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Studies on dietary sodium knowledge, attitudes and behaviours in the Americas: a scoping review

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ABSTRACT

Objective To characterise the literature on dietary sodium knowledge, attitudes and behaviours (KAB) among adults in the Americas.

Design A scoping review conducted between September 2023 and August 2024, with an updated search in March 2025.

Data sources Ovid MEDLINE, Ovid EMBASE, Web of Science Core Collection, ProQuest Dissertation & Theses Global, Latin American and Caribbean Health Sciences Literature, Scientific Electronic Library Online, and other grey literature sources.

Inclusion criteria Studies with adults (≥ 18 years) residing in the Americas that assessed sodium-KAB were included.

Screening and data extraction Two reviewers independently screened titles, abstracts and full texts. Data charting was conducted by one polyglot reviewer and validated by another.

Results Thirty-two studies were included, mostly from North America (n=17; USA=11), followed by South America (n=13; Argentina and Chile=4) and Central America and the Caribbean (n=7; Costa Rica=5). Only one US study monitored sodium KAB over time, and three assessed differences by intake level. Most used quantitative methods (n=26), convenience samples (n=22), and had predominantly female participants (n=20). Rural populations were interviewed in only two studies, and just one used questions that underwent content validity testing with published results. Knowledge assessments focused on health outcomes (72%), food sources (47%) and intake recommendations (44%). Attitudes centred on concern about intake (53%), perceived intake (41%) and intention to change (28%). Behaviours commonly assessed included actions to reduce intake (72%), use of added salt (53%) and food practices (50%).

Conclusions Significant gaps exist in dietary sodium KAB monitoring across the Americas, particularly in lower-income countries with several under-represented populations. Future research should prioritise equity-focused surveillance using validated tools and behaviour change theories and frameworks to generate actionable data to advance public health policies and WHO sodium reduction targets.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Excess sodium intake is a major modifiable risk factor for cardiovascular disease, stroke and chronic kidney disease. Current estimates indicate that adult sodium consumption in most countries across the Americas substantially exceeds recommended thresholds. Systematic assessments of behavioural determinants underlying excessive sodium consumption, such as knowledge, attitudes and behaviours (KAB), are critical for the formulation and implementation of evidence-based population-wide sodium reduction strategies.

WHAT THIS STUDY ADDS

⇒ This scoping review systematically examined the literature on sodium KAB among adults in the Americas. Overall, monitoring of sodium KAB across the region remains limited, particularly in longitudinal studies. Certain population groups—such as men and individuals living in rural areas—were under-represented. The frequent use of assessment tools with limited validation was observed. Additionally, some KAB attributes were more commonly assessed in specific subregions, highlighting variability in the operationalisation and measurement of constructs across studies.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This review provides the first regional synthesis of sodium KAB research in the Americas, revealing critical gaps in population coverage, methodological rigour and theoretical application. These findings can inform the development of more robust, equity-focused monitoring systems using validated, context-specific tools. Strengthening KAB surveillance is essential to support evidence-based policies and advance progress towards World Health Organization (WHO) sodium reduction targets in the region, especially in low and middle-income countries.

INTRODUCTION

Excess sodium intake is a major risk factor for cardiovascular disease (CVD), stroke and chronic kidney disease, accounting for an estimated 1.89 million deaths and 45 million disability-adjusted life years (DALY) in 2019 worldwide.[1] Considering meta-analyses, the World Health Organization (WHO) recommends adults consume <2000 mg/day of sodium (<5 g/day of salt) regardless of blood

pressure status.[2] Despite public health efforts, most individuals in the Americas consume excess sodium,[3] with dietary sodium sources varying across countries. High-income countries derive more sodium from packaged and prepared foods, including restaurant foods, whereas in low- and middle-income countries, most dietary sodium is obtained from discretionary salt (eg, sodium added to food while cooking or at the table) and salt-based condiments (eg, bouillon).[4]

Population-wide sodium reduction is a major global public health priority. The WHO included '30% reduction in population sodium intake' by 2030[5–8] as one of nine global targets for non-communicable disease prevention.[9] To achieve this goal, the WHO endorsed several 'best buy' policy interventions which have a cost-effectiveness ratio of ≤$100 per DALY averted in low- and middle-income countries:[10] food reformulation and setting of target levels for sodium in prepared foods; ensuring low sodium options are available in public institutional environments (hospitals, schools, workplaces); the implementation of front-of-pack labelling; and behaviour change communication and mass media campaigns. Country-level implementation of these policies varies significantly across the Americas,[11 12] and, of interest, no country in the region has yet implemented behaviour change communication and mass media campaigns at the national level.[13]

Communications and campaigns are not only essential to garner public support for the successful implementation of sodium reduction policies overall, but they also are critical to raise awareness of the issue and to support the positive development of sodium-related KAB change among the public. Studies seeking to better understand and monitor the behavioural determinants of excess sodium intake, including KAB, can inform public health campaigns for population-level sodium reduction.[14] This includes refining messages, identifying target audiences and optimising intervention components. In response, the monitoring of sodium KAB is recommended by the WHO as part of surveillance programmes that are embedded within implementation frameworks for population-wide sodium reduction interventions.[14] However, to our knowledge, there have been no studies that have systematically examined sodium-related KAB research in the Americas. More specifically, it remains unclear to what extent researchers, and/or governments or non-governmental organisations have explored sodium KAB in the region, including what constructs have been assessed, how they have been measured and where in the Americas the research has been conducted. Therefore, the objective of this study was to conduct a scoping review to characterise the literature on sodium KAB among adults living in the Americas (North America, Central America and the Caribbean and South America). The protocol for this review was registered on the Open Science Framework in November 2023 and last amended in April 2024 (online supplemental file 1).

