*" OR Indigen* OR "first natio*" OR Maori OR Aotearoa OR "first people*" OR "native people*" OR "native born" OR Metis OR Inuit* OR "African America*" OR "Native America*" OR "American India*" OR Amerindian* OR Eskimo* OR "Native Canad*" OR "First America*" OR "Indigenous America*" OR Saami OR Sami OR Greenlandic* OR Nunavut* OR "first Australia*" OR "Alaska Native*" OR "Alaskan Native*" OR "Native Hawaiian*" OR natives OR "American Indians or Alaska Natives" OR "Indigenous Canadians" OR "Native Hawaiian or Other Pacific Islander") OR AB = (Aborigin* OR "torres strait island*" OR Indigen* OR "first natio*" OR Maori OR Aotearoa OR "first people*" OR "native people*" OR "native born" OR Metis OR Inuit* OR "African America*" OR "Native America*" OR "American India*" OR Amerindian* OR Eskimo* OR "Native Canad*" OR "First America*" OR "Indigenous America*" OR Saami OR Sami OR Greenlandic* OR Nunavut* OR "first Australia*" OR "Alaska Native*" OR "Alaskan Native*" OR "Native Hawaiian*" OR natives OR "American Indians or Alaska Natives" OR "Indigenous Canadians" OR "Native Hawaiian or Other Pacific Islander")) AND (TI = (Remote OR Isolated OR rural OR secluded OR regional OR "Rural Population") OR AB = (Remote OR Isolated OR rural OR secluded OR regional OR "Rural Population")) AND ((TI = (((((soft OR sugar* OR fizzy OR energy OR carbonated OR discretionary OR "sugar sweetened" OR sugar-sweetened OR "sucrose sweetened" OR sucrose-sweetened) NEAR/3 (beverage* OR drink*)) OR (cordial* OR juice* OR soda* OR "coca cola" OR coke OR softdrink*)) OR "Sugar-Sweetened Beverages" OR ((((Diet* OR food* OR drink*) NEAR/3 (qualit* OR preference* OR choice* OR pattern*)) OR ("Food secur*" OR "food insecur*")) OR "Food preferences")))) OR AB = (((((soft OR sugar* OR fizzy OR energy OR carbonated OR discretionary OR "sugar sweetened" OR sugar-sweetened OR "sucrose sweetened" OR sucrose-sweetened) NEAR/3 (beverage* OR drink*)) OR (cordial* OR juice* OR soda* OR "coca cola" OR coke OR softdrink*)) OR "Sugar-Sweetened Beverages" OR ((((Diet* OR food* OR drink*) NEAR/3 (qualit* OR preference* OR choice* OR pattern*)) OR ("Food secur*" OR "food insecur*")) OR "Food preferences"))))	1087
Ovid Medline	((Aborigin* or "torres strait island*" or Indigen* or "first natio*" or Maori or Aotearoa or "first people*" or "native people*" or "native born" or Metis or Inuit* or "African America*" or "Native America*" or "American India*" or Amerindian* or Eskimo* or "Native Canad*" or "First America*" or "Indigenous America*" or Saami or Sami or Greenlandic* or Nunavut* or "first Australia*" or "Alaska Native*" or "Alaskan Native*" or "Native Hawaiian*" or natives).tw. or exp "American Indians or Alaska Natives"/ or exp "Indigenous Canadians"/ or exp "Native Hawaiian or Other Pacific Islander"/) and ((Remote or Isolated or rural or secluded or regional).tw. or exp "Rural Population"/) and ((((soft or sugar* or fizzy or energy or carbonated or discretionary or "sugar sweetened" or sugar-sweetened or "sucrose sweetened" or sucrose-sweetened) adj3 (beverage* or drink*)) or (cordial* or juice* or soda* or "coca cola" or coke or softdrink*)).tw. or exp "Sugar-Sweetened Beverages"/ or ((((Diet* or food* or drink*) adj3 (qualit* or preference* or choice* or pattern*)) or ("Food secur*" or "food insecur*")).tw. or exp "Food preferences"/))	481

2.3. Selection Process and Data Collection

Eligible papers were transferred to EndNote and exported to Covidence; a software used to streamline the SLR process, on 18 March 2022 [31]. All duplicate papers were removed automatically. Phase 1: Title and abstracts were screened by to exclude papers that did not meet the inclusion/exclusion criteria. Screening required consensus between two reviewers, otherwise the study would appear as a conflict. The authors deliberated all conflicts until a unanimous decision was reached. Phase 2: The full text of accepted papers was screened to determine which papers would be included in the review. This screening phase required consensus regarding reason for paper exclusion, therefore an exclusion hierarchy was established to reduce contention when eliminating papers. Again,

the authors collaborated to resolve any conflicts. Phase 3: The study selection process remained conservative until the final phase, where the eligibility criteria were further refined, and the accepted studies were extracted for data.

2.4. Data Extraction

Key characteristics were obtained for all included studies and transferred into a standardised table. In a separate table, all information pertaining to influencers of SSB consumption were compiled.

2.5. Data Synthesis

Thematic analysis was used to synthesise the data set. Open coding was used to highlight relevant data in a systematic way. It should be noted that data were only pulled when directly relating to SSBs, as opposed to food choice in general. This information was then categorised and collated into potential themes. These themes were then reviewed and refined as needed. Finally, these factors were aligned with the Determinants of Nutrition and Eating (DONE) Framework using deductive coding by two authors who were experienced with qualitative research [32]. Any discrepancies in this process were resolved by consensus.

2.6. Quality Assessment

The Mixed-Methods Appraisal Tool Version 2018 (MMAT) was used to appraise and critique the methodological quality of studies from a range of designs, including qualitative research, quantitative descriptive research, and mixed methods research [33]. The relevant criteria were assessed for all included studies. A random 30% sub-set of the included papers were cross-checked by a different author. A detailed rating for each criterion is presented, rather than an overall score, to better inform the quality of the included studies [33].

3. Results

3.1. Study Selection

Identification and selection of studies is summarised in Figure 1. The search string yielded 2529 studies, of which Covidence automatically removed 1096 duplicates, leaving 1433 to screen from databases. From here, 1269 studies were excluded based on the tile and abstract, resulting in 164 studies for full text review. A total of 137 full texts were excluded primarily due to the paper not relating to SSB. Concurrent to database searching, the authors also identified 54 studies from other methods: 28 from organisation searching and 26 from citation searching. Of these, 20 papers were found to already be included in database searching, so these duplicates were manually removed. The remaining 34 articles were assessed for eligibility, where 27 were excluded, primarily due to being the wrong article type. The two article recruitment streams resulted in a total of 34 studies to be included in the review.

3.2. Quality Assessment

All studies received a 'yes' for the first two screening questions which asked whether studies had a clear research question and had data collected which would allow the research question to be addressed. In total, 65% of the included studies (n = 22) scored 'yes' for all relevant criteria. For the studies that had a quantitative design (n = 8), under 40% (n = 3) scored a 'yes' for all criteria. The most common reason the other studies did not achieve this is due to the risk of nonresponse bias. There were several instances where there was no explanation for a significant drop in participation rates over time or for when there was a high refusal rate. For studies that had a mixed-methods design (n = 7), the general concern was that many studies did not adequately provide a rationale for utilising a mixed-methods design or did not adhere to all the qualitative and quantitative criteria. This resulted in just under 60% (n = 4) of these papers achieving 'yes' for all criteria. Finally, for the studies that had a qualitative design (n = 19), over 75% (n = 15) received a 'yes' for

criteria 1.1–1.5. The main concern regarding the four remaining studies was whether the qualitative approach and data collection methods were adequate to address the research question, and oftentimes it appears the study's quality would have been enhanced from addition of a quantitative element. Refer to Table 2 for the full quality assessment and Table 3 for MMAT criteria.

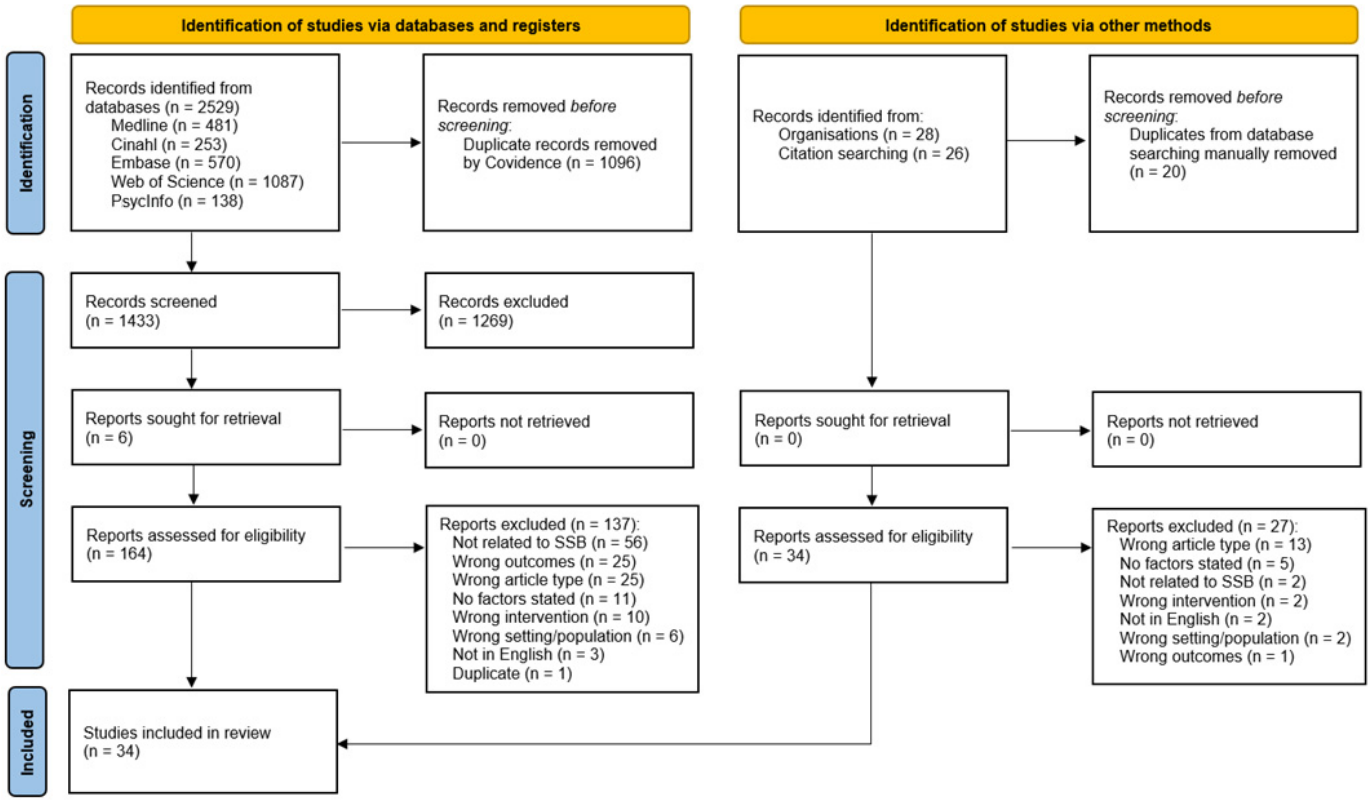

Figure 1. PRISMA flow diagram [29].

