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Interventions in Small Island Developing States to improve diet, with a focus on the consumption of local, nutritious foods: a systematic review

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ABSTRACT

Introduction Food security in Small Island Developing States (SIDS) is an international policy priority. SIDS have high rates of nutrition-related non-communicable diseases, including obesity and type 2 diabetes, micronutrient deficiencies and, in many, persistent childhood stunting. This is associated with an increasing reliance on imported processed food of poor nutritional quality. Calls have been made for strengthening local food systems, resilient to climate change, to increase the consumption of nutritious locally produced food. We aimed to systematically review interventions intended to improve diet in SIDS, and specifically explore whether these interventions applied a local food approach.

Methods The search strategy was applied to 11 databases, including in health, social science and agriculture. Screening of titles, abstracts and data extraction was undertaken in duplicate. Risk of bias was assessed using Cochrane tools. Narrative synthesis of the results was undertaken. The study protocol was registered (PROSPERO registration number: 2020CRD42020201274).

Results From 26 062 records, 154 full texts were reviewed and 24 were eligible. Included studies were from the Caribbean, Pacific, Mauritius and Singapore. Five were a randomised study design, one an interrupted time series analysis, eight controlled and ten uncontrolled pre-test and post-test. Nine studies included some aspect of a local food approach. Most interventions (n=15) included nutrition education, with evidence of effectiveness largely limited to those that also included practical skills training, such as vegetable gardening or food preparation. Three studies were considered low risk of bias, with the majority (n=13) of moderate risk.

Conclusion There is a lack of robust evidence on interventions to improve diet in SIDS. The evidence suggests that multifaceted approaches are likely to be the most effective, and local food approaches may promote effectiveness, through mechanisms of cultural and contextual relevance. Further development and evaluation of interventions is urgently required to increase the comparability of these studies, to help guide policy on improving nutrition in SIDS.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Increasing local nutritious food production is suggested for improving local diets and food security in Small Island Developing States (SIDS).

WHAT THIS STUDY ADDS

⇒ Multifaceted interventions show greatest promise.
⇒ Local food approaches may promote effectiveness through mechanisms of cultural and contextual relevance.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ We require high-quality, multifaceted SIDS-based dietary interventions, informed by local cultures and contexts.

INTRODUCTION

Small Island Developing States (SIDS) are disproportionately impacted by the triple burden of malnutrition.[1] This includes the clinical manifestations of overconsumption and underconsumption of energy and inadequate consumption of micronutrients, namely, overweight and obesity, nutritional deficiencies (such as anaemia in women), childhood stunting and increasing prevalence of non-communicable disease (NCD).[1 2] The majority of SIDS are located in the Pacific and Caribbean regions, which have some of the highest prevalence of overweight and obesity, and type 2 diabetes, in the world.[3 4] More than one in five adults are expected to die from an NCD in most SIDS before their 70th birthday.[5]

The major determinant of these challenges is attributed to rapid dietary changes in SIDS, associated with the 'nutrition transition'.[6] Over the past three decades, diets within these states and territories have shifted from the consumption of local tubers, roots, fruits and other vegetables towards diets high in

saturated fat, added sugar and sodium, particularly from ultraprocessed and processed foods.[6] These changes are attributed to globalisation, increased access to and availability of imported, non-native and often processed food, and a fall in local agricultural production for local consumption.[5] Moreover, environmental conditions, extreme weather events becoming more frequent due to climate change, and economic factors such as poor economies of scales, distance to market and limited infrastructure have led to a dependence on food importation which in turn exacerbates food insecurity for many SIDS.[5 7 8]

An increase in sustainable, local food production, particularly the production of diverse, unprocessed or minimally processed foods, that promotes intra-regional trade and links within local communities, is envisaged by the United Nations (UN), Food and Agricultural Organisation (FAO) and SIDS governments as a major component in addressing the triple malnutrition burden.[2 9–11] It is suggested that improved local food production and an emphasis on nutrition-sensitive value chains may help to offset the severity of these aforementioned shocks to the food system.[1] For SIDS and similar settings, cross-sectional data suggest that the way food is sourced may impact dietary diversity[12] and that own food production, through growing a diverse range of crops, may contribute to greater dietary diversity.[13] However, evidence from interventional research is required to identify the most effective ways of realising this approach.[14] To our knowledge, this systematic review is the first to assess the effectiveness of interventions in SIDS, aimed at improving diet, and in particular, the first to explore if and how these interventions apply a local food approach. It builds on a broader scoping review on the health and other impacts of community food production in SIDS,[14] and aims to provide evidence required to guide related practices, programmes and policies in SIDS and other low-income and middle-income countries.