METHODS

Inclusion/exclusion criteria

This scoping review included both qualitative studies and quantitative observational (cross-sectional and longitudinal) studies that assessed KAB variables among adults (≥ 18 years) residing in the Americas.[15] *Knowledge* was defined as both content and procedural knowledge, which involves the understanding of advantages, disadvantages and how to engage in a given behaviour (ie, 'reduce sodium intake').[16] Under *knowledge*, objective ('what is true') or subjective ('what do you think is true') assessments were also captured. *Attitudes* were defined as the components related to an object of interest (ie, 'sodium'), including cognitive (ie, ideas, opinions, perceptions) and affective (ie, emotions, feelings) and behavioural (ie, intentions towards actions, reactions, practices) domains.[16] Finally, *behaviours* were defined as actions, responses or reactions of an individual, group or system that prevent illness, promote health and maintain quality of life.[16]

Studies were excluded if they focused solely on the measurement of sodium intake and sensory examinations. Studies that tested interventions (eg, randomised controlled trials, quasi-experimental), that included intervention study participants' baseline findings or that examined sodium KAB in a specific population subgroup (eg, patients, parents/caregivers, healthcare providers, food service workers, athletes, students/educators) were also excluded.

Information sources and search

For all included peer-reviewed articles and, when possible, grey literature, backward and forward citation searching was conducted. Forward citation searches were performed using Scopus or, if unavailable, Google Scholar.

Published literature

The search of published literature was conducted in six databases: Ovid MEDLINE, Ovid EMBASE, Web of Science Core Collection, ProQuest Dissertations & Theses Global, Latin American and Caribbean Health Sciences Literature – LILACS and Scientific Electronic Library Online – SciELO. The search strategy combined relevant subject headings (eg, MeSH) and keywords relevant to the concepts of dietary sodium intake, KAB, and North, Central and South America geography. No language or date limits were applied (online supplemental file 2). A medical research librarian developed the search strategies in collaboration with team members. A draft MEDLINE strategy was submitted for Peer Review of Electronic Search Strategies,[17] revised per peer review feedback, and translated to the other five databases. Database searches were conducted between 29 September to 2 October

2023 and updated on 28 March 2025. The search results were imported to Covidence (Veritas Health Innovation, Melbourne, Australia) for deduplication, screening, data extraction and analysis.

Grey literature

The first author (AG) conducted a search of grey literature from August 2023 to August 2024. This search included government-owned websites (eg, Ministry of Health), civil society organisations websites (eg, Institutional Repository for Information Sharing of the Pan-American Health Organization- IRIS-PAHO) and other websites identified by search engines (eg, Google), to account for local and regional documents (eg, reports, written presentations). In this case, relevant keywords/terms to search websites and to use in search engines were applied (online supplemental file 3).

Screening and data extraction

Screening for this review was divided into three stages: 1) reviewing search results and duplicate removals, automatically performed by Covidence, checked by two independent reviewers; 2) title/abstract screening, performed by two independent reviewers; and 3) full-text screening by two independent reviewers.

Data extraction was conducted between July and August 2024 and again in March and April 2025 for studies identified in the updated search. One reviewer extracted data using a pilot-tested form and a second reviewer validated the information. A third reviewer resolved any disagreements that arose during screening and data extraction phases. Study quality and risk of bias were not formally assessed, nor was an overall quantitative synthesis of outcomes conducted, as these were beyond the scope of the research objective.

Reporting followed the Joanna Briggs Institute recommendations[18] and Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews[19] reporting guidelines (online supplemental file 4). Data extracted included author, publication year; study design, country, population/sample characteristics, development and validation of assessment tools (D&V), KAB constructs assessed and key findings of relevance. Sodium KAB assessment tools were described according to the number of questions, theoretical elements and number of items by construct. D&V of tools were assessed as follows:[20] content validity, extent to which a tool covers all aspects of a concept (eg, experts panel); face validity, whether a tool appears to measure its intended construct(s) (eg, expert/participant review); construct validity, how well a tool measures the theoretical concept (eg, factor analysis); and reliability, consistency and stability of measurements over time or raters (eg, test-retest, internal consistency).

RESULTS

As shown in figure 1, the search identified 2323 studies from bibliographic databases and two additional studies through citation searching. After removing duplicates, 1690 studies remained. Grey literature search identified 54 studies, with 44 remaining after duplicate removal. The database search update in March 2025 identified an additional 128 results after deduplication. Following screening and full-text review, 32 studies were included in the final analysis—27 from bibliographic databases and five from grey literature. A summary of included studies is provided in online supplemental file 5.

General study characteristics

Regions, scope and population

Among 32 published studies, sodium KAB was assessed in 14 out of the 45 countries in the Americas, including 11 upper-middle income and three high-income countries,[21] as shown in figure 2. Overall, there were 17 (53%) studies from North America, with two multiregional;[22–38] seven (22%) from Central America and the Caribbean, three multiregional;[22 39–44] and 13 (41%) from South America, with four multiregional.[22 38 43–53] The most frequently studied countries were the USA (n=11), Canada (n=5), Costa Rica (n=5), Argentina (n=4) and Chile (n=4). Only two studies were found for the Caribbean region (Barbados and Dominican Republic). The earliest study was published in 2006.