Table 2. MMAT quality assessment for included studies [33].

	S1	S2	1.1	1.2	1.3	1.4	1.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5
Bailie et al. [34]	Y	Y						Y	Y	Y	Y	Y					
Brimblecombe et al. [35]	Y	Y	Y	Y	Y	Y	Y										
Byker Shanks et al. [36]	Y	Y											Y	Y	Y	Y	Y
Chakona et al. [37]	Y	Y											Y	Y	Y	Y	Y
Colles et al. [38]	Y	Y	Y	Y	Y	Y	Y										
Dimitropoulos et al. [39]	Y	Y						Y	Y	Y	Y	Y					
Elwan et al. [40]	Y	Y											Y	Y	Y	Y	Y
Frank et al. [41]	Y	Y	Y	N	Y	Y	Y										
Galloway et al. [42]	Y	Y						Y	N	Y	N	Y					
Godrich et al. [43]	Y	Y	N	Y	Y	Y	Y										
Hall et al. [44]	Y	Y	Y	Y	Y	Y	Y										
Johnson-Down et al. [45]	Y	Y						Y	N	Y	N	Y					
Kirkham et al. [46]	Y	Y	Y	Y	Y	Y	Y										
Koller et al. [47]	Y	Y	Y	Y	Y	Y	Y										

Table 2. *Cont.*

	S1	S2	1.1	1.2	1.3	1.4	1.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5
Kruske et al. [48]	Y	Y	Y	Y	Y	Y	Y										
Kurschner et al. [49]	Y	Y	Y	N	Y	Y	Y										
Kyoon-Achan et al. [50]	Y	Y	Y	Y	Y	Y	Y										
Levin et al. [51]	Y	Y	Y	Y	Y	Y	Y										
Lindsay et al. [52]	Y	Y	N	Y	Y	Y	Y										
Myers et al. [53]	Y	Y	Y	Y	Y	Y	Y										
Patel et al. [54]	Y	Y	Y	Y	Y	Y	Y										
Pollard et al. [55]	Y	Y	Y	Y	Y	Y	Y										
Sarkar et al. [56]	Y	Y											N	Y	Y	Y	N
Seear et al. [57]	Y	Y	Y	Y	Y	Y	Y										
Thurber et al. [58]	Y	Y						Y	Y	N	N	Y					
Thurber et al. [59]	Y	Y											Y	Y	Y	Y	N
Tomayko et al. [60]	Y	Y											Y	Y	Y	Y	Y
Tonkin et al. [61]	Y	Y											Y	Y	Y	Y	N
Walch et al. [62]	Y	Y	Y	Y	Y	Y	Y										
Walch et al. [63]	Y	Y	Y	Y	Y	Y	Y										
Wattelez et al. [64]	Y	Y						Y	Y	N	Y	Y					
Wood et al. [65]	Y	Y	Y	Y	Y	Y	Y										
Wycherley et al. [66]	Y	Y						Y	Y	N	Y	Y					
Zoellner et al. [67]	Y	Y						Y	Y	Y	Y	Y					

Key: Y = yes, N = no.

Table 3. MMAT criteria definitions [33].

Screening	
S1	Are there clear research questions?
S2	Do the collected data allow to address the research questions?
Qualitative	
1.1	Is the qualitative approach appropriate to answer the research question?
1.2	Are the qualitative data collection methods adequate to address the research question?
1.3	Are the findings adequately derived from the data?
1.4	Is the interpretation of results sufficiently substantiated by data?
1.5	Is there coherence between qualitative data sources, collection, analysis, and interpretation?
Quantitative Descriptive	
4.1	Is the sampling strategy relevant to address the research question?
4.2	Is the sample representative of the target population?
4.3	Are the measurements appropriate?
4.4	Is the risk of nonresponse bias low?
4.5	Is the statistical analysis appropriate to answer the research question?

Table 3. *Cont.*

Mixed methods	
5.1	Is there an adequate rationale for using a mixed methods design to address the research question?
5.2	Are the different components of the study effectively integrated to answer the research question?
5.3	Are the outputs of the integration of qualitative and quantitative components adequately interpreted?
5.4	Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?
5.5	Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?

3.3. Study Characteristics

Of the 34 included peer-reviewed studies, 50% (n = 17) were from Australia [34,35,38,39,43,44,46,48,53–55,57–59,61,65,66], seven were from USA [36,40,47,60,62,63,67], four from Canada [42,45,50,56], one was from Africa [37], one from Mexico [41], one from Guatemala [49], one from Ecuador [51], one from Brazil [52], and one from New Caledonia [64]. All studies were published within the past 20 years, with the oldest being 2004 [34] and the most recent being published in 2022 [62]. The included articles were a mix of qualitative study design (n = 19) [35,38,41,43,44,46–55,57,62,63,65], quantitative (n = 8) [34,39,42,45,58,64,66,67], and mixed-methods (n = 7) [36,37,40,56,59–61]. The number of participants in each of the studies ranged from 15 mothers in a qualitative study [48], to 1283 caregivers in one of the quantitative studies [58]. Two of the included studies used pre-existing survey data [34,66], while all others collected primary data. Data were collected from a range of different stakeholder perspectives including caregivers and families, health professionals, adult community members, and elders. Data collection methods were mainly focus groups (n = 13) [35,37,40,50,52–54,56,57,59,60,62,63], interviews (n = 18) [35,36,38,40,41,43,44,46–49,51,53–56,61,65], and surveys (n = 13) [34,36,37,39,40,42,45,58–61,64,67], with other methods such as shop inventory (n = 1) [40], water quality testing (n = 1) [56], and point-of-sale data (n = 1) [66] also being used. Broadly, the aims of the included papers were to investigate and explore remote Indigenous food environments, to increase understanding of how these food systems operate, and to report on challenges or barriers influencing SSB intake. Refer to Table 4 for more details on study characteristics.

Table 4. Study characteristics of included papers.

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Bailie et al. [34]	2004	QLD, SA, NSW, NT, WA Tasmania, Victoria, Australia	Water supply and sanitation in remote Indigenous communities–priorities for health development	To review survey data on water supply and sanitation in remote Indigenous communities over the past 10 years, and to discuss the significance of the findings in terms of their contribution to the available information and in terms of informing priorities for health development.	Quantitative: surveys	Strong	N/A–2 pre-existing survey results used	N/A–Community Housing and Infrastructure Needs Survey (QLD, SA, NSW, NT, WA Tasmania, Victoria), Environmental Health Survey (NT)
Brimblecombe et al. [35]	2014	NT, Australia	Factors Influencing Food Choice in an Australian Aboriginal Community	To build a deeper understanding of the meaning of the traditional Aboriginal diet and the contemporary food supply through people's views and experiences in relation to food-related knowledge, attitudes, and choice.	Qualitative: semi-structured interviews and focus groups	Strong	46 people (12 from individual interviews, 34 from focus groups)	All adults, 67% individual interviews male, 6 focus groups with family members, 2 with health centre staff
Byker Shanks et al. [36]	2020	Montana, USA	Perceptions of food environments and nutrition among residents of the Flathead Indian Reservation	To investigate food environments and diets among Flathead Reservation residents to inform programs, policy, and practice around food and nutrition in the future.	Mixed methods: Qualitative semi-structured interviews, Quantitative surveys	Strong	80 people (80 from surveys, 76 from interviews)	All participants identified as household decision makers, 78% female, 82% graduated high school, mean age 40 years, 81% no children

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Chakona et al. [37]	2020	Eastern Cape province, South Africa	Social circumstances and cultural beliefs influence maternal nutrition, breastfeeding and child feeding practices in South Africa	To gather information on infant care giving practices including breastfeeding, children's diets, maternal and child dietary diversity and household socio-economic characteristics.	Mixed methods: Qualitative focus groups Quantitative: surveys	Strong	178 caregiver/child pairs (84 from surveys, 94 from focus groups)	Surveys: mean age of 34.7 years for mothers/caregivers and 16.3 months for children, 48 pairs were mother–child whilst 36 were caregiver–child pairs which included 21 grandmothers and the other 15 pairs were other female family members. Focus groups: 43 Mothers and 51 grandmothers, majority of which had informal employment, 6 participants <20 years, 24 participants 20–30 years, 26 participants 31–50 years, 38 participants >50 years, from 9 different communities
Colles et al. [38]	2014	NT, Australia	Food, food choice and nutrition promotion in a remote Australian Aboriginal community	To explore strategies to provide culturally sensitive information and approaches to support food choice and health among residents of a remote Aboriginal community.	Qualitative: semi-structured interviews	Strong	30 people	Adults aged 18–61 years, 70% female, mean age 42.9 years, number of people in each participants household ranges from 3 to 20, with an average of 9.3 people.

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Dimitropoulos et al. [39]	2018	NSW, Australia	A collaboration with local Aboriginal communities in rural New South Wales, Australia to determine the oral health needs of their children and develop a community-owned oral health promotion program	To collaborate with local Aboriginal communities to determine the oral health needs of Aboriginal children aged 5–12 years, the oral health knowledge, and attitudes towards oral health of parents/guardians, and the perceived barriers and enablers towards oral health promotion for school children by local school staff and community health workers.	Quantitative: surveys	Strong	149 people	Children survey: 78 children aged 5–12 years enrolled in local schools, 56% female Caregiver survey: 32 parents/guardians, 88% female Staff survey: 37 School staff/Health workers employed in local schools and community centres–3 school principals, 19 teachers, 4 administration staff, 11 education officers
Elwan et al. [40]	2015	Rural Athabascan community, 200 miles west of Fairbanks, Alaska, USA	Beverage consumption in an Alaska Native village: a mixed-methods study of behaviour, attitudes, and access	To assess the frequency of SSB, water and milk consumption, ascertain the attitudes towards consumption of water, milk and SSB of residents of a rural, Interior Alaska Native (Athasbascan) community, and assess rural access to water, milk and SSBs.	Mixed methods: Quantitative: survey and shop inventory Qualitative–focus groups and individual interviews	Strong	95 people (67 from surveys, 21 from focus groups, 7 from interviews) and 3 shops	Survey: 25 adults (76% female), 21 adolescents (48% female), and 21 children (48% female) Interviews: Head Start and Early Head Start program instructors and shop owners Focus groups: community members Shops: located in the village

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Frank et al. [41]	2016	Yucatan, Mexico	Two approaches, one problem: Cultural constructions of type II diabetes in an indigenous community in Yucatán, Mexico	To understand how diabetes is understood and treated in Indigenous settings in rural Yucatán.	Qualitative: semi-structured interviews	Moderate-strong	36 people	34 community members (74% female, aged from 33 to 38 years, 71% had T2DM), 2 clinicians employed in health care facility
Galloway et al. [42]	2015	Inuvialuit, Nunavut, and Nunatsiavut Regions, North Canada	Socioeconomic and Cultural Correlates of Diet Quality in the Canadian Arctic: Results from the 2007–2008 Inuit Health Survey	To increase understanding of the factors influencing nutrition and health outcomes in Inuit communities so that the many positive aspects of Inuit nutrition can operate unconstrained by socioeconomic and institutional barriers.	Quantitative: survey	Moderate	2097 people	All Inuit residents, 26% aged 19–30 yo, 47% aged 31–50 years, 27% aged 51+ years, 62% women, 40% employed
Godrich et al. [43]	2017	WA, Australia	What are the determinants of food security among regional and remote Western Australian children?	To explore the impact of food security determinants on children in regional and remote WA, across food availability, access, and utilisation dimensions.	Qualitative: semi-structured interviews	Moderate-strong	20 people	8 health workers, 6 school/youth workers, 6 food supply workers, 80% female