METHODS

The protocol for this review was registered with the International Prospective Register of Systematic Reviews (PROSPERO registration number: 2020CRD42020201274) and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidance.[15]

Specific objectives of this review were (1) to identify published and grey literature evaluating interventions in SIDS, from any part of the food system, that aim to improve diet or nutrition knowledge; (2) to evaluate the quality of these studies; and (3) to provide narrative and, as appropriate, statistical summaries of the findings, highlighting interventions that aim to improve diet by increased consumption of locally produced foods.

Box 1 Eligibility criteria

Inclusion criteria
- ⇒ Interventions implemented and evaluated in one or more SIDS.
- ⇒ Any experimental, quasi-experimental and natural experimental evaluation design.
- ⇒ Quantitative outcomes reported—impact on any aspect of diet (eg, measures of dietary intake or dietary behaviour, sale or purchase of, or expenditure on food, nutrition knowledge or attitude, feeding practices).
- ⇒ Interventions implemented since January 2000.
- ⇒ Publications in any language.

Exclusion criteria
- ⇒ Multi-setting interventions that do not disaggregate SIDS data.
- ⇒ No intervention implemented (eg, cross-sectional research design).
- ⇒ Alcohol consumption as only measure of dietary intake.
- ⇒ Breastfeeding interventions (excluded at title and abstract screen).
- ⇒ Interventions implemented before January 2000.

(SIDS, Small Island Developing States).

Eligibility criteria

Inclusion and exclusion criteria are summarised in box 1. A 20-year timeframe was chosen to ensure that included research was relevant in informing future interventions.

Search strategy

A comprehensive search strategy, in 11 databases from health, social and agricultural sciences was developed, piloted and then conducted in July 2020 in 11 databases (see review protocol and online supplemental box 1 for details). Reference lists of included studies were checked for other potentially relevant studies as well as reference lists of identified reviews, including those that included grey literature in their searches.

The search included all studies published since 1 January 2000. No language restrictions were applied; however, we acknowledge a limitation to our search in that all search terms were written in English and most databases searched were primarily English language based. Where the report provided insufficient detail to assess eligibility, study authors were contacted for further details.

Study selection

Identified citations were uploaded into the online bibliographic database, Rayyan.[16] Title and abstracts were screened in duplicate by four pairs of reviewers. When eligibility was in doubt, the full text was reviewed. Discrepancies between pairs of reviewers were resolved by a third reviewer.

Data extraction

Eligible full texts were extracted in duplicate into an online data extraction form.[17] Data extracted included that necessary to meet our objectives and assess risk of bias (see review protocol for details). Any discrepancies in the extracted data were resolved by a third reviewer.

Risk of bias in individual studies

Each included study was evaluated for risk of bias using the Cochrane Risk of Bias Tool for randomised trials and the Cochrane ROBINS-I tool for non-randomised studies.[18–20] Risk of bias was evaluated for the primary outcome measure of interest, in most cases dietary intake, but where not reported (n=4), risk of bias was assessed on another primary outcome such as nutrition knowledge, or food sale or purchase.

Synthesis of results

Given the heterogeneity of the studies identified, descriptive or narrative synthesis was used to summarise the results. We were particularly interested to determine if interventions promoted a local food approach, and define any intervention components that could be included as such. We did not limit the search, or bias the selection and management of articles, to those that promoted a local food approach, but attempted to identify any aspect of a local food approach within the included studies.

Patient and public involvement

The need for and scope of this systematic review has been informed by previous work that involved engagement with stakeholders from across the food systems in Jamaica, St Vincent and the Grenadines, St Kitts and Nevis, and Fiji.[21 22] The findings of this review will be used in further engagement activities and the co-creation of interventions.

RESULTS

Study selection

Twenty-six thousand unique records were identified, of which 24 were included in the review (figure 1).