Only one study from the USA examined changes in sodium KAB over time using nationally representative data.[25] Two studies reported participants living in rural areas.[37 48] Three studies investigated the difference in sodium KAB according to sodium intake.[23 40 46] The majority of studies relied on convenience samples (69%, n=22), while 10 studies (31%) used random sampling.[25 26 29–32 36 40 42 46] Two-thirds included a higher proportion of women/females (63%, n=20),[22 23 31 33–37 40–43 45–49 51–53] with nine studies having roughly equal sex/gender representation (50–53%)[25–30 32 38 50] and one study having a slightly higher participation of men/males.[44] One study from the grey literature did not report any sex/gender distribution,[24] and another did not report the characteristics of the sample who answered the sodium KAB questionnaire.[39]

Collaborations, funding and access

Four studies examined sodium KAB across multiple countries and regions.[22 38 43 44] Only five studies had involved international collaborations among co-authors.[22 31 38 43 53] Three studies were industry-funded.[24 35 38] Most studies were available in an open access format, with only four requiring payment or a journal subscription.[27 31 37 49]

Analytical methods & assessment tools

Most studies used quantitative methods (n=26, 81%),[22–36 38–40 42 44–47 49–51] while six employed qualitative approaches (19%).[37 41 43 48 52 53] One study reported the application of a quantitative survey, but also presented quotes from participants.[42] Quantitative data collection methods varied: 12 (46%) used online surveys,[24–28 31 33–35 38 45 47] nine (35%) used in-person

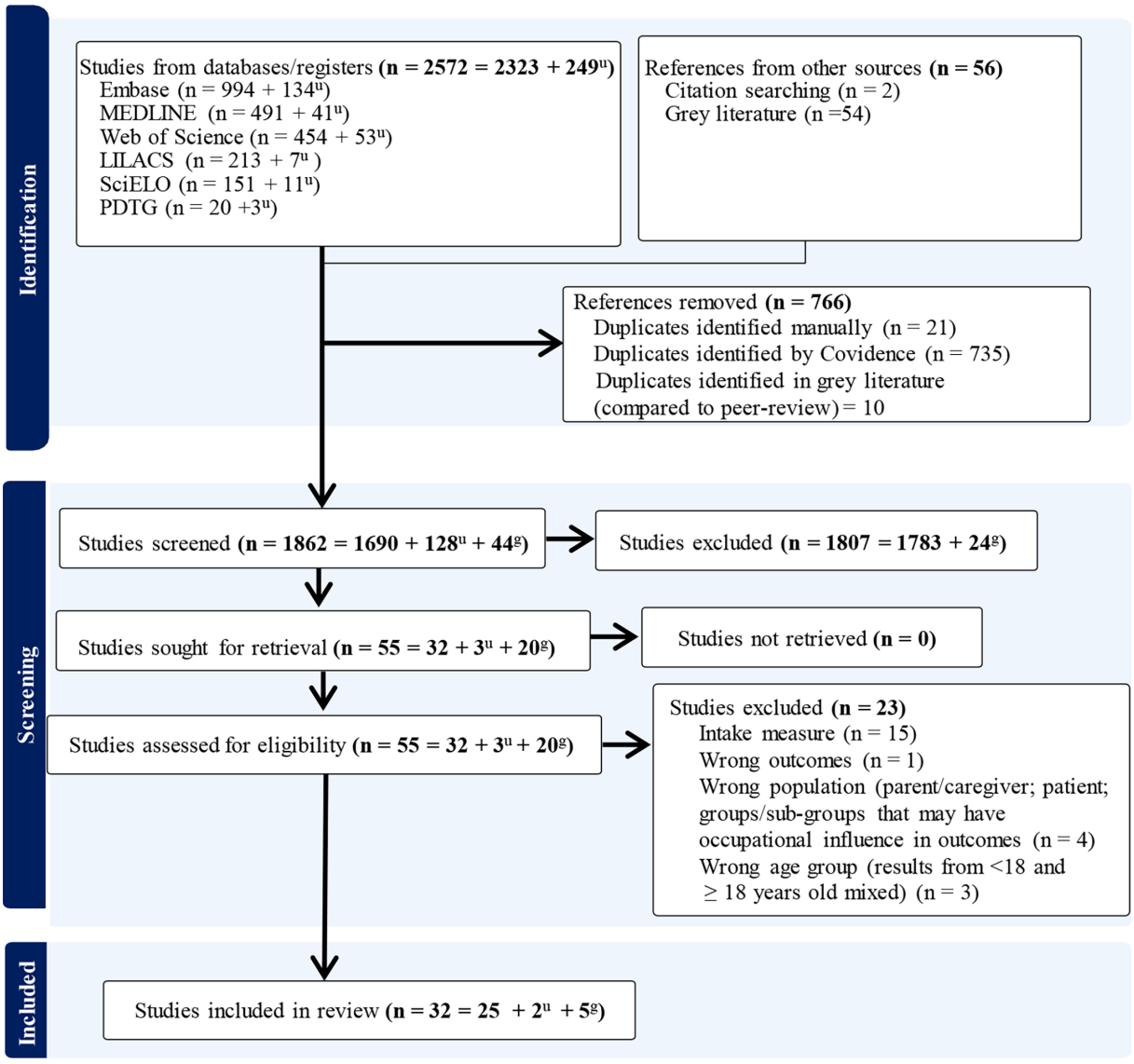

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart diagram from the initial and updated searches. **Legend**: **u** = Updated search (March 2025); **g** = Grey literature.