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Hall et al. [44]	2019	NT, QLD, NSW, and SA, Australia	Challenges of WASH in remote Australian Indigenous communities	To identify the status of water, sanitation, and hygiene services within remote communities on mainland Australia.	Qualitative: open-ended interviews	Strong	16 people	6 state representatives, 4 Indigenous representatives, 3 research representatives, 2 utility representatives, 2 NGO representatives
Johnson-Down et al. [45]	2012	Northern Quebec, Canada	How is nutrition transition affecting dietary adequacy in Eeyouch (Cree) adults of Northern Quebec, Canada?	To evaluate TF intake for its importance in Cree communities and characterise the nutrient intake and dietary adequacy of adults in this population, as well as look at the impact of TF on dietary adequacy.	Quantitative: surveys	Moderate	850 people	59% women, average age of 40.9 years, age range of 19–91 years, 48% current smokers
Kirkham et al. [46]	2020	NT, Australia	'No sugar', 'no junk food', 'do more exercise'–moving beyond simple messages to improve the health of Aboriginal women with Hyperglycaemia in Pregnancy in the Northern Territory–A phenomenological study	To explore Aboriginal women's experiences of hyperglycaemia in pregnancy, associated health care, and their understandings of the condition and health behaviours, to better understand women's specific needs and inform future systems change.	Qualitative: semi-structured interviews	Strong	42 people	35 Aboriginal women (age spanning 21–44 years, 2 pregnant, 33 post-partum, 10 with T2DM and 25 who had GDM), 7 Health professionals across NT (100% female)

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Koller et al. [47]	2021	Yukon-Kuskowim region, Western Alaska, USA	Storekeeper perspectives on improving dietary intake in 12 rural remote western Alaska communities: the "Got Neqpiaq?" project	To update and increase understanding of why fruit and vegetable intake remains low and SSB consumption continues to be high despite years of recommended changes by health care providers, nutritionists, and public health professionals.	Qualitative: semi-structured interviews	Strong	22 people	100% storekeepers, from 12 different communities
Kruske et al. [48]	2012	NT, Australia	Growing Up Our Way: The First Year of Life in Remote Aboriginal Australia	To better inform Western-educated health professionals working in remote communities on how to incorporate an Aboriginal-centred perspective in their work associated with infant development, parenting, and child-rearing practices by collecting Aboriginal families' stories about child rearing, development, behaviour, health, and well-being.	Qualitative: semi-structured interviews every 4–6 weeks for 1 year	Strong	15 mothers and any family members present at time of interview	100% female, 100% pregnant, aged between 15 and 29 years, 93% had male partners, 40% were first time mothers, 60% had 2–4 children

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Kurschner et al. [49]	2019	Tecpan, Chimaltenango, Guatemala	Impact of school and work status on diet and physical activity in rural Guatemalan adolescent girls: a qualitative study	To address the impact of out-of-school status on diet and physical activity by conducting a series of qualitative interviews with adolescent girls from one midsized, largely Indigenous Maya town.	Qualitative: semi-structured interviews	Moderate-strong	20 people	20% 15–16 years, 70% 17–18 years, 10% 19 years, 100% girls, 50% at school and unemployed, 10% at school and employed, 40% not at school and employed, 95% single, 25% have children, median household size is 6 people
Kyoon-Achan et al. [50]	2021	Manitoba, Canada	First Nations and Metis peoples' access and equity challenges with early childhood oral health: a qualitative study	To report the challenges and problems faced by First Nations and Metis parents in meeting the early childhood oral health needs of their children and to offer context-based and community informed recommendations on improving oral healthcare equity and outcomes in First Nations and Metis communities in Manitoba.	Qualitative: focus groups	Strong	59 people	18.4% male, 88% had children, age range from 21 to 71 years, 44% employed, 50% married or living in common-law relationships

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Levin et al. [51]	2017	Pueblo Kichwa, Rukullakta, Ecuador	Maintaining Traditions: A Qualitative Study of Early Childhood Caries Risk and Protective Factors in an Indigenous Community	To identify the risk factors and protective factors for nutrition and oral health among Kichwa families participating in a community-based oral health and nutrition intervention.	Qualitative: semi-structured interviews	Strong	18 caregiver/child pairs	Parent/caregiver commenting on their child. Child mean age was 4.1 years, age range was 6 months-6 years, 56% male, average of 6.4 decayed teeth. No information on parents provided.
Lindsay et al. [52]	2008	Ceara State, North-East Brazil	Brazilian mothers' beliefs, attitudes and practices related to child weight status and early feeding within the context of nutrition transition	To describe mothers' child feeding practices and perceptions of how these factors might be associated with child weight status, including underweight and the development of childhood overweight, to explore the role of socioeconomic, cultural, and organisational factors on these relationships; and to identify potential barriers that mothers in this population face to making healthy feeding choices for their children.	Qualitative: focus groups	Moderate-strong	41 people	100% mothers, 75% married, age range of 19–49 years, have 4 children on average

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Myers et al. [53]	2014	Victoria, Australia	Early childhood nutrition concerns, resources, and services for Aboriginal families in Victoria	To investigate the child nutrition concerns of Aboriginal families with young children attending Aboriginal health and early childhood services in Victoria, training needs of early childhood practitioners, and sources of nutrition and child health information and advice for Aboriginal families with young children.	Qualitative: focus groups and semi-structured interviews	Strong	80 people (35 from focus groups, 45 from interviews)	Focus groups: parents of children aged 0–8 years, 63% male Interviews: health and children's services practitioners, "mostly female", 44% Aboriginal health workers
Patel et al. [54]	2021	Kimberley, WA, Australia	Oral health education and prevention strategies among remote Aboriginal communities: a qualitative study	To investigate the perceptions and attitudes of oral health among Aboriginal Australians living in remote Kimberley communities in the context of better understanding existing and informing future prevention and education strategies.	Qualitative: interviews and focus groups	Strong	103 people (23 from interviews, 80 from focus groups)	Adults over 18 years, 66% females

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Pollard et al. [55]	2014	WA, Australia	Understanding food security issues in remote Western Australian Indigenous communities	To determine store managers' perceptions of the extent of food insecurity in their communities, key concerns relating to food in remote stores, store operations, infrastructure, and resource needs.	Qualitative: telephone semi-structured interview	Strong	33 people	100% remote community store managers
Sarkar et al. [56]	2015	Labrador, Canada	Water insecurity in Canadian Indigenous communities: some inconvenient truths	To determine the water insecurity of a remote Indigenous community and their coping strategies and to find their associated health risks.	Mixed methods; Qualitative: open-ended interviews and focus groups Quantitative: water quality testing	Moderate	48 people (43 from focus groups, 5 from interviews) 4 water samples	4 Focus groups: women's group, high school students, community members, and community leaders Interviews: community leader, woman, community nurse, teacher, elder Water samples: wells, brooks, ponds, and public water

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Seear et al. [57]	2020	Derby, WA, Australia	Maboo wirriya, be healthy: Community-directed development of an evidence-based diabetes prevention program for young Aboriginal people in a remote Australian town	To discover what type of prevention program would be suitable for young Aboriginal people in and around Derby; utilise community knowledge and previous research evidence to design a preliminary lifestyle modification program consistent with community preferences; and refine the program after testing in a small exploratory pilot.	Qualitative: focus groups	Strong	32 people	75% female, 47% participants aged 16–17 years, 13% aged 18–25 years, 41% aged from 26 to 45 years
Thurber et al. [58]	2014	11 diverse locations across Australia	Social determinants of sugar-sweetened beverage consumption in the Longitudinal Study of Indigenous Children	Using data from the fourth wave of the Longitudinal Study of Indigenous Children, this cross-sectional study uses multilevel modelling to examine the association between sugar-sweetened beverage consumption and an array of social, cultural, and environmental factors, including area-level influences.	Quantitative: survey	Moderate	1283 caregiver/child pairs	Parent/caregiver reporting on their child. Children aged 3–9 years

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Thurber et al. [59]	2018	11 diverse locations across Australia	Sugar-sweetened beverage consumption among Indigenous Australian children aged 0–3 years and association with sociodemographic, life circumstances and health factors	To explore beverage intake and associations between sugar-sweetened beverage intake and sociodemographic, life circumstances, health, and well-being factors in a national cohort of Indigenous children.	Mixed methods: Quantitative: survey Qualitative: focus groups	Moderate-strong	938 people (933 from surveys, 5 from focus groups)	Survey: Parent/caregiver reporting on their child. Children 0–3 years, 51% male, 30% aged 0–12 months, 42% aged 12–18 months, and 28% 18–36 months old. Focus groups: Research Administration Officers, 100% Aboriginal and/or Torres Strait Islander, most live in the area in which they conduct interviews
Tomayko et al. [60]	2017	5 communities across USA	Household food insecurity and dietary patterns in rural and urban American Indian families with young children	To evaluate the prevalence of food insecurity among American Indian households from both rural and urban communities and examine the association of food insecurity with diet patterns of both adults and young children (2–5 years) concurrently in these households.	Mixed methods; Quantitative: survey Qualitative–focus groups	Strong	481 caregiver/child pairs (450 from surveys, 31 from focus groups)	Survey: 53% rural households, 61% food insecure, 100% adult caregiver (95% female, average age 31.5 years), of child (average age 45 months old, 50% female) 6 Focus groups: adults from families who had completed the Healthy Children Strong Families 2 intervention

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Tonkin et al. [61]	2017	NT, Australia	A Smartphone App to Reduce Sugar-Sweetened Beverage Consumption Among Young Adults in Australian Remote Indigenous Communities: Design, Formative Evaluation and User-Testing	To consult RIC members to inform the content of a smartphone app that can be used to monitor and reduce sugar-sweetened beverage intake in RICs.	Mixed method; Qualitative: semi-structured interviews (F and E), "think aloud shop" (F and E) Quantitative–survey (F)	Moderate-strong	36 people (20 from formative research phase, 16 new participants and 4 repeated participants in end-user testing phase)	Formative research: 50% female, 55% under 25 years, age range from 18 to 35 years End-user testing: 55% female, 25% under 25 years, age range from 21 to 35 years
Walch et al. [62]	2022	Yukon-Kuskokwim region, South-West Alaska, USA	Impact of Assistance Programs on Indigenous Ways of Life in 12 Rural Remote Western Alaska Native Communities: Elder Perspectives Shared in Formative Work for the "Got Neqpiaq?" Project	To share perspectives of Alaska Native Elders that identify the benefits of, and encourage, careful consideration of the impact of government-sponsored food, nutrition, and childcare assistance programmes on Indigenous cultures and traditional ways of life.	Qualitative: focus groups	Strong	66 people	55% female, 100% community elders