Study characteristics

Of the 24 eligible studies, 4 were from separate arms of two multi-country projects.[S20-S23] Figure 2 summarises studies by regional location, focus or not on a local food approach and the type of intervention. Table 1 indicates the country location of the studies, their outcome measures and their risk of bias. Online supplemental table 1 provides a detailed overview of studies that included a focus on local food production, and online supplemental table 2 provides the study characteristics for all 24 included studies.

Location and design of selected studies

Eight studies were conducted in the Pacific region; one each in American Samoa,[S5] Guam,[S6] Federated States of Micronesia (FSM),[S14] Samoa,[S23] Solomon Islands[S24] and Tonga,[S20] and two in Fiji.[S21,S22] Eight were conducted in the Caribbean; one in Barbados,[S16] one in Dominican Republic[S13], three in Puerto Rico[S7,S10,S19] and three in Trinidad and Tobago.[S8,S11,S12] Eight were based in the Atlantic, Indian Ocean, Mediterranean and South China Sea (AIMS region); two in Mauritius[S3,S4] and six in Singapore.[S1,S2,S9,S15,S17,S18]

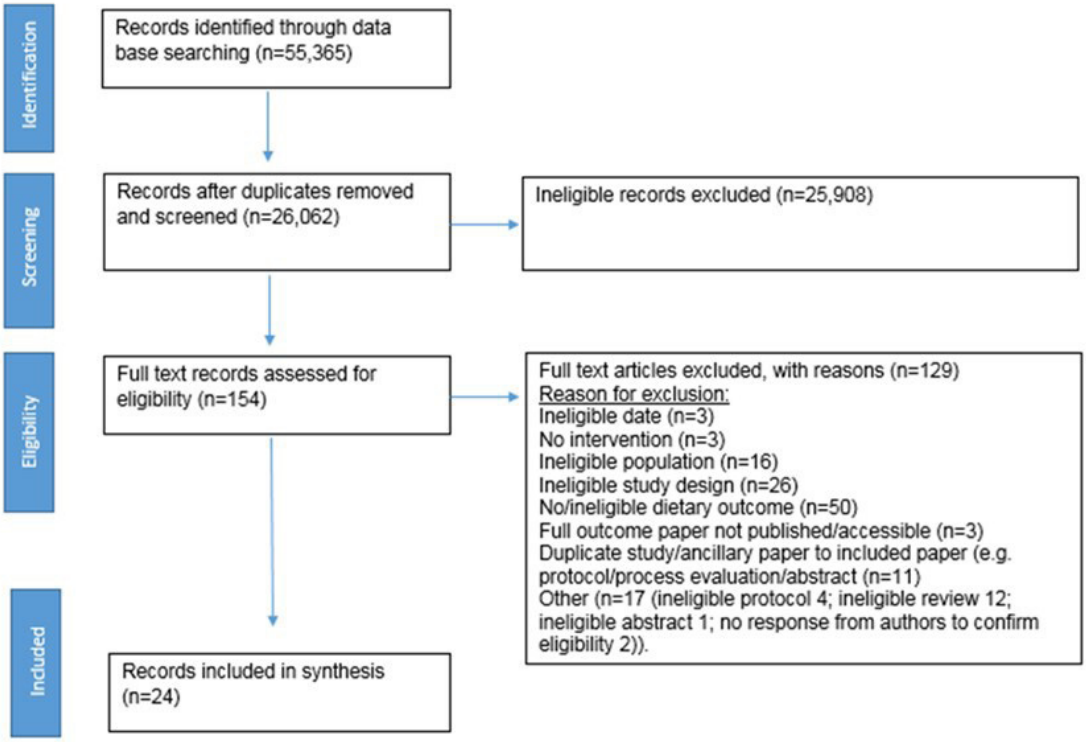

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart. Flow chart summarising the identification and selection of studies.