surveys,[22 23 39 40 42 44 46 49 51] and four (15%) used telephone interviews.[29 30 32 36] One study did not report how the survey was applied.[50] Qualitative studies relied on individual interviews,[37 41 43 52] focus groups[37 43 48 52 53] and direct observation.[43]

Studies used the terms 'sodium' or 'salt' in assessment tools, with no reported rationale for choosing one term over the other, and no clear regional preferences were observed. However, most tools incorporated both terms, to some extent. In particular, 'sodium' was predominantly used in questions related to intake, labels and food sources, while 'salt' was used when referring to the use of discretionary salt.[22 23 25 27–29 31 32 34–36 42 43 49 52] Some studies exclusively used the term 'salt', except in some circumstances when inquiring about the relationship between salt and sodium or dietary recommendations.[25 37 38 40 41 44–48 50 51 53] All studies assessed sodium knowledge except one,[30] while four did not evaluate attitudes or behaviours.[30–32 42 51] Another reported results as scores across KAB constructs (sufficient/insufficient).[47]

Although most studies reported using inputs to develop questionnaire items from previous research (n=16, 52%),[22 23 25–28 31–33 39 40 43 46 47 49 52] or experts' feedback (n=9, 29%),[22 25–28 31 33 44 47] most did not clearly report other validation methods or psychometric testing (online supplemental file 6). In six studies (19%), questionnaire items were either adapted from PAHO/WHO-developed instruments or were developed based on the frameworks established by PAHO/WHO experts.[22 23 39 40 44 46] Four studies stated that they used behavioural theories to guide items development, including the Health Belief Model,[43 48] Social Cognitive Theory,[36] Theory of Planned Behaviour[36] and Transtheoretical Model.[48] Two studies adapted questionnaire items from survey instruments developed outside the Americas.[47 49] Several studies conducted in the USA[25–28 30 32]