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Walch et al. [63]	2021	Yukon-Kuskokwim region, South-West Alaska, USA	Alaska Native Elders' perspectives on dietary patterns in rural, remote communities	To enhance the local and regional relevance to design, implement, and evaluate an obesity prevention effort, the objective of this study was to listen to Yup'ik and Cup'ik Elders to better understand their views on maintaining a healthy diet, physical activities, and traditional values to inform obesity prevention efforts.	Qualitative: focus groups	Strong	66 people	55% female, 100% community elders
Wattelez et al. [64]	2019	New Caledonia	Sugar-Sweetened Beverage Consumption and Associated Factors in School-Going Adolescents of New Caledonia	To broaden the vision on health among the 11–16 years adolescents in New Caledonia by assessing their SSB consumption behaviours and the associations with individual and socio-environmental factors.	Quantitative: survey	Moderate-strong	447 people	Adolescents 11–16 years, 57% female, 81% rural, 46% low SES

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Wood et al. [65]	2021	NT, Australia	Incorporating Aboriginal women's voices in improving care and reducing risk for women with diabetes in pregnancy–A phenomenological study	To explore Aboriginal women's and health providers' preferences for a program to prevent and improve diabetes after pregnancy.	Qualitative: semi-structured interviews	Strong	22 people	11 Aboriginal women with a history of GDM or T2DM in the last 5 years, aged >18 years, 7 health professionals, 4 community advocates
Wycherley et al. [66]	2019	NT, Australia	Associations between Community Environmental-Level Factors and Diet Quality in Geographically Isolated Australian Communities	To conduct a descriptive analysis to explore modifiable environmental-level factors that are associated with the features of dietary intake that underpin cardio-metabolic disease risk in geographically isolated Indigenous Australian communities.	Quantitative: point-of-sale data	Moderate-strong	N/A–2 pre-existing study results used	N/A –the Stores Healthy Options Project in Remote Indigenous Communities (SHOP@RIC) study and the Environments and Remote Indigenous Cardio-Metabolic Health Project (EnRICH)

Table 4. *Cont.*

Author	Year Published	Study Location	Study Title	Study Aim	Study Design: Method	Study Quality [1]	Number of Participants	Participant Characteristics
Zoellner et al. [67]	2011	Lower Mississippi Delta, USA	Health literacy is associated with healthy eating index scores and sugar-sweetened beverage intake: findings from the rural Lower Mississippi Delta	To evaluate health literacy skills in relation to Healthy Eating Index scores and SSB consumption while accounting for demographic variables.	Quantitative: survey	Strong	376 people	76% female, aged 18–84 years

[1] Study quality assessed on MMAT: Strong = 0 "No" ratings, Moderate-strong = 1 "No" ratings, Moderate = 2 "No" ratings, Moderate-weak = 3 "No" ratings, Weak = 4 or 5 "No" ratings. Key: USA = United States of America, N/A = not applicable, GDM = Gestational Diabetes Mellitus, T2DM = Type 2 Diabetes Mellitus, years = years old, SSB = sugar-sweetened beverage, NT = Northern Territory, SES = socioeconomic status, F = formative, E = end user, RIC = remote Indigenous community, WA = Western Australia, QLD = Queensland, SA = South Australia, NSW = New South Wales, WASH = Water, sanitation and hygiene, TF = traditional food.

3.4. Review Outcomes

Thematic analysis of included studies revealed 37 factors which influenced SSB consumption in remote Indigenous communities. Figure 2 presents the 15 most identified factors that have been mentioned in three or more papers. These codes, or factors were further synthesised into four overarching domains, which were further categorised into the stem and leaf level of the DONE framework, guiding the formulation of conclusions and recommendations [32]. Figure 3 provides an overview of the domains and codes. All extracted data are provided in Tables 5–7 for qualitative, mixed-methods, and quantitative papers, respectfully.

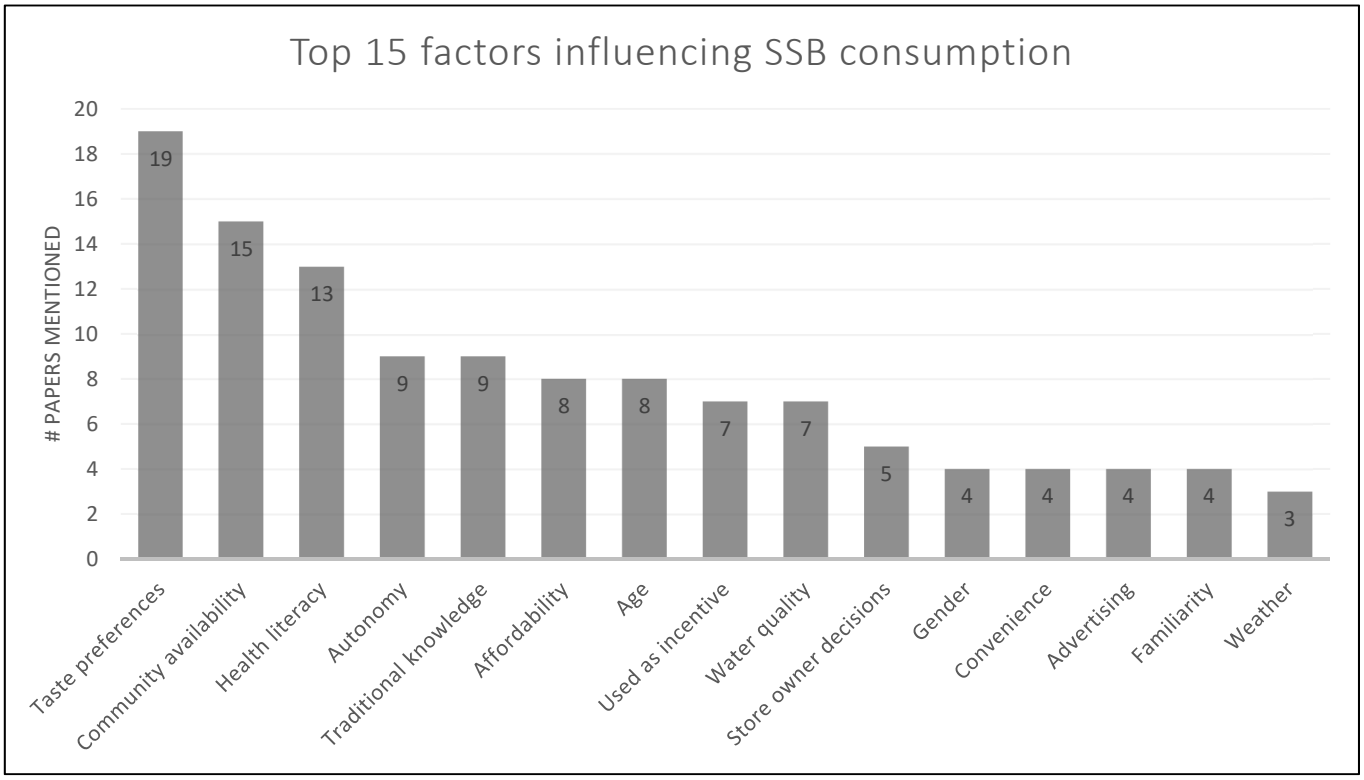

Figure 2. Factors reported to influence SSB consumption in 3 or more of the included studies.

Main	Stem	Leaf	Factor	# Papers mention
Individual	Biological	Sensory perception	Taste preferences	19
	Psychological	Food knowledge, skills, and abilities	Health literacy	13
		Food habits	Familiarity	4
	Demographic	Personal SES	Employment status*	1
			Income	1
		Biological demographics	Age	8
			Gender	4
	Situational	Situational and time constraints	Convenience*	4
			Stress	1
Interpersonal	Cultural	Cultural cognitions	Autonomy*	9
			Traditional knowledge	9
	Social	Social influence	Presence of others	2
		Family structure	Household size	2
		Household SES	Parental income	2
			Parent education level	2
			Parent employment status	2
			Food security	1
		Parental resources and risk factors	Time constraints	1
			Age of mother*	1
			Social support*	1
			Mother smoking status*	1
			Prenatal catch-up attendance*	1
		Parental feeding style	Used as incentive	7
		Parental behaviours	Parent role modelling	1
		Parental attitudes and beliefs	Priorities*	2
Environment	Meso/Macro	Characteristics of living area	Water quality*	7
			Living environment*	2
			Access to health services*	1
			Area of deprivation	1
		Exposure to food promotion	Advertising	4
		Environment food availability and accessibility	Community availability	15
		Market prices	Affordability	8
		Natural conditions	Weather	3
	Micro	Home food availability and accessibility	Household availability	1
Policy	Government	Governmental regulations	Store owner decisions*	5
			Exploitation of small communities*	1
		Campaigns	Policy/education in schools	1

Figure 3. Factors grouped according to the DONE framework, where * indicates the factor is not currently identified within the DONE framework [32].

Table 5. Factors influencing SSB consumption extracted from the included qualitative studies.

Author	Quotes	Other Comments	Summarised Factors
Brimblecombe et al. [35]	- "They reckon I am only telling them lie story. I always talk to my kids, have gapu (water) all the time, it is good for your body . . . Even we tell them-because it is already advertised on TV [television] that Coke is good or even Sprite or Fanta or Solo, stuff like that. It is already there; they're already watching it on TV. That is why they go in and buy stuff like that."–Elder - "We can't change, people have to change themselves, habit or, the cycle we see. You can't change people buying Coke, fish, and chips, that's crazy. We can't judge your life, what you want. No, we are talking about something that needs to change, not for us but for the generation coming."–Health professional	- The older participants raised a number of issues that they believed challenged parents' ability to guide their children's intakes, including the appeal and easy availability of so many different foods and drinks perceived as tasty, sweet, and convenient, and the autonomy children have to make their own choices. - The addition of often-excessive quantities of sugar to frequently consumed cups of tea was not considered to be a problem. Instead, they considered tea drinking to be an acceptable practice related to the past.	Exposure to food promotion–Advertising Environment food availability and accessibility- Community availability Cultural cognitions–Autonomy Food knowledge, skills, and abilities–Health literacy Situational and time constraints–Convenience Sensory perception–Taste preferences
Colles et al. [38]	In response to the question, "if you are in the store and your child/children/grandchildren is/are crying 'I want, I want' for coke or lollies, what do you do?" - "If the children want those drinks then I give them . . . I know fizzy drinks aren't any good but if they want them then I buy them . . . "–Mother - "Many mothers are not strong . . . They might not know the coke is bad, and also they can't say no; they don't know the story of coke and the fizzy drinks."–Mother - "Mothers say 'yes' because they don't have the full information on good food . . . If she knows the story she can close her heart to this bad food . . . Children need an education background before they have children."–Grandmother - "In the traditional style a mother or grandmother can't say no if a child wants something to eat . . . We tell kids what is there; it's up to the children what to choose. If we see it's not good food we tell them this will make you fat or get sick. What they eat, it is up to the children."–Grandmother - "When it's just mum, dad and kids, the rules can be there. But when there are lots of people, they influence the children and show them the wrong way."–Father	- Although soft drinks were considered dangerous, small amounts of sugar, particularly in tea, were considered acceptable or beneficial. - Some viewed the inability to say 'no' when their child is crying and begging for coke as a sign of weakness or associated with lack of knowledge. - -Those who had completed schooling appeared more likely to report actively guiding their children's food choices and saying no when a child is crying and begging for coke. - In response to children crying and begging for coke, most parents admitted difficulty saying no.	Parent feeding style–used as incentive Food knowledge, skills, and abilities–Health literacy Cultural cognitions–Autonomy Social influence–presence of others Household SES–parent education level Sensory perception–Taste preferences