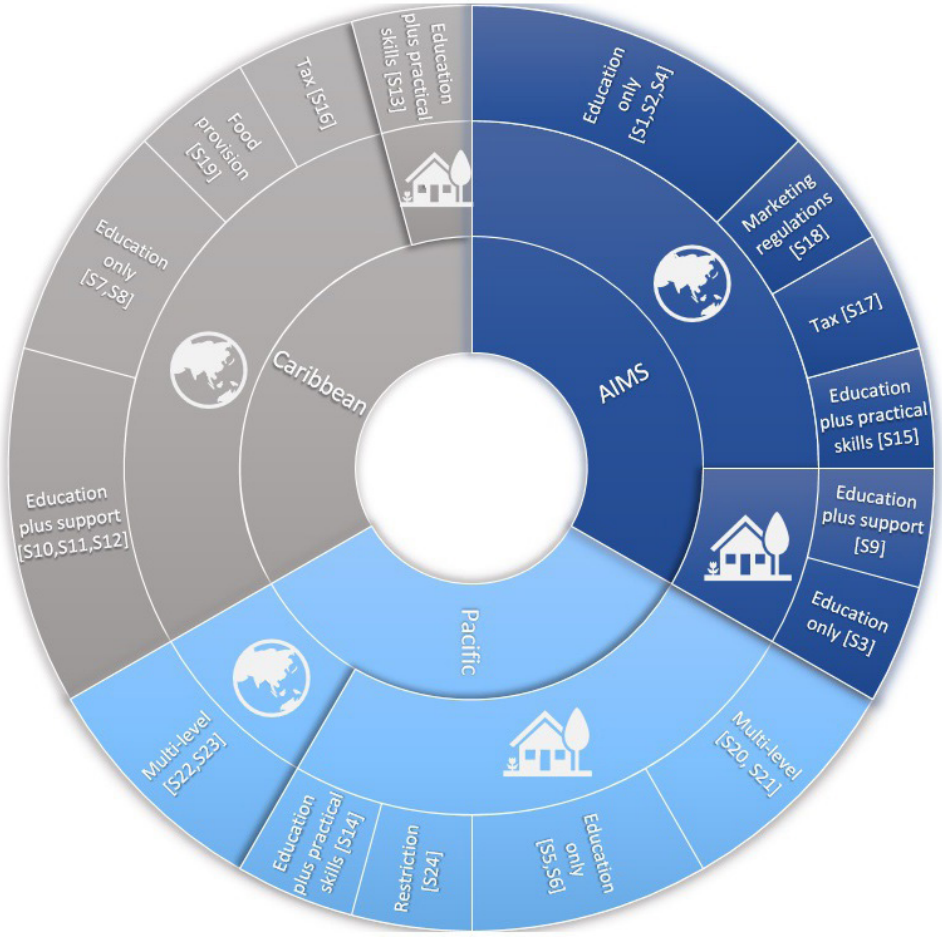

Figure 2 Diet-related interventions in Small Island Developing States summarising study location, focus on local or non-local food approach, and the type of intervention. Sunburst diagram of all 24 included studies showing local food approaches represented with the house icon and non-local approaches represented with the globe icon.

Nineteen of the studies employed a non-randomised study design; 10 uncontrolled pre/post-test, [S23,S5,S6,S14,S7,S11,S4,S2,S15,S18] 8 controlled pre/post-test [S21,S20,S24,S13,S19,S12,S3] and 1 interrupted time series study.[S16] Five were randomised study designs; three individually randomised parallel group trials,[S10,S1,S9] one individually randomised multi-arm parallel group trial[S17] and one cluster-randomised parallel group trial.[S8]

Types of interventions

A large proportion of interventions focused on nutrition education (n=15) and included education that targeted adults in the community, [S3,S4,S5,S11,S13,S14] clinic [S12,S9,S15] or workplace setting,[S2] children at school[S6,S7,S8] or young adults at university,[S10] and four targeted women only. [S4,S9,S11,S13] Three of the education interventions included a skill acquisition component, such as gardening or cooking workshops,[S13,S14,S15] and four provided additional support through individual face-to-face sessions,[S11] mindfulness lessons to promote healthy diets,[S10] food coaching from an app[S9] or counselling from a dietitian.[S12] Two interventions implemented a tax (one real-world 10% levy on sugar-sweetened beverages[S16] and one hypothetical tax on high-calorie products via an online choice experiment.[S17] An online, hypothetical choice experiment evaluated different types of front-of-pack nutrition labelling.[S1] Four interventions were multifaceted, including education, social marketing, community gardens and advocacy for change among manufacturers and retailers; two of these were implemented at population level[S22,S23] and the other two targeted secondary school children.[S20,S21] The final four interventions implemented strategies for building capacity for improved diets in a variety of ways (healthy school meals,[S19] a portion guidance plate for hospital staff,[S2] targeted advertising and marketing of unhealthy foods to children[S18] and marine protected areas to protect community fish stocks.[S24] Six of the interventions included a physical activity component.[S5,S8,S10,S21]

Local food approaches and their effectiveness

Figure 2 provides a visual summary of the frequency of 'local food' versus non-local food approaches applied across the 24 studies. A narrative overview of the effectiveness of all 24 studies is available in online supplemental box 2.