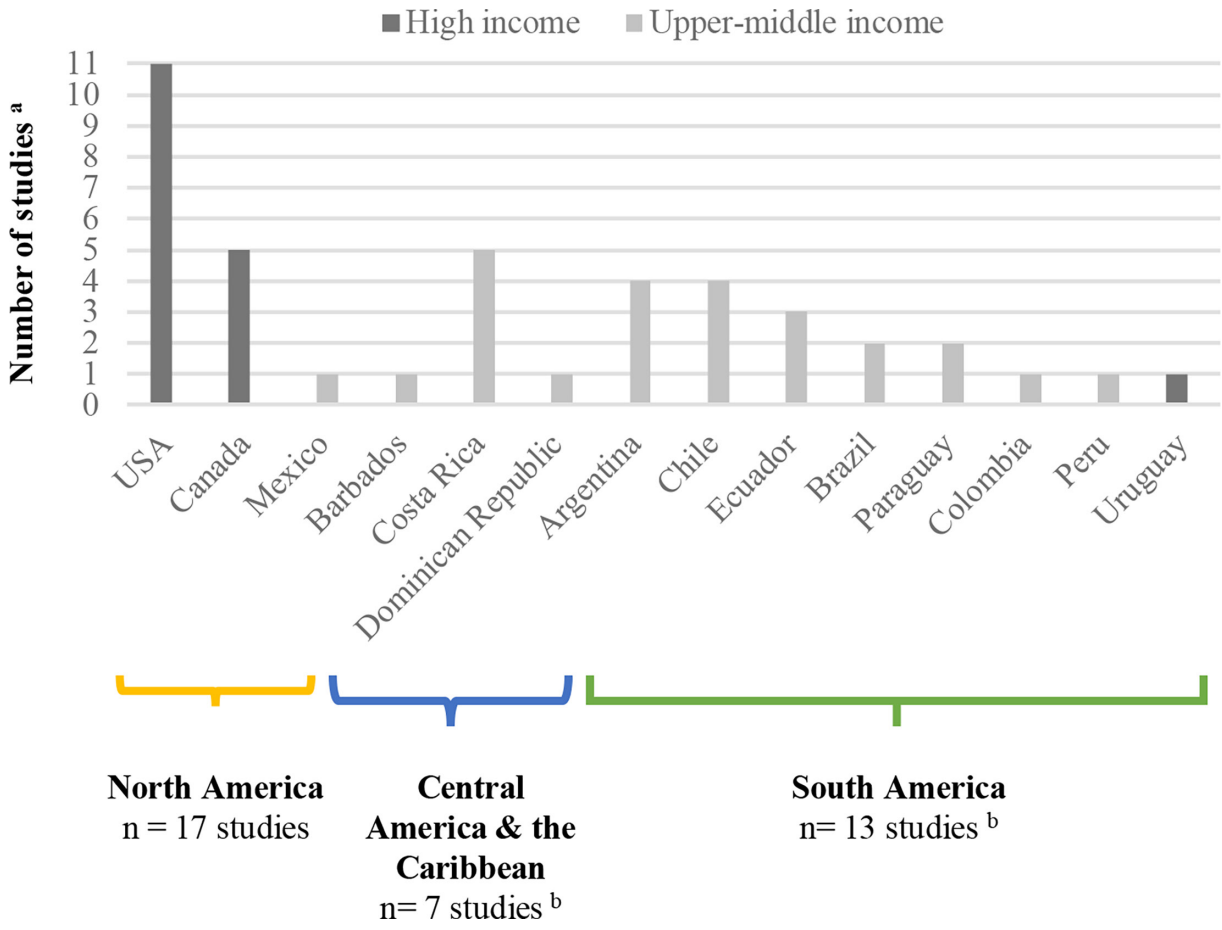

Figure 2 Distribution of studies by country, income level and region in the Americas. **Legend: a** Some studies included more than one country, which may also include multiple regions; **b** One multi-country study resulted in two publications with unique results (a report by Linders and a manuscript by Claro et al., 2012).

incorporated items from established national surveys, such as the Behavioral Risk Factor Surveillance System and the National Health and Nutrition Examination Survey. Two studies conducted systematic evaluations of content validity: one through experts consultation on developed items (results not reported)[22] and another by calculating experts' agreement[47] (results published separately).[54] Some studies pilot-tested questionnaire items (n=12, 38%).[22 26 28 29 31 33 34 37 42 46 49 53] Face validity was rarely assessed. In seven studies[25–30 32] (22%), selected questions underwent cognitive evaluations, while in others, question phrasing and response options were adapted/revised using inputs from participants[22 31 40 49] or experts.[22] No study reported assessments concerning construct validity or reliability.

Main findings: sodium KAB

The regional distribution of sodium KAB attributes that have been assessed in the Americas is summarised in table 1 and presented as figures in online supplemental file 7. Considering attributes related to knowledge, studies conducted in North America more frequently reported findings related to food sources (71%) compared with those from South America (38%) and Central America and the Caribbean (14%). In contrast, a relatively similar proportion of studies in Central America and the Caribbean and South America reported on sodium and health outcomes (71% and 85%), as well as salt/sodium recommendations (57% and 54%), respectively—which is higher than those from North America (65% on health outcomes and 41% on salt/sodium recommendations). Among all regions, label information and culinary skills were the least frequently investigated, in only 9% and 3% of the studies, respectively.

Concern about sodium intake was more frequently assessed in studies from North America (71%), nearly twice as often as in South America (38%) and Central America and the Caribbean (43%). In contrast, the meaning of salt was more commonly explored in studies from South America and Central America and the Caribbean (31% and 29%, respectively), compared with North America (12%). Self-efficacy, perceived barriers and perceived risk were the least frequently investigated attributes overall, each addressed in approximately 5% of studies overall (table 1).

In addition, sodium reduction actions were more frequently investigated in studies from Central America and the Caribbean (86%) and North America (82%) than from South America (54%). Interestingly, the

Table 1 Regional distribution of assessed sodium-related KAB attributes in the Americas

	Total n (%)	North America n (%)	Central America and the Caribbean n (%)	South America n (%)
Number of studies*	32 (100%)	17 (53%)	7 (22%)	13 (41%)
Knowledge attributes				
Sodium and health outcomes	23 (72%)	11 (65%)	5 (71%)	11 (85%)
Food sources	15 (47%)	12 (71%)	1 (14%)	5 (38%)
Salt/sodium recommendations	14 (44%)	7 (41%)	4 (57%)	7 (54%)
Understanding of salt/sodium	9 (28%)	2 (12%)	4 (57%)	7 (54%)
Preferred information sources	4 (13%)	2 (12%)	0	3 (23%)
Perceptions on groups at higher risk	4 (13%)	1 (6%)	0	3 (23%)
Label information	3 (9%)	2 (12%)	0	1 (8%)
Culinary skills	1 (3%)	0	1 (14%)	0
Total	31 (97%)	16 (94%)	7 (100%)	13 (100%)
Attitudes attributes				
Concern about intake	17 (53%)	12 (71%)	3 (43%)	5 (38%)
Perceived intake levels	13 (41%)	7 (41%)	4 (57%)	5 (38%)
Intention to change	9 (28%)	5 (29%)	1 (14%)	3 (23%)
Meaning of salt	7 (22%)	2 (12%)	2 (29%)	4 (31%)
Perceived environment	5 (16%)	3 (18%)	1 (14%)	2 (15%)
Role of others	5 (16%)	4 (24%)	0	2 (15%)
Perceived health status	4 (13%)	0	1 (14%)	2 (15%)
Taste preferences	3 (9%)	3 (18%)	1 (14%)	2 (15%)
Perceived benefits	3 (9%)	2 (12%)	0	1 (8%)
Labelling preferences	2 (6%)	1 (6%)	2 (29%)	2 (15%)
Self-efficacy	2 (6%)	2 (12%)	0	0
Perceived barriers	1 (3%)	1 (6%)	0	0
Perceived risk	1 (3%)	0	1 (14%)	1 (8%)
Total	28 (88%)	14 (82%)	7 (100%)	12 (92%)
Behaviours attributes				
Sodium reduction actions	23 (72%)	14 (82%)	6 (86%)	7 (54%)
Use of added salt	17 (53%)	9 (53%)	5 (71%)	7 (54%)
Food practices	16 (50%)	9 (53%)	4 (57%)	7 (54%)
Limiting intake	11 (34%)	8 (47%)	1 (14%)	2 (15%)
Influence of healthcare professionals	8 (25%)	7 (41%)	0	1 (8%)
Supportive social environment	5 (16%)	1 (6%)	1 (14%)	3 (23%)
Total	31 (97%)	17 (100%)	6 (86%)	13 (100%)