Table 5. *Cont.*

Author	Quotes	Other Comments	Summarised Factors
Frank et al. [41]	- "[These days] you can sit around all day and watch TV and drink Coca[-Cola], and that is what people want!"–Woman - One participant mentioned a male diabetic she knew, saying, "The diabetes affects the way that he lives. He has pain, his vision is worse, and he feels sicker all the time. The doctor told him that he needed to stop drinking . . . but it is part of his life. He cannot stop."–Woman - When another participants husband who had diabetes had to get a blood test, the wife said "his blood glucose level was 383 [mg/dL]. And he couldn't understand why it was so high. I tried to explain to him about eating better and drinking less [SSB and alcohol]. But he just told me that he would not stop drinking, and that he would keep [doing things] the same as he has always done."–Women	- SSBs are omnipresent in Tope and throughout Yucatan. - SSBs were available in large quantities at nearly every meal, even breakfast. Toddlers often received Coca-Cola in their bottles. - Physicians named SSBs as the biggest contributor to the diabetes epidemic and also consumed these products themselves. - While participants acknowledged changing their diets might have had health benefits, they placed greater importance on the role of food as an important part of their individual autonomies, personal relationships, and social interactions. Additionally, they were accustomed to their diet and did not want to give up their favourite foods. - Although some females recognised the importance of modifying their behaviours, most women with diabetes acknowledged familial duties and social stigmas were enough to prevent them from making meaningful changes, such as decreasing SSB consumption. - This style of eating was relatively recent, and unique to the past two or three generations. - Many participants acknowledged that SSB consumption was a risk factor for obesity, diabetes, and other negative health outcomes. Clinicians always recommend reducing or eliminating SSB consumption in diabetes patients. Despite this knowledge, almost all participants admitted to still drinking SSBs.	Cultural cognitions–traditional knowledge Sensory perception–Taste preferences Home food availability and accessibility–Household availability Environment food availability and accessibility–Community availability Biological demographics–gender Cultural cognitions–Autonomy Food Habits–Familiarity Food knowledge, skills, and abilities–Health literacy

Table 5. *Cont.*

Author	Quotes	Other Comments	Summarised Factors
Godrich et al. [43]	- N/A	- 25% of participants believed local food outlets promoted discretionary foods, such as sugary drinks, more heavily than healthy foods. - Discretionary foods were placed in "high view" at the front of the store or on check-out counters, in contrast to healthy foods which were placed towards the back of the store.	Exposure to food promotion–Advertising Government regulations–Store owner decisions
Hall [44]	- "The water is quite hard . . . people don't want to drink it because it doesn't taste very good, so then they start substituting it for other things like soft drink or cordial or something like that . . . "– Indigenous organisation member	- The interviewees all commented on the low community acceptability of the groundwater in terms of taste and colour, and commented that alternative drinks, such as soft drink, were preferred.	Characteristics of living area–water quality Sensory perception–Taste preferences
Kirkham et al. [46]	- "[after finding out I have hyperglycaemia in pregnancy], I just stopped [drinking Coke] and started drinking Sprite [lemonade] . . . "–Mother with GDM - " . . . I talk to [the women] about diabetes. You know, soft drink, don't look at the soft drink. Soft drink a big lot sugar. But some, they don't listen. They go shop and buy soft drink."–Aboriginal Health Practitioner	- Coke was understood to be a sugary drink, but Sprite was not.	Food knowledge, skills, and abilities–Health literacy Sensory perception–Taste preferences

Table 5. *Cont.*

Author	Quotes	Other Comments	Summarised Factors
Koller et al. [47]	- "[Fruit flavoured juices] like Capri Sun . . . Yes, they sell, mostly children. They go fast, too. Those might be more popular than the 100% juices . . . "–Storekeeper - "Volleyball season, a lot of [teenage] volleyball players were going in and getting Gatorade and yes, Powerade"–Storekeeper - "Kool-Aid and Tang, yes. They usually go. I think it's just like whole families buying them". Another concurred by listing the drinks sold in the store as "Soda, Vitamin Water, the powdered KoolAid, powdered Tang". - " . . . Water, we can keep up with. Gatorade we can keep up with. Pop, we can't keep up with"–Storekeeper - " . . . Parents are role models for the children for drinking sodas, juice, and that. They see it."–Storekeeper - "Energy drink doesn't really have a written policy, but we know for the fact it's not really good for younger kids"–Storekeeper - " . . . Everybody is going to buy, drink, and eat sugary fatty foods because it's cheap. And I don't see an end to it because the prices are not going to go down"–Storekeeper - "Sales won't let me stop ordering soda. It's money. So, I've got to go by what they say"–Storekeeper - "I can't just . . . say, 'you can't buy [soda] it's not too good for you'. It's already on the floor and if they want to buy it they will buy it"–Storekeeper	- While flavoured additives, vitamin water, flavoured teas, and smoothies were available in several stores, they did not sell as well as soda/pop or the powdered drinks. Some storekeepers claimed price was a primary factor, while others felt it was because people bought what they were used to. - Most storekeepers indicated that diet soda/pop was not a popular item. Alternative healthy drink options, such as teas and smoothies, are carried in stores, but reportedly do not sell well because they are more expensive. - Storekeepers were aware of healthy options, but also knew these products were more expensive than unhealthy alternatives like SSB. - The storekeepers expressed how they are required to satisfy their customer base and, in several cases, company management- which means ordering large amounts of SSBs. - Fruit-flavoured juices were popular and appealing to young children. - For older kids, sports drinks were more popular and sold best in summer months and during sports seasons. - By far, the most well-stocked beverages in stores were sodas/pops.	Biological demographics–age Natural conditions-weather Food Habits–Familiarity Sensory perception–Taste preferences Market prices–Affordability Environment food availability and accessibility–Community availability Parental behaviours–parent role modelling Government regulations–Store owner decisions Cultural cognitions–Autonomy

Table 5. *Cont.*

Author	Quotes	Other Comments	Summarised Factors
		- When asked what people mostly drank, multiple storekeepers volunteered "soda" or "pop" as the beverage of choice. - Storekeepers agree that healthy beverages should be promoted, but pleasing customers is the priority, and none feels comfortable advising customers about food choices or telling them what they should or should not buy. However, purchasing policies that require healthy choices or limit unhealthy choices actually empower storekeepers with concrete actions they can enforce.	
Kruske et al. [48]	- N/A	- Family members appeared to find it impossible to deny children anything they wanted, including sweets and carbonated drinks, even when the parents knew the foods were unhealthy. To "want," "like," or "need" something are all regarded as part of the same concept: even families in strained financial circumstances will provide a child whatever he or she requests.	Parent feeding style–used as incentive
Kurschner et al. [49]	- "I do not have time to pack myself a snack for school (from home) and so I will buy something at the nearby store that is out in front. Sometimes I will buy fruit juice with cookies or some chips. Those are the only options that they have"–Adolescent female enrolled in school, not employed	- N/A	Situational and time constraints–Convenience Environment food availability and accessibility–Community availability

Table 5. *Cont.*

Author	Quotes	Other Comments	Summarised Factors
Kyoon-Achan et al. [50]	- "With my son, I didn't know how to take care of his teeth, he was two years old I had to be at work and for a drink, I'd gave him juice. I had no idea that apple juice is not supposed to be good for you and that's what I gave him."–Metis participant - "Well in my family my parents like to spoil my son, so they like to give him goodies. They like to give him apple juice in a bottle, and I try to step in normally [but] they try to sneak it in. So, I try to educate everybody and even people who aren't parents"–First Nations participant	- Some parents were unaware of the effects of sugary drinks on teeth or the seriousness of untreated tooth decay. Families reported not having avenues (Internet or television) to access information on caring for their children's oral health, which contributes to seeming inaction on their part. - Participants feed children sugary foods and beverages because those are more readily available than healthy options. - Participants in this study mentioned that other adults make poor food and beverage choices for their children.	Food knowledge, skills, and abilities–Health literacy Environment food availability and accessibility–Community availability Parent feeding style–used as incentive Parental resources and risk factors- time constraints
Levin et al. [51]	- "The first time he tried cola he must have been really small still, because sometimes we would take the little ones into town with us. But we wouldn't bring enough chicha to last through the day and they'd get thirsty. So, we would have to buy them cola and we'd put it in his bottle. I'm not sure how old he was—Maybe six months?"–High-caries parent - "My parents were not educated about these things. So, then they also weren't able to educate us, we would always eat candy, chocolates, popsicles, soda. We had no idea what could damage our teeth. And they didn't know to tell us that we should brush our teeth. If we wanted to brush, great; if not, that was fine too. So, that's why my generation, we have such damaged teeth and so many caries, and even mouth pain.—Low-caries parent	- A common theme among high-caries parents was how much diets had changed since their own childhoods. They discussed the challenge of preserving their healthy indigenous dietary traditions, primarily a low-sugar, plant-based diet. This was a particularly difficult struggle in the face of the allure of processed snacks and sugary drinks. - Parents described this nutrient transition in a context where stores began selling more processed snack foods and sugary drinks; more parents commenced wage-paying jobs outside the home; and both the access to and convenience of processed foods increased.	Environment food availability and accessibility–Community availability Market prices–Affordability Sensory perception–Taste preferences Characteristics of living area- water quality Food knowledge, skills, and abilities–Health literacy Parent feeding style–used as incentive Situational and time constraints–Convenience Cultural cognitions–traditional knowledge

Table 5. *Cont.*

Author	Quotes	Other Comments	Summarised Factors
		- Many parents stated that they never drank soda as children and tried soda for the first time as adults. By the time they were adults with their own children, they believed that soda was more available, affordable, thirst-quenching, and safer than the local water sources.	
Lindsay et al. [52]	- "I mix sugar in water or make herbal tea, when I can I give them food but when I can't . . . they've been to bed before just with sugar and water."–Mother	- These mothers spoke of having to give their children sugar water or 'herbal tea' when there was no money for food	Household SES–parental income
Myers et al. [53]	- "We have a bit of trouble with coke, cordial, and juice in bottles. People don't realise the sugar content of juice. They think they're giving their child a healthy drink by giving it juice."–Health Practitioner - "I try and buy heaps of fruit but it's just that Coke always ends up at home. I'll get a can and it's . . . drunk by everyone else. It's the Coke that's a killer in our black kids. Especially with the bottle, cordial in the bottle, that's rotting teeth, my kids have got em'."–Parent - "They put sugar in everything! Sugar in the bottles, sugar when they cook . . . cook the vegetables, sugar in everything. I think it would be a good idea to have a [nutrition and play policy]"–Health Practitioner - "Sugary foods–gives the mother peace."–Mother	- Reliance on sweet drinks and bottles was the most frequently reported nutrition concern raised by both parents and early childhood practitioners alike - Several parents reflected on the role food plays as a link between children's demands, tantrums, and their responses to children's demands.	Food knowledge, skills, and abilities–Health literacy Parent feeding style–used as incentive Sensory perception- Taste preferences Campaigns–Lack of policy