Table 1 Overview of country location, study design, outcome measures and risk of bias for included studies

Ref	Region/country	Study design	Local*	Measured outcome	Evidence for effectiveness†	Risk of bias
	Nutrition education					
S1	Singapore	Individually randomised parallel group trial	No	**Purchase**—foods high in sugar	+/–	
S2	Singapore	Non-randomised controlled pre/post-test study	No	**Dietary intake**— carbohydrate, protein, vegetable	+	
S3	Mauritius	Non-randomised controlled pre/post-test study	Yes	**Dietary intake**— calcium	+	
S4	Mauritius	Non-randomised uncontrolled pre/post-test study	No	**Dietary intake**—fruit and vegetable	+	
				Nutrition knowledge score	+	
S5	American Samoa	Non-randomised uncontrolled pre/post-test study	Yes	**Nutrition knowledge** score	+	
S6	Guam	Non-randomised uncontrolled pre/post-test study	Yes	**Dietary intake**—fruit and vegetable	–	
				Willingness to try fruit and vegetables	–	
S7	Puerto Rico	Non-randomised uncontrolled pre/post-test study	No	**Dietary intake**—daily energy and fibre, fruit and vegetable	–	
S8	Trinidad and Tobago	Cluster-randomised parallel group trial	No	**Dietary intake**—fruit, vegetable, soda, fried food, high fat, salt or sugar food (HFSS).	+/–	
				Nutrition knowledge score	+	
				Attitudes to eating	–	
	Nutrition education plus additional support					
S9	Singapore	Individually randomised parallel group trial	Yes	**Dietary intake**— energy, carbohydrate, protein, total fat, cholesterol, calcium, dietary fibre, sodium	–	
S10	Puerto Rico	Individually randomised parallel group trial	No	**Dietary intake**— bread, SSB (self-reported)	–	
S11	Trinidad and Tobago	Non-randomised uncontrolled pre/post-test study	No	**Dietary intake**—daily and 7-day fruit and vegetables	+	
S12	Trinidad and Tobago	Non-randomised controlled pre/post-test study	No	**Nutrition knowledge** attitude practice score (mean)	+	
	Nutrition education plus practical skills					

Continued

Table 1 Continued

Ref	Region/country	Study design	Local*	Measured outcome	Evidence for effectiveness†	Risk of bias
S13	Dominican republic	Non-randomised controlled pre/post-test study	Yes	**Dietary intake**—vitamin A-rich foods	+/–	
S14	Federated States of Micronesia	Non-randomised uncontrolled pre/post-test study	Yes	**Dietary intake**—frequency of consumption of various food groups	+/–	
S15	Singapore	Non-randomised uncontrolled pre/post-test study	No	**Dietary intake**—whole grains (self-reported)		
				Nutrition knowledge—wholegrain specific	+	
	Actual or hypothetical tax					
S16	Barbados	Interrupted time series study	No	**Sales**—Sugar-sweetened beverages (SSBs).	+	
S17	Singapore	Individually randomised multiarm parallel group trial	No	**Purchase** of taxed products	+	
	Advertising/marketing regulations					
S18	Singapore	Non-randomised uncontrolled pre/post-test study	No	**Dietary intake**—HFSS, fruits and vegetables and nutrient dense foods	+/–	
				Purchase—snacks (sweets and potato chips, burgers), fruit, vegetables	+/–	
	Food provision					
S19	Puerto Rico	Non-randomised controlled before-after study	No	**Dietary intake**—various macronutrient and micronutrients	–	
	Multi-level intervention					
S20	Tonga	Non-randomised controlled before-after study	Yes	**Dietary intake**—breakfast, fruit, vegetables, SSBs, fruit drink, and various snacks	–	
				Purchase—snack food from shop or takeaway after school	+	
S21	Fiji	Non-randomised controlled pre/post-test study	Yes	**Dietary intake**—fruit, vegetable, soft drink, fruit drink/cordial	–	
S22	Fiji	Non-randomised uncontrolled pre/post-test study	No	**Dietary intake**—mean population salt intake	–	
S23	Samoa	Non-randomised uncontrolled pre/post-test study	No	**Dietary intake** salt	–	
				Nutrition knowledge, attitude and behaviour—salt related	+/–	
	Restriction					