*Some studies included more than one country, which may also include multiple regions.
KAB, knowledge, attitudes and behaviours.

proportion of studies examining the use of added salt was similar in North America (53%) and South America (54%). In contrast, no studies from Central America and the Caribbean investigated the role of healthcare professional advice in reducing sodium intake, while one study from South America and seven from North America addressed this attribute. The role of a supportive social environment was more commonly explored in South America (23%) and Central America and the Caribbean (14%) compared with North America (6%). Despite these regional differences, this attribute remained the least frequently investigated overall (16%) (table 1).

Knowledge

Knowledge was a commonly evaluated domain, with 16 studies reporting findings for North America,[22–29 31–38] 13 for South America[22 38 43–53] and seven for Central America and the Caribbean.[22 39–44] Most assessments focused on

objective and content knowledge, with fewer studies examining subjective[41 48 50–53] and procedural knowledge.[29] The most frequently assessed knowledge attributes included sodium and health outcomes (n=23), food sources (n=15), salt/sodium recommendations (n=14) and general understanding of salt/sodium (n=9).

Sodium and health outcomes

Studies assessed participants' knowledge of the health consequences of excess dietary sodium.[32 33 35 37 40 41 43 46 52 53] The most frequently examined was the relationship between sodium intake and blood pressure (hypertension) using binary responses (yes/no), with 92%–97% of participants correctly acknowledging this association. This was followed by knowledge of other CVD and broader health outcomes, such as overall health status.

Food sources

Studies assessed participants' knowledge on sodium content of food, either in general[22 23 46] or in specific/local products.[41] Studies also asked participants to identify relevant food groups for sodium intake through multiple choice questions[24 49] or Likert scales.[25 27 28 32] Additionally, participants were asked to evaluate the sodium content of specific products or food groups (high or low),[35] in addition to ranking (eg, 'none' to 'a lot'),[29 36] and associated words with high in sodium content.[34] Overall, the literature shows participants are inconsistent in their abilities to identify food sources of sodium.

Recommendations and understanding of salt/sodium

Studies assessed participants' awareness of daily sodium intake recommendations (eg, up to 2000 mg/day or 2300 mg/day for sodium; or 5 g/day of salt) predominantly through multiple choice questions.[22 26 28 38 42 46 50 51] Additionally, some studies assessed participants' knowledge of the relationship between salt and sodium using binary questions.[22 23] One study asked participants to explain their responses with an open-ended question.[44] Overall, the literature shows low awareness of sodium recommendations among participants. While over 70% of participants claimed to know the difference between salt and sodium in two studies,[23 42 51] others found this knowledge below 30%.[22 44 49] Two studies also identified specific misconceptions reported by participants about other groups, rather than themselves, including the belief that sodium was 'a source of energy for athletes',[43] and that there was no recognised relationship between salt and sodium.[52]

Attitudes

Attitudes towards sodium were evaluated across studies using various approaches, including assessments of concerns about intake (n=17), perceived intake levels (n=13), intention to change (n=9) and the meaning of salt (n=7). Fourteen studies reported findings for North America,[22–29 33–38] 12 for South America[22 38 43–50 52 53] and seven for Central America and the Caribbean.[22 39–44]

Concern about sodium intake

Studies examined concerns about sodium intake.[22–29 33 35 36 38–40 46 48 49] This attribute was assessed through various measures, including participants' perceived importance of lowering, monitoring or controlling their dietary sodium;[22 23 36 38–40] overall concern about the risks of excess sodium;[24 29 33 35 45 46] beliefs about health risks;[25–28 48] and concern about sodium content in food.[49] Overall, the literature showed that participants expressed concerns about sodium intake, especially in relation to 'vulnerable' groups, like pregnant women, older adults and those with a CVD diagnosis.

Perceived intake levels, meaning of salt and intention to change

Several studies investigated participants' perceptions of their own sodium intake using either descriptive (eg, 'too little, just right or too much')[22 23 23 33 36 38 40 42 46 49 53] or numerical (eg, '> 3000 mg, about 3000/23000/1500/1000 mg, <1000 mg')[24] approaches, often including an 'I do not know' option. Some studies also assessed participants' perceptions of sodium intake at the population level (eg, 'Canadians in general').[29 36] Additionally, studies explored the meanings participants' associate with sodium (eg, 'essential', 'love').[34 37 41 43 45 48 52 53] Intentions to reduce sodium intake were assessed directly (eg, 'Definitely intend to reduce the amount of sodium you eat')[25 27 36] and indirectly (eg, 'What do you think about reducing salt intake?', 'I should eat reduced or low sodium products').[29 34 41 48 49 52] Overall, the literature suggests that most participants did not perceive their sodium intake as high. Adding salt while cooking was seen as an act of care, while 40%–65% of participants expressed a desire to reduce their intake, and ≥80% were willing to try low-sodium products.