Table 5. *Cont.*

Author	Quotes	Other Comments	Summarised Factors
Patel et al. [54]	- "You can't stop [sugary drink consumption] in this town! Say if you stop it at the supermarket, they will go to the butcher shop or roadhouse"–Female - "It's very easy (to buy), my son goes mad for the hot chocolate it's only $0.90 but he buys one everyday"–Female - "[Sugary food and drink] is an easy source of something to keep the kids quiet"–Male - Sugar was seen to be 'damaging people' and community addiction to sugar was often talked about: "people are eating sugary things everybody is mad for sugar in this town, sweetness, and later on they get holes in their teeth." - "Long time ago, they used to drink tea from their own fields . . . yeh in the days 60s and 70s, we never worried about things like sweets, we used to hunt for bush food but this time lately everything is sweet now . . . everything is changing"–Male - "It's up to the parenting, the adults to stop buying the sugar . . . because the kids cry and whinge or it depends who they are with"–Female - "[Store owners] leave everything out near the counter the chocolate ice cream everything is to the kids eye level so they need to lift it up and put it behind the counter just so that we as a parent have the choice to say OK well you can have one whereas when they see it and they start grabbing it and you'll say no put it back and then they're screaming in the shops . . . "- Female	- Private enterprises exploit smaller communities targeting children through the sale of sugary foods and drinks. - Sugar also played a role in parenting whether it be by controlling its availability or using sugary food and drink to manage a child's behaviour. - Sugar and processed foods were ubiquitous in remote communities and the ease of access adversely impacted on the nutritional preferences for children living in remote communities. - The marketing of sugar to appeal to children was found to further complicate parenting and influence food choices at community stores. - There was a sense that the accessibility to sugary food and drinks within larger towns was unavoidable. As a result, restrictions on the sale of sugary food and drink seemed to be too difficult to introduce in communities with several outlets.	Environment food availability and accessibility–Community availability Sensory perception- Taste preferences Government regulation–Exploitation of small communities Market prices-Affordability Parent feeding style–used as incentive Exposure to food promotion- Advertising Cultural cognitions–traditional knowledge Government regulation–Store owner decisions
Pollard et al. [55]	- "[Despite awareness of health risks of a poor diet], they only want to buy pies, sausages and coke and they do not want to change their diet"–Community store Manager	- There was complacency about the value of healthy eating; one manager said people in his community already knew the health risks of a poor diet, but still bought unhealthy foods such as SSB.	Sensory perception–Taste preferences

Table 5. *Cont.*

Author	Quotes	Other Comments	Summarised Factors
Seear et al. [57]	- "Just tell them to just stop bringing cool drink here."–Adolescent female - Young people if they have money, they won't go home for a feed they'll go to the shops, there's cool drink, chips, have a snack, something before they go home, and what they have at home they don't know yet."–Adult male	- Participants spoke about ubiquitous availability and marketing of unhealthy foods and drinks.	Environment food availability and accessibility–Community availability Exposure to food promotion–Advertising Cultural cognitions–Autonomy Biological demographics–age Sensory perception–Taste preferences
Walch et al. [62]	- N/A	- Although participants believe that some of the foods in the stores are healthy, they are also concerned that there is too much junk food (such as candy, chips, pizza, pop, and convenience foods) served, eaten, and widely available. - Some Elders believe that due to the amount of processed foods and sugary drinks available, younger people are not eating as many Native foods and are concerned that they will lose their taste for these traditional foods and lifestyle practices.	Environment food availability and accessibility–Community availability Cultural cognitions–traditional knowledge

Table 5. *Cont.*

Author	Quotes	Other Comments	Summarised Factors
Walch et al. [63]	- "When I see the children, I always see them eating chips and candy bars and pop and juice, even though we tell them not to have them all the time, to have Yup'ik food, but they don't like to eat it"–Elder - "My concern is when I observe the store, [store owners] stock up a lot of soft drinks like pop, sugary stuff, and they disappear in no time . . . So that kind of tells us they're eating a lot of that stuff"–Elder	- Elders spoke of influences that today's generations have to contend with that the Elders did not, such as SSBs, which are more convenient, and less expensive than healthier alternatives. - Elders indicated they [parents] used the sugar sweetened beverages as a reward, as a babysitter, or to keep children quiet. - Many children are introduced to SSBs including soda and powdered drinks such as Tang at an early age through bottles and sippy cups.	Sensory perception–Taste preferences Government regulations–Store owner decisions Environment food availability and accessibility–Community availability Cultural cognitions –traditional knowledge Situational and time constraints–Convenience Market prices–Affordability Parent feeding style–used as incentive Cultural cognitions–Autonomy Food habits–familiarity
Wood et al. [65]	- "I think Coke is just addictive, you know . . . I think Coke is the best friend for everybody"–Woman - "Maybe if you ban soft drinks, I don't know. But again, even as I say that I know you've got to make the decision yourself."–Health Professional - "[Even if you made junk food and soft drink expensive and subsidised fruit and vegetable prices], they don't care if it's expensive they still buy it"–Woman - "At outstation, out bush we have good food but here [in community] we sometimes I drink coke."–Woman - Women responses to ways to decrease soft drink intake: "take it [soft drink] off the shelf", "maybe lower the prices [of healthy foods]", and "stop selling sugary stuff in the shop."	- Women described a healthier lifestyle and less soft drink consumption when they were on Country; with improved diet when eating bush tucker. - Some women thought that making access to unhealthy food and drink options more difficult would help people make healthier choices. - Many suggested the addictiveness and appeal of soft drinks as reasons for their widespread use.	Sensory perception- Taste preferences Cultural cognitions–Autonomy Environment food availability and accessibility- Community availability Market prices–Affordability Cultural cognitions–traditional knowledge Characteristics of living area- living environment

Key: SSB = sugar-sweetened beverage, SES = socioeconomic status, TV = television, N/A = not applicable.

Table 6. Factors influencing SSB consumption extracted from the included mixed-methods studies.

Author	Quotes	Other Comments	Summarised Factors
Byker Shanks et al. [36]	- "[stores] have a lot of pop, they have a ridiculous amount of pop"–Community member	- N/A	Environment food availability and accessibility–Community availability
Chakona [37]	- "They (mothers) do not care for their babies' health as many are not breastfeeding their babies. They give them juice which is sweet and they say babies like it."–Grandmother	- Although children preferred consuming snacks and juice rather than nutritious foods, mothers stated they would have been feeding them with good quality foods if they could afford to purchase them.	Market prices–Affordability Parental attitudes and beliefs–priorities Sensory perception–Taste preferences Food knowledge, skills, and abilities–Health literacy
Elwan et al. [40]	- "Kool-Aid or Tang was pretty much the only thing the kids drank"–Head Start Instructor - "The little ones, if they are by themselves, they buy pop [soda]. If they are with their parents, they buy Gatorade. Little kids that can barely look over the counter will buy pop."–Shop owner	- While many young children frequently drank Tang, Kool-Aid and even sodas, many people in the village recognised that SSB consumption was unhealthy. - While most participants in the study recognised soda could cause excessive weight gain and did not provide vitamins or minerals, many did not realise that other drinks such as 100% juice and juice drinks could contribute to excessive caloric intake too. - SSB consumption begins early, with children as young as 1 year of age drinking SSBs in the village, as participants claimed to receive no instruction in nutritional practices from healthcare providers. - Young children regularly visit village shops without a guardian and are allowed to purchase soda and all SSBs. - Shop owners and consumers reported that soda was usually the first product to disappear from shelves, and that it was not unusual for the entire village to run out of soda. - People in the village would not come into the store if no soda was available and soda is responsible for generating human traffic into the stores. - Kool-Aid or Tang is priced 75% cheaper per serving than healthier beverages such as bottled water or milk. - Only the largest store in the village sold 100% juice, which was nearly double the price of a can of soda or half the price of a bottle of water. - Bottled water was available for purchase at 2 of the village's 3 shops, and SSB was available at every store in the village.	Biological demographics–Age Food knowledge, skills, and abilities–Health literacy Cultural cognitions–Autonomy Government regulations–Store owner decisions Market prices–Affordability Environment food availability and accessibility–Community availability Sensory perception- Taste preferences Social influence–presence of others

Table 6. *Cont.*

Author	Quotes	Other Comments	Summarised Factors
Sarkar et al. [56]	- "I gave up diet drinks over a year ago and I was doing very well but then [the community] ran out of water and when I had to drink water at $1.25 a bottle and I needed four [bottles] a day–there was no water available from the treatment plant–well, I couldn't get fresh or clean water–I couldn't afford to buy four bottles of water a day just for me. Pepsi was all that was available, and Pepsi was cheaper, so I went back on it. The boiled water is disgusting; it tastes disgusting. Pepsi is $1.10 compared to water, which is $1.25."–Woman	- High-sugar beverages cost 15 cents less than a bottle of water at the local store, and they were more consistently available. So, the choice was made to consume high-sugar beverages, although residents expressed serious concern about the negative effects of high-sugar consumption on health. - Water was always on peoples' minds, especially before storms; hence, despite their knowledge of the potential health risks, people consumed untreated water and unhealthy high-sugar drinks. The residents understood the linkages between water insecurity and high rates of obesity, and they regretted their high-sugar intake, but they expressed a sense of helplessness. - To make water more palatable or to mask water with a brown cast (due to the high iron content or natural organic materials), parents offered Kool-Aid or a bottle of high-sugar-containing pop (Pepsi/Coca-Cola). - The residents managed the perennial water problem by conservation and recycling of water at home, reducing its intake and drinking high-sugar beverages as the alternative. - Water insecurity and poverty have resulted in a high intake of cheap sugary beverages as an alternative to water, particularly among children.	Sensory perception–Taste preferences Market prices–Affordability Environment food availability and accessibility–Community availability Characteristics of living area–water quality Biological demographics–age Natural conditions- weather

Table 6. *Cont.*

Author	Quotes	Other Comments	Summarised Factors
Thurber et al. [59]	- N/A	- The prevalence of consumption of any SSB and individual SSB types was higher in older compared with younger age groups. For example, 29% of 0–12 month old's had SSB, 56% of 12–18 month old's had, and 66% of 18–36 month old's had. - SSB consumption increased with number of children in the household - SSB consumption prevalence was significantly higher among children whose mother was ≤21 years old at their birth, and whose caregiver was non-employed. - SSB consumption prevalence was significantly higher for children whose caregivers had lower levels of family support, social network, and emotional support. - SSB consumption prevalence was significantly higher among children whose families were financially strained, and who were exposed to more stressors (e.g., racism, negative major life events). - For many families, there were 'more important' things to worry about, so what their children were drinking was not their highest concern. - SSB consumption prevalence was significantly higher among children who were exposed to smoke in utero, whose caregiver had poor social and emotional well-being and physical health, whose mother had no prenatal check-ups, who had inadequate access to health services and whose caregiver was a current smoker. - When concerned about water taste or safety, many people avoid drinking tap water and buy bottled water or other beverages; when bottled water is the same price as SSB, people may opt for SSB. - Without regular electricity supply, it is not possible to cool warm tap water. The warm climate of many remote areas also contributed to high SSB intake, with SSB perceived to quench thirst better than (warm) water.	Biological demographics–age Family structure–Household size Parental resources and risk factors–Age of mother Parental resources and risk factors–parental social support Parental resources and risk factors–mother smoking status Parental resources and risk factors–prenatal catch-up attendance Household SES–parental income Household SES–parental employment status Parental attitudes and beliefs–priorities Characteristics of living area- water quality Natural conditions–weather Situational and Time Constraints–Stress Characteristics of living area–Access to health services
Tomayko et al. [60]	- N/A	- 2–5 years old children from food insecure households had significantly higher intake of soda and sports drinks compared to food secure households. - Adults in rural food insecure households had higher intake of 100% fruit juice and SSBs compared to rural food secure households.	Household SES–Food security

Table 6. *Cont.*

Author	Quotes	Other Comments	Summarised Factors
Tonkin et al. [61]	- "I'm normally addicted to um [cola soft drink brand] . . . I drink [cola soft drink brand] whenever I'm out"–Participant	- Most participants (80%) identified that there are drinks that they would find difficult to give up, soft drinks (defined here as carbonated drinks, either unsweetened, sweetened, or artificially sweetened) being the main type of drink mentioned (70%). - A large number of participants were not aware of the need to, or not motivated to, change their SSB consumption behaviours.	Sensory perception–Taste preferences Food Habits–Familiarity Food knowledge, skills, and abilities–Health literacy

Key: SSB = sugar-sweetened beverage, SES = socioeconomic status, N/A = not applicable.