Continued

Table 1 Continued

Ref	Region/country	Study design	Local*	Measured outcome	Evidence for effectiveness†	Risk of bias
S24	Solomon Islands	Non-randomised controlled before-after study	Yes	**Dietary intake**—energy, protein, fat	+	

Region: Pacific, Caribbean, AIMS.
ROB: low risk, moderate risk, high risk, severe/critical risk.
*Local defined as included process or outcome related components as defined in table 2.
†+ mostly significantly effective on outcomes measured; ± some significant positive effects plus some no change/insignificant effect; – no significant positive effects or negative effect.
AIMS, Atlantic, Indian Ocean, Mediterranean and South China Sea; ROB, risk of bias.

Local food approach to outcome-related components

Nine[S21,S20,S5,S6,S14,S24,S13,S3,S9] of the 24 studies included some form of local approach (table 2). Eight of these nine studies included the promotion of locally produced food or traditional dietary behaviours such as traditional cooking techniques or foods of cultural significance.[S3,S5,S6,S13,S14,S20,S24] Further details on these studies are documented in online supplemental table 1. The other study did not promote local food specifically but examined the nutritional composition of local food in their measure of nutrient intake.[S9] Five of these nine interventions included a practical food production component, such as teaching skills for own food production.[S6,S13,S14,S21,S20]

Of the eight studies that specifically promoted locally produced food, four showed significant improvements in dietary intake and one study that did not measure dietary intake showed significant improvement in nutrition knowledge. Of those that improved dietary intake, two were garden-based nutrition education interventions, supplemented with practical skills components (one in Dominican Republic and one in FSM), an education-only intervention targeting adults in Mauritius, and a study that implemented marine protected areas in the Solomon Islands to improve food security for local communities.[S24] The intervention that improved nutrition knowledge involved culturally appropriate strategies to educate adults in American Samoa.[S5]

Three studies included a practical local food production component but were not shown to improve diet. These included a summer camp-based intervention in Guam[S6] and two separate arms of the regional Pacific Obesity Prevention in Communities Project in Fiji[S21] and Tonga.[S22]

Local food approach to process-related components

All but one[S9] of the nine studies applied a local approach to process-related components. This included involving local communities,[S24] non-government organisations[S14,S13] or national government[S23] in the prioritisation or development phase of the intervention, employing strategies to enhance the cultural appropriateness of the intervention (such as piloting evaluation tools with members of the community,[S21,S13] translating intervention resources or evaluation tools into the most commonly used language)[S20,S5,S14,S3] or recruiting local facilitators, such as local non-government organisations to deliver culturally appropriate education or implement the intervention.[S5,S14]

Non-local food approaches and their effectiveness (n=15)

The findings from the non-local studies showed mixed effectiveness on dietary intake. Only two showed consistent evidence for improving dietary intake, both using lessons and educational materials to teach adults about nutrition.[S4,S15] Four studies demonstrated mixed effectiveness across measures of intake and six were ineffective.[S7,S9,S10,S11,S22,S23] The three studies that measured impact of tax or labelling interventions on purchasing or

Table 2 Overview of aspects of 'local' approach within included studies (n=9)

Study reference number			S5	S6	S24	S3	S13	S20	S14	S21	S9
Aspects of local	Process related		Afele Fa Amuli 2009	Aflague 2019	Aswani 2007	Bhurosy 2013	Binford 2012	Fotu 2011	Hanson 2011	Kremer 2011	Li 2019
		Priority setting and intervention development: Drawing on local expertise and involvement in co-developing intervention objectives and tools (eg, local organisations).			■		■	■	■		
		Recruitment: Drawing on local expertise and involvement in recruiting participants/ communities (eg, community headmen/ leaders).	■					■	■		
		Implementation: By local organisations (eg, Non-government organisations (NGOs)) or individuals rather than a research team from outside the SIDS.	■	■		■		■	■		
		Evaluation: Drawing on local expertise and involvement in data collection and/or analysis.	■				■	■	■	■	
	Outcome related	**Promote locally produced food**	■	■	■	■	■	■	■	■	
		Promote traditional/ cultural dietary behaviours: Such as traditional cooking techniques or culturally valued foods.	■	■					■		
		Consider food composition relevant to local food: Through nutrient analyses.									■

SIDS, Small Island Developing States .

sales of unhealthy products were effective.[S1,S16,S17] For details of all study findings, see online supplemental box 2.