Behaviours

Studies assessed behavioural attributes related to sodium intake, in addition to objectively measuring intake through a dietary assessment.[23 39 40 46] Eleven studies directly asked participants if they were monitoring or reducing their sodium intake, while most (n=23) inquired about engagements on actions to reach this goal, in addition to added salt use (n=17). Other food-related practices, such as dietary intake of sodium-rich products, were commonly evaluated (n=16). Overall, 17 studies reported results for North America,[22–38] 13 for South America[22 38 43–53] and six for Central America and the Caribbean.[22 39–41 43 44]

Food practices, use of added salt and influence of healthcare professionals

Some studies examined the intake of sodium-rich foods and the use of fresh herbs.[23 25 27 31 32 34 40 41 43 46 50 52] Salt addition habits were also evaluated, including whether and how much salt is added to food (binary and frequency question types).[22 23 26 31–34 37–40 43 46 50 52 53] Some studies explored how participants measured added salt (eg, fingers or a spoon) and timing of salt addition (eg,

while or after cooking, before or after food taste).[41 52] Studies frequently examined whether participants had received healthcare advice on reducing sodium intake, commonly using binary questions without a specific timeframe.[25–30 33 51] Overall, the literature highlighted a regular use/intake of sodium-rich packaged foods, frequent use of discretionary salt, mainly added while cooking rather than at the table, salt added 'by eye' ('*a ojo*') until food reaches a 'good flavour', with 20%–50% of participants reported receiving guidance to reduce their sodium intake. One study found that adding salt before cooking was perceived as healthier than adding 'raw' salt at the table and that 'freshness' was undesirable due to its 'bland' taste, reinforcing the need for added salt.[37] Finally, adding salt to fruit was reported as a strategy to encourage children's fruit consumption[43] or as a mandatory ingredient for alcoholic drinks (eg, *michelada*).[50]

Limiting intake & sodium reduction actions

Some studies assessed participants' current or past efforts to reduce their sodium intake through direct questions, requiring them to assess their own practices and perceived success.[23 25 27–30 33 36 39 45 46] Others investigated participants' actions to reduce intake, including familiarity with or use of sodium-reduced products and seasonings, including low sodium salt substitutes, as well as deliberate choices for lower-sodium products and meals when shopping or eating out.[25–29 31 33 34 37 39 40 43 46 49 52] Most common question formats involved listing selected strategies with binary response options and using Likert scales to measure agreement or frequency of engagement. Many studies also examined the extent to which participants use nutrition information on labels (eg, Nutrition Facts table, list of ingredients, warnings labels, claims).[22–29 31 34–36 41 43 44 46 48 49] Literature showed that approximately 50% of participants are currently limiting their intake. The use of low-sodium products was not unanimously popular, since they are not comparable to regular versions in terms of taste and cost. There was also relatively low usage of nutrition information on food packages.

DISCUSSION

This scoping review characterised the literature on sodium KAB among adults living in the Americas. Notably, only one study from the USA monitored sodium KAB over time, showing small increases in knowledge and behaviours (eg, recognition of processed foods as a sodium source, purchase of low-sodium foods), alongside a decrease in reported health professional advice for respondents with hypertension.[25] This underscores a lack of long-term monitoring efforts as part of a broader population-wide sodium reduction strategy. This gap persists despite clear recommendations from the WHO that emphasise sodium intake surveillance, food reformulation, nutrition labelling and the creation of healthier food environments.[10 14] In fact, one of the earliest public commitments to monitoring sodium KAB in the Americas dates back to 2011,[55] followed by expert-recommended assessment protocols in 2013[56] and the formation of a regional sodium reduction network in 2018.[57] Regular monitoring of sodium KAB allows for the detection of shifts and gaps in consumer awareness, KAB, enabling policymakers and non-governmental organisations to make timely, data-driven adjustments to population-wide sodium reduction initiatives. This, in turn, enhances population-wide dietary sodium reduction efforts and improves public health outcomes.

Among the studies identified in this review, only one quarter of countries in the Americas had data available on sodium KAB. The data reported were from high- and upper-middle income countries, with no data from low or lower-middle income countries. This disparity in data is concerning since some low or lower-middle income countries in the Americas have some of the highest sodium intakes in the region, such as Honduras and Nicaragua (>10 g/day of salt),[3] signatories of the *Regional Strategy for the Reduction of Salt and Sodium Consumption in Central America and the Dominican Republic*.[58] The USA, Canada and Costa Rica were the countries with the highest number of studies in the region investigated. This finding is likely related to the availability of research funding and national policy directives promoting the monitoring of sodium KAB since 2010, such as the *Strategies to Reduce Sodium Intake in the United States*,[59] the *Sodium Reduction Strategy for Canada*[60] and the *National Plan for Salt/Sodium Reduction in the Costa Rican Population*.[61] Similar commitments in Latin America include initiatives in Chile and Argentina—countries that also had the highest number of publications in South America, with the *Strategy for Reducing Salt Consumption in Chile Action Plan*[62] and *Argentina's Bill on Sodium Intake Reduction*.[63] Priority actions to address sodium intake in the region, as outlined in a multicentre project Policy Brief with evidence from Costa Rica, Argentina, Brazil, Paraguay and Peru, include regular monitoring of population sodium KAB and cross-country collaboration.[64] The development of *Costa Rica's National Social Marketing Plan for the Reduction of Excessive Salt and Sodium* demonstrated how sodium KAB data can guide public policy formulation.[65]

Additional inequities were observed with the use of convenience samples that were not representative of the population of interest. For instance, many studies had an under-representation of males/men, who usually have the highest sodium intakes in a population.[3] Moreover, studies had limited sampling in rural areas, which is relevant since approximately 30% of the land area in the Americas is considered 'agricultural'.[66] These areas often have limited access to healthy food options,[67] which can have adverse impacts on diet quality and health outcomes, especially for vulnerable groups such as children and older adults.[68 69] Furthermore, 48% of the survey instruments in this review were administered online, increasing the risk that individuals without access to internet or technology are under-represented. This

limitation may also affect the validation of survey instruments and their psychometric integrity, a challenge that has been identified in previous reviews.[70 71] Future research should prioritise more effective sampling strategies that ensure inclusive representation from diverse geographic and sociodemographic groups and minimise the use of research methodologies that perpetuate inequities and under-representations.