Table 7. Factors influencing SSB consumption extracted from the included quantitative studies.

Author	Other Comments	Summarised Factors
Bailie et al. [34]	- Consumption of large volumes of beverages with high sugar content is a result of poor palatability of bore water.	Characteristics of living area-water quality Sensory perception-Taste preferences
Dimitropoulos et al. [39]	- 4% of children believe sugary foods and soft drink are healthy for teeth and bodies - Over 12% of children did not consume tap water regularly and 5.1% identified tap water as 'unhealthy' for teeth and bodies. - There has been a history of poor water quality in some of the communities involved in this study, which could be contributing to the notion that water is 'unhealthy' and may be increasing the consumption of sugary drinks rather than water. - 25% of parents believe bottles with liquids other than water, such as SSB, do not make a baby's teeth unhealthy.	Food knowledge, skills, and abilities–Health literacy Characteristics of living area–water quality

Table 7. *Cont.*

Author	Other Comments	Summarised Factors
Galloway et al. [42]	- Men reported significantly lower percent energy from sugar-sweetened beverages and greater percent energy from traditional foods than women. - Being 51+ years old is strongly predictive of traditional food consumption and consuming <13% energy from high sugar beverages. - Being 31–50 years old is significantly more likely than the 51+ age group to consume more energy from high sugar beverages, and significantly less likely than the 19–30 years old group. - Being female is predictive of meeting the AMDR; however, it is also associated with lower likelihood of consuming < 13% energy from high-sugar beverages. - Consumption of TF predicted significantly greater likelihood of consuming <10% energy from saturated fat and <13% energy from high sugar beverages. - Total energy intake decreased significantly with increasing age as did the percent of energy from high sugar beverages.	Biological demographics–gender Biological demographics–age Cultural cognitions–traditional knowledge
Johnson-Down et al. [45]	- Younger individuals consumed more high-sugar beverages than did individuals aged >50 years old. - Men drank more servings of high-sugar beverages than did women. - The transition away from TF has led to the adoption of many unhealthy foods from nonindigenous sources, including high sugar drinks.	Biological demographics–gender Biological demographics–age Cultural cognitions–traditional knowledge
Thurber et al. [58]	- The probability of sugar-sweetened beverages consumption was significantly higher among children who were not taught traditional practices, who had experienced housing instability, who had a bigger household size, and whose primary carers had lower levels of education, were not employed, and reported financial strain. - Overall, sugar-sweetened beverage consumption was higher among older children, with significantly higher odds of consumption for children aged 5–7 years compared to children less than 4 years of age. This may be a result of children's increasing autonomy to make their own decisions.	Cultural cognitions –traditional knowledge Family structure–Household size Household SES–parental income Household SES–parental employment status Household SES–parental education level Cultural cognitions–Autonomy Biological demographics–age

Table 7. *Cont.*

Author	Other Comments	Summarised Factors
Wattelez et al. [64]	- Living environment, and knowledge about energy expenditure were significantly related to the quantity of SSBs consumed. - The adolescents categorised as "don't know" for energy expenditure knowledge consumed significantly more SSBs (6.22 L per week) than the others did (4.26 L per week for adolescents who underestimated, 3.64 L per week for adolescents who gave an accurate answer, and 3.73 L per week for adolescents who overestimated the energy expenditure required to eliminate a SSB unit). The higher the estimated expenditure, the lower the SSB consumption. - Low SES was associated with higher SSB consumption (4.44 L/day compared to 3.11 L/day in high SES) - Participants that disagreed that consuming SSBs can cause weight gain drank more SSBs than those who agreed (4.82 L/day compared to 3.77 L/day) - In New Caledonia, SSBs are widely available near all schools before, during and after the school day. - People living in environments where access to drinking water is a problem might become suspicious of their water source, especially as the taste can be unpleasant. This might explain the preference for SSBs among some rural populations. - Even though most of the New Caledonian adolescents thought consuming SSBs can cause weight gain, they drank them regardless.	Characteristics of living area–living environment Food knowledge, skills, and abilities–Health literacy Personal SES–Income Environment food availability and accessibility–Community availability Characteristics of living area–water quality Sensory perception–Taste preferences
Wycherley et al. [66]	- Sales of SSBs as a percent of the total energy were lower in communities with higher levels of household crowding, higher levels of Indigenous unemployment, and when the distance to a neighbouring store was greater.	Family structure–Household size Personal SES–Employment status Characteristics of living area–area deprivation
Zoellner et al. [67]	- Compared to women, men had significantly lower health literacy scores, lower HEI scores, and higher intakes of SSBs. - Participants in the lowest health literacy category consumed about 119 kcal/day more SSBs than those with adequate health literacy (230 kcal/day compared to 111 kcal/day). - Each additional point in health literacy scores was associated with 34 kcal/day lower SSB intakes. - Each additional year older a participant was, 7 kcal/day less SSBs were consumed. This means 18 years olds had the highest SSB consumption.	Biological demographics–gender Biological demographics–age Food knowledge, skills, and abilities–Health literacy

Key: SSB = sugar-sweetened beverage, AMDR = acceptable macronutrient distribution range, SES = socioeconomic status, TF = traditional food, HEI = Healthy Eating Index.

3.4.1. Individual Level

Studies identified nine factors encompassing biological, psychological, demographic, and situational domains at the individual level influencing SSB consumption. The most common was taste preferences, described by 19 papers as a determining factor of SSB intake. Papers referred to SSB as palatable [34], tasty [35], popular [47], thirst-quenching [51], difficult to give up [61], addictive [65], and one of their favourite foods [41]. Despite health literacy being the third most common factor to influence SSB intake, several papers reported that even when participants were aware that SSB were unhealthy, they drank them anyway [41,46,64]. There was a consensus among all included papers that young children and adolescents consumed the most SSBs, whether the evidence was in the form of regression analyses [42,45,58,59,67], or direct quotes/observations [40,47,56,57]. However, there was disagreement about which gender consumed the most SSBs, as some papers reported it was males [45,67], while others reported it was females [42], and some papers found gender to have no influence on SSB intake [58,59].

3.4.2. Interpersonal Level

Studies identified 16 factors in the social and cultural domains of interpersonal relationships to influence SSB intake. The concept of autonomy emerged, particularly when discussing child behaviours. Despite authority figures informing or advising children not to have so many SSBs, studies reported it was ultimately up to the children to make this decision independently [35,38,40,63]. More generally, it was identified that food was an important part of the individual autonomies of Indigenous people, and this was valued more highly than changing their diet to elicit potential health benefits [41]. Relating to cultural values is traditional practices, which have been shown via regression analyses to be inversely related to SSB consumption [42,45,58]. Older Indigenous participants have identified that the current style of eating is relatively recent [41] and diets have changed vastly since their own childhoods [51]. They never had to worry about sweets but now they do [54], and they are concerned generations to come will lose their taste for traditional foods in the face of sugar-laden newcomers such as SSBs [62,63]. The included papers had a large focus on child–parent dyads, and many influential factors of SSB consumption were related to parental actions, beliefs, and demographics. For example, in some studies parents reported using SSBs as a reward for when their children were well-behaved [38,48,50,53,54,63]. In one study, parents believed there were more important things to worry about than their children drinking SSBs [59]. It was also found that younger mothers and those who smoked were more likely to give their children SSBs [59].

3.4.3. Environmental Level

The included studies identified nine factors at the micro, meso, and macro domains of the environmental level. The general consensus among included papers was that SSBs were cheaper than healthy foods/alternatives [37,40,47,51,56,63]. While affordability was identified as a factor, one paper reported that Indigenous people do not consider the price of SSB in their purchasing decisions and that the want/desire is a stronger influence [65]. SSB sales in remote Indigenous communities are often mediated by other characteristics of the living area. For example, less than 50% of children aged 0–3 years of age with adequate access to health care consumed SSBs, in contrast to 75% of children without adequate access to health care [59]. Poor water quality has also been shown to influence SSB consumption via SSB addition to mask the colour or taste [56], diversionary drinking to conserve water [56], and due to perceptions that SSBs are healthier [39], safer [51,59], tastier [34,44,51,56,59,64], more aesthetically pleasing [44], cheaper [51,56,59], and more available [51,56], than local water sources. Availability of SSBs was the second most mentioned factor, referred to in 15 of the 34 included studies, as SSBs were described as being omnipresent [41], well-stocked [47], ubiquitous and unavoidable [54] in remote Indigenous communities.

3.4.4. Policy Level

At the policy level and within the government stem, there were three factors that influenced SSB intake. In focus group discussions, it was identified there were not many SSB consumption policies in place [47], and Myers et al. [53] have identified that this may be an effective avenue to reduce SSB consumption. Within community stores, the store owners were identified as key proponents of community SSB purchasing and consumption, particularly if they ordered and stocked large quantities of SSBs [40,47]. One paper mentioned that small community stores were often exploited by private enterprises, ultimately resulting in higher consumption of SSBs [54].

4. Discussion

The aim of this scoping review was to understand the most frequently reported moderators of SSB consumption in remote Indigenous communities in the published literature. After extraction from the 34 included studies, 37 different factors were summarised into the domains of the DONE socio-ecological framework. This facilitated the collation of results into: (i) 9 "individual level" factors; (ii) 16 "interpersonal level" factors; (iii) 9 "environmental level" factors and (iv) 3 "policy level" factors. Some of the factors were novel, while others had previously been identified in published work in Indigenous and other populations. Many of these factors influencing intake have been reported on, researched, and targeted in interventions to reduce SSB intake for several decades; however, interventions have not been effective and the problem of SSB consumption is ongoing [68]. The lack of a comprehensive and holistic understanding of factors influencing SSB consumption in remote Indigenous communities may be driving this problem and limiting the effectiveness of current strategies. Our scoping review helps to fill this gap. A key finding was that taste preferences were the most common factor influencing intake; however, no previous studies have considered this and incorporated it into strategies. Our results also showed that determinants of SSB intake stem from all different levels of the DONE framework, highlighting why strategies using a deficit-based approach are not appropriate. It is well-established that a deficit-discourse approach to research with Indigenous people results in disempowerment and has been identified as a barrier to improving health outcomes in communities [26]. Re-framing of this problem-based paradigm to a strengths-based approach [69], involving a deep consideration of First Nations people's values, culture, and environment, fosters empowerment within Indigenous communities; a critical component to achieve improved health of this group. In relation to the practical application of the DONE framework, our findings provide impetus for focusing on individual, interpersonal and environmental level factors with communities, rather than enacting change from a policy/governmental level. These top-down approaches cannot be expected to work if the individual's demographics, habits, and beliefs are not considered or accounted for.