Risk of bias

Table 1 presents the overall risk of bias for the individual studies and online supplemental figure 1 presents the risk of bias for each domain of the tools used.[18 19] Overall, 13% (n=3) of studies had low risk, 50% (n=12) moderate or some concern, 33% (n=8) high or serious risk and 4% (n=1) had critical risk, that is, unable to provide any useful evidence on the effects of intervention.[18 19] All eight studies that specifically promoted the consumption of locally produced food were either moderate or high risk of bias.[S3,S24, S13,S14,S20,S6,S21] All were non-randomised studies and the main sources of risk were for confounding and missing data in study reports.

DISCUSSION

This systematic review identified 24 studies of interventions in SIDS that aimed to improve diet. Variation in study objectives, measured outcomes and quality makes it difficult to draw generalisable conclusions on the effectiveness of these interventions, or to conclude whether incorporating a local food approach into interventions made them more or less effective than their non-local equivalents. However, as there is a particular interest in SIDS in strengthening local, sustainable food systems to address drivers of malnutrition,[1 2] a comparison of those which focused on a local food approach, versus those that did not, provides interesting learnings which have potential implications for future work.

In placing the findings of this review in the wider context of what is required for change, it is important to consider how SIDS food systems function and where interventions could promote a shift in how people source their food, the type of food they source and consume, and their diet-related health. One example of research in SIDS that has taken a food systems perspective used group model building methodology with local stakeholders to represent food systems as causal loop diagrams in Jamaica, St Vincent and the Grenadines, and St Kitts and Nevis.[22] These illustrate potential coordinated intervention points to improve diet in these settings; examples include trade agreements and policies that favour imports, impacts on (and opportunity for government to improve) capacity for local agricultural production through knowledge, skills and resilience to shocks, improved access to land for food production and strengthened local supply chains, the relative availability, price and advertising of unhealthy food, cultural norms and social acceptability. This work indicates what is required to enhance local food production for local consumption in SIDS and emphasises that change is required across the food system, beyond a shift in individuals' knowledge and attitude.

This breadth of potential levels of intervention was not reflected in the research identified by this review. The most implemented type of intervention across the included studies was education (63% (n=15)). Although effectiveness of these interventions varied, those that supplemented education with practical skills training (such as vegetable gardening or cooking demonstrations) showed greatest promise with improvement in dietary intake across all three studies, two taking a local food approach. This is consistent with the findings of educational interventions conducted in other settings, whereby those with additional components such as cooking classes or gardening are more likely to be effective.[23] However, most of the reviewed studies provide little information as to why their interventions may have worked or not and for whom. The authors of one local education intervention in FSM present findings from an accompanying qualitative study.[S14] They highlight the perceived desirability of imported alternatives over local food (in the Pacific) and emphasise the importance of challenging these perceptions. This requires understanding of the wider sociocultural context, including the food traditions and values attached to different food sources and food types.[24–27] Local food interventions may be easier to implement in some SIDS populations where traditional foods and methods are highly valued in the context of health than in others where a strong preference for modern, westernised dietary patterns is well established.[28]

The effective and culturally 'strong', nutrition education and practical skills interventions in this review[S13,S14] support the notion that cultural relevance, combined with improvements in nutrition knowledge, has the potential to act as a mechanism to dietary change in these settings.[24] Frameworks that help to identify various ways that cultural relevance can be encompassed within intervention designs may be integral to their effectiveness in these settings.[29] Local food interventions may need to go beyond the nutrition-education, or skills-based components, and invite communities to explore sociocultural meanings of food and co-develop strategies accordingly.

How can local approaches contribute to effectiveness?

The findings from this review suggest that local approaches may add a level of contextual relevance to support local food production and the consumption of that food in SIDS that is missing from non-local interventions. This is particularly evident within education and skills interventions that are relatively low-cost and feasible in these resource-limited settings, and already being implemented by local non-government organisations. Such approaches have the potential to reshape perceptions, at individual level, around food preferences which are largely driven by strong sociocultural factors, and therefore should be encouraged as part of future interventions to increase demand for local, healthy foods. However, higher level government intervention is also required, and research into how local governance structures can be strengthened to prioritise local produce over corporate and import markets has been identified as important in SIDS settings.[30] One example of these

higher level infrastructural changes is realised in 'farm to fork' programmes that enable nutrition-sensitive value chains to improve local production capacity, and increase availability of healthy, local foods; an approach which may be appropriate in SIDS settings.[1]

For SIDS and similar settings, cross-sectional data suggest that the way food is sourced may impact the diversity of diets[12] and that own production of a range of crops may contribute to greater dietary diversity.[13] In the context of disproportionate impacts of climate change and the COVID-19 pandemic on SIDS, there is an urgent need for high-quality interventional research to explore novel ways to implement and evaluate local approaches to ensure food security and sovereignty for the future.[1] The heterogeneity across studies included in this review preclude quantitative data synthesis and limit a comparison of effectiveness across interventions. This highlights that, in order to do so, we require a standard universal tool for evaluating food production diversity and that allows us to analyse the association between food sourcing, what people are producing themselves, and dietary diversity in order to better understand the impacts of improving local food production on diet and health.

Reflections on defining local food

Our aim to identify and classify interventions that took a local food approach was challenging to realise, both in terms of clearly defining what we meant by 'local food' (table 2) and interpreting, from the published reports, how study authors defined the term. In the studies included, local food was usually implicitly defined by concepts of tradition and cultural value[S6,S14] and/or whether it was locally (geographically) grown or produced.[S3,S5,S6,S14,S24] However, we acknowledge the multitude of ways that 'local food' could be defined, such as the felt 'sense' of locality that varies between individuals,[31] or other ways in which food is sourced including community-level sharing, borrowing, exchanging or in a way that is perceived as 'more local' such as a small 'local' shop or food market that may not necessarily provide food that is produced nearby. As it remains unclear what 'local food' means in a given context,[32] a standard definition or typology is required to produce comparable evidence on the impacts of local food production and consumption versus other approaches. One example of such is that produced for this review, which is presented in table 2.

Understanding the nutritional implications of consuming local over imported food is important, especially for SIDS that are disproportionately impacted by the globalised food system, its drivers and consequences.[2 33] One study emphasised how traditional and cultural food practices create opportunities for healthy dietary behaviours (such as fruit and vegetable consumption) for many indigenous cultures,[S6] but it is important to acknowledge that 'local' may not necessarily mean 'healthy', and in this context it is important that definitions of local food, explicitly refer to minimally processed, seasonal and nutritious food.[14]

We considered whether including local versus non-local stakeholders to intervention components impacted effectiveness. However, while acknowledging potential value engaging local stakeholders, there were too few studies describing intervention development to draw generalisable conclusions. In addition, it is possible that the long-term effectiveness of these programmes is enhanced by such engagement. Thus, the true value of 'local approach' interventions may not be fully portrayed by the relatively short follow-up in most of the studies we found.

Limitations

Our review is subject to a general limitation of nutrition-related research, that is, by the accuracy and reliability of the dietary assessment methods, particularly issues obtaining valid dietary recall data using subjective, retrospective methods.[34 35] As noted in the previous section, a lack of a standard typology for local food is a further limitation. It is imperative to understand *how* these interventions are effective, and the inclusion criteria for this review were not designed to find accompanying qualitative studies.

CONCLUSION

It is crucial that we understand the effectiveness of interventions that aim to improve diet in SIDS to inform future strategies to reduce the very high burdens of poor nutrition. This review provides a summary of the evidence on the impact of interventions on aspects of diet and indicates that there appears to be potential for promoting effectiveness by applying a local food approach, through mechanisms of cultural and contextual relevance. However, standard tools, indices and definitions, are required to increase the comparability of these studies.

Additional references can be found in online supplemental file 2.

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literature search. EH, EA, NU, CG, KM, LJ, conducted the screening and full-text data abstraction and drafted the manuscript, led by EH, and all authors contributed to the writing of the final version of the manuscript. Guarantor for this study: EH.

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Supplementary