Few studies clearly reported the behavioural theories that guided both instrument development and data analysis, making it difficult to identify the intended assessment of the constructs, especially for broader concepts like 'attitudes'. Related to this, no studies clearly reported to have assessed, altogether, the reliability, validity and accuracy of their instrument relative to the intended constructs through psychometric testing, such as factorial or internal consistency analyses (as defined in the Methods section), which could lead to misleading conclusions. Some studies received inputs from experts to develop items and to conduct content validation, but few studies performed cognitive interviewing for questions with the sample population to ensure question clarity, interpretation and response accuracy before large-scale data collection. Future research should consider prior efforts to conceptualise significant constructs and attributes to be assessed concerning sodium KAB and include the adaptation of survey instruments to local contexts to reflect food practices, environment, policies and interpersonal and cultural influences that may vary across countries. It should also build on the identified studies by incorporating behaviour change models and psychometric tests to guide item development and validation, beyond experts and participants' inputs to elaborate questions. These should be supported by more clearly defined constructs, dimensions, attributes and concepts related to assessment tools, as these may vary depending on the theoretical framework adopted. Qualitative research can also complement questionnaire content and face validities, as part of a more rigorous mixed methods approach.

Notably, in this review, only three studies investigated sodium KAB in relation to dietary intake. Although there were still mixed results concerning sodium KAB and actual intake, this analysis offers valuable insights into how sodium KAB corresponds to measured consumption, which could contribute to future assessments of criterion validity of tools.[20] Also, evidence on sodium knowledge indicates that people are aware of health risks associated with high-sodium diets but lack clarity on its main sources, recommendations and the salt/sodium relationship. While knowledge does not necessarily lead to behaviour change, it is essential for long-term motivation, decision-making and self-efficacy.[72] Future research should identify these gaps between knowledge and action, in overall and relevant population subgroups, to inform effective sodium reduction interventions. As found in this review, adults perceived themselves as concerned about sodium intake and were willing to reduce it, but did not self-identify as high intake consumers. Adults also had misconceptions about sodium sources and generally viewed their intake as low compared with recommendations and the general population. Further examinations of perceived risks, susceptibility, benefits and barriers, and measured dietary intake should be encouraged to better understand how these perceptions influence dietary choices,[72] especially given the food inflation and competing interests of the food industry on this matter.[73–76] Most studies have assessed sodium reduction behaviours indirectly, emphasising engagement with behavioural actions rather than incorporating objective measures of daily sodium intake. This approach may reflect a preference for evaluating behavioural intentions or practical actions, which are more prone to social desirability and recall bias.[77] However, comparing behaviours with objective intake can provide valuable insights into the extent to which individuals recognise and address a dietary concern, as well as strategies employed. Additionally, studies assessing the social environment (eg, family and community support) were limited, despite its crucial role in shaping dietary habits.[78] Further research could explore how social support influences sodium reduction behaviours, particularly among men who might also be involved in the food selection and preparation in the household.

This study has some limitations that need to be addressed. First, during the abstract screening stage, we identified studies published in English, French, Portuguese and Spanish; therefore, language translation ability of reviewers might have impacted results. However, one reviewer was fluent in all languages, and a second used, whenever necessary, online translation services (Google Translate). Also, this scoping review excluded studies that focused on sub-groups of the population, such as patients; however, the intent of this study was to review population-based samples as recommended by the WHO.[56] However, this approach may limit the generalisability of findings to specific sub-populations. Finally, while the purpose of a scoping review is to map the key concepts, evidence types and gaps in research related to a defined area or topic by systematically searching, selecting and synthesising existing knowledge, formal assessment of methodological quality or risk of bias is not typically conducted. Therefore, findings should be interpreted as an overview of available evidence rather than as definitive conclusions. In summary, this scoping review reveals significant gaps in the monitoring of sodium KAB across the Americas. This region was selected since PAHO/WHO supports the implementation of population-wide sodium reduction initiatives in the regions, including the updated regional targets for sodium reduction in processed and ultra-processed foods.[79 80] While sodium KAB has been studied in other parts of the world, a comprehensive global assessment remains a high priority for future research. Data were available for only one quarter of countries, with limited representation of low and middle-income countries, as well as certain geographical and sociodemographic subgroups. There was also limited reported

instrument validation, psychometric testing and application of behavioural theories that places limitations on the rigour of existing research. Future studies should prioritise comprehensive, equity-focused monitoring, using validated, context-specific tools and behaviour change frameworks to ensure that meaningful and actionable data is produced. These actions, in addition to strengthened sodium KAB surveillance across diverse populations in the region, are essential to inform effective public health policies and accelerate progress towards WHO sodium reduction targets in the region.

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