4.1. Individual Level Factors Moderating SSB Intake

Age was found to influence SSB consumption, as children and young adolescents were more likely to consume SSBs than adults and older community members [42,45,58,59,67]. This trend was consistent internationally. While the reasons for this remain unclear, previous longitudinal research has suggested the innate preference for sweetness at birth and in the early years of life declines over time, and may be superimposed by maturational changes, hormonal changes, as well as many other behavioural and environmental factors [70]. The findings of the current study highlight that children should be a focus of future strategies to reduce SSB consumption, as this will improve the health of the next generation and influence family and community preferences [58]. This aligns closely with the broader realisation in public health nutrition that children can act as major agents of change and form an instrumental component of interventions targeted at improving family and community health [71]. The findings in this study also support The Lancet's calls for risk reduction in children to be a much higher priority than it currently is [72].

Poor health literacy was reported to influence SSB consumption in 12 of the 34 studies. Previous studies have identified low health literacy to be highly prevalent within remote Indigenous communities [73], and to be an important social determinant of health [74]. Past interventions have trialed nutrition education sessions in communities or in schools aiming to decrease SSB consumption, and while these interventions are often found to improve knowledge, it appears they are not sufficient to facilitate behaviour change to actually reduce SSB intake [8]. This notion of knowledge and education not influencing actions was also identified in the current review [55,64], implying that a higher health literacy does not guarantee a healthier beverage is chosen. Even when applied in conjunction with another factor such as a price discounts on diet-SSBs, nutrition education is shown to have no extra added benefit to improving diet quality or reducing regular SSB purchases [75]. This may suggest the taste of the regular SSBs is a paramount influencer of consumption.

Taste preferences is another factor at the individual level that contributes to high SSB intake in remote Indigenous communities. The current study found this factor to be most influential, and was consistently observed to influence SSB consumption of Indigenous populations across the diverse range of countries included in this review. Despite this, to the authors' knowledge there are no interventions within this population group based on taste or preferences. Dono et al. [76] stated that interventions targeting this purchasing decision are warranted. An Australia-wide survey has also found taste to be a ubiquitous reason for purchase [76], implying that this factor is not unique to Indigenous communities. However, as previous literature has consistently reported that First Nations people preferred significantly higher concentrations of sugar than non-Indigenous counterparts [77], and two of the included studies expressed that Indigenous people were feeling physically addicted to SSBs [61,65], it may be that the desire for the taste of SSBs is heightened in Indigenous populations.

4.2. Interpersonal Level Factors Moderating SSB Intake

The highest number of factors influencing SSB intake were categorised in the interpersonal level of the DONE framework. This is due to many of the included studies reporting on child/parent relationships. The findings of this review emphasised the role of autonomy as an important cultural belief that influences SSB intake in these communities. The belief that adults and children have the right to choose when, where, and what they eat [38] is deeply valued and engrained within Indigenous culture, which is why interventions such as soft drink bans may erode this cultural value [65]. In Australia, published work indicates this has influenced food choice among Indigenous people for over 40 years [78]. Conversely, in most Western families, parents are primarily responsible for decisions around food provision and dining [79]. A qualitative study on Western groups has also found parental practices such as using SSBs to reward good behaviour influenced overall intake [79]. Similarly, this practice was also identified within Indigenous settings, as SSBs were found to commonly be used by parents as incentives or treats, which subsequently increased total daily intake of SSBs [38,48,50,53,54,63]. Given that many Indigenous parents admit difficulty saying no to their child when they ask for sweet drinks [38], the impacts of using SSB as a parenting tool are likely compounded within Indigenous communities by the cultural significance of autonomy.

Although the traditional cultural approach to eating behaviour may have nurtured self-sufficiency within a largely safe, healthful, traditional food environment, in a commercially driven, colonised world it has been described as challenging and problematic [80]. The culmination of colonial practices such as relocating Indigenous people to missions, the provision of food rations, forced reduction in hunting and gathering, and separating mothers from their children has interrupted intergenerational knowledge transfer which has contributed to the cyclical loss of culture and traditional feeding practices [59,81]. This presents a culturally unique challenge to consider when attempting to decrease SSB consumption in Indigenous communities. A study included in this review found that the nutrient transition and loss of Indigenous culture over the past few decades has decreased

diet quality and increased SSB consumption [42]. A recurring justification throughout studies was that sugar consumption is a habitual behaviour, formed during mission times when packet sugar was a staple food provided to Indigenous people [8]. Other research has supported this in a broader sense, which has found accelerated urbanisation and globalisation has resulted in profound decreases in diet quality of Indigenous people [82].

4.3. Environmental Level Factors Moderating SSB Intake

Our review found availability to be the second most popular factor influencing SSB intake. In contrast to the traditional practices of living and eating from the land, remote Indigenous communities have become heavily reliant on their local convenience stores, with increased SSB consumption as a consequence [21,81]. Previous interventions have aimed at targeting the availability of SSBs by removing the top three selling soft drinks from the convenience store [83]. While this was shown to be effective at decreasing consumption of SSBs in the short term, sustainability and translation into improved health outcomes is unclear [83]. For example, an Indigenous community in one of the included studies identified that nothing is stopping people from visiting a neighbouring store to purchase the soft drink that they prefer the taste of, again indicating that taste preferences for the drink is a highly influential factor [54].

Past interventions have discounted the prices of diet or artificially sweetened beverages by up to 20%, but this did not affect SSB sales [75]. Data from the current review revealed that SSB are actually cheaper than water and diet drinks in some remote Indigenous communities, making it the most cost-effective choice where funds are often tight [40]. Previous studies have also suggested that Indigenous people will pay almost anything for something they want [68]. On the other hand, it is virtually impossible to give away anything that this group does not want [68]. This is another example of individual preference being the strongest predictor of SSB consumption.

A 2022 report by the UN has identified Indigenous people's lacking access to safe water sources as a global issue, which continues to be eroded due to activities such as mining and development of large agricultural and livestock farms damaging and contaminating water sources and putting livelihoods at risk [84]. This review has revealed that poor water quality in remote Indigenous communities can result in higher SSB consumption via means such as diversionary drinking [56]. However, a past intervention has attempted to reduce SSB consumption by introducing water bubblers to the community [85]. Post-installation, they found that despite water intake increasing by 19 mL per person per day, there was a reduction in diet-carbonated beverages by 42 mL, and an increase in SSBs by 20 mL per person per day [85]. The findings of this independent study are also supported by a recent SLR, which concluded that there is limited evidence that interventions aimed solely at increasing water consumption actually reduce SSB intake [86]. This highlights that even in the presence of safe drinking water, Indigenous communities are still drawn to, and choose SSBs, possibly due to personal preferences and taste.

4.4. Policy Level Factors Moderating SSB Intake

At an institutional level, a dearth of policy and lack of rigour and evaluation of policy implementation has been shown to increase SSB consumption [47,85]. When discussing strategies to reduce SSB consumption, Indigenous community members often brought up putting a policy in place; to remove some of the power store owners face, to monitor cooking methods in a school and community setting, and to circumvent exploitation [47,54]. Making changes at an institutional level may appear to be the most efficient approach as it focuses on widespread change rather than changing one person's behaviour. However, a recent SLR found that policies and interventions targeting Indigenous people that are implemented without Indigenous leadership or consultation do not improve nutrition outcomes and may be harmful [25]. Even when policies are community-driven, such as placing time restrictions on when SSBs can be sold and prohibiting children to purchase SSBs, it was found that these types of interventions are difficult to implement and inevitably

create tension within the community [54]. As one community member pointed out, "if you stop it at the supermarket, they will go to the butcher shop or roadhouse" [54]. Other policies that have been tried include provision of healthy foods and drinks at childcare centres, removal of the top three selling SSBs from the community store, and income management where 50% of their social security payments were quarantined for essential purchases only (such as groceries) [25]. The caveats of these ideas are that they either rely heavily on funding, which is often not available long term, the policy is put in place with no follow-up or audit to ensure its implementation, it is inherently based on a top-down approach, and often lacks cultural sensitivity [25]. Therefore, while the concept of a policy is a good idea, caution must be taken in its implementation by working closely with the Indigenous community and harnessing their strengths to design it.

4.5. Limitations

A limitation regarding the evidence obtained was the language bias towards only including papers that were published in the English language. Therefore, the findings may not be translatable to all countries and cultures since the included papers primarily had Western-centric perspectives which is not representative of global diversity.

During the full text review and data extraction phase, there were occasions where it could not be differentiated whether the factor was for food or drink or both. As this literature review is only documenting factors for SSB intake, it became difficult to gauge whether the paper should be included, or the data should be extracted. Therefore, to minimise this limitation resulting in a bias, it was unanimously decided to exclude the information unless it explicitly related the factor to SSB consumption. However, the caveat of this decision is that there is so much rich data and information relating to food and drink choice more broadly that had to be excluded as it was unclear if it related directly to SSBs. The consequence of this is there are other potential factors that may influence SSB intake in remote Indigenous communities that are not noted here.

Finally, the authors found preference to be most common factor, which has been interpreted to mean it has the most influence on SSB intake. However, there is the possibility it could also mean it has just been studied the most, which may decrease the strength of this conclusion.

A strength of this paper is it is the first of its kind; an international scoping review with a quantitative component grouping factors influencing SSB consumption into the socio-ecological framework, and therefore produced highly novel findings with significant implications worldwide for further research in this area. Moreover, the methodology used throughout the review process was rigorous and thorough, as stages of screening and data extraction involved at least two reviewers to enhance the objectivity of results and remove any potential personal bias, and there were comprehensive extraction categories. Another strength of this paper lies in its investigation into the 'why', as identifying the root cause of SSB behaviour in remote Indigenous communities has been severely overlooked in pre-existing literature.

5. Conclusions

This literature review endeavoured to identify and summarise the factors influencing high SSB consumption within remote Indigenous communities. Using the DONE framework, the myriad of factors were grouped into different socio-ecological levels. A novel finding of this scoping review is that SSB intake is influenced by all levels of this framework, which offers insight into why previous top-down deficit-based strategies have had limited success, and why empowering these remote Indigenous communities from an Individual level is paramount. Another key finding from this review was that taste preferences outweigh all other factors for influencing SSB consumption. Despite past interventions targeting other avenues that our review has shown to be factors, such as water quality, SSB availability, policies, education, and affordability of SSBs, these interventions have not considered the individual's taste preferences for SSB. These findings will enhance the

approach taken and the effectiveness of further research and strategy development in this area, which should ultimately decrease SSB consumption and thereby positively influence NCCD levels in remote Indigenous communities.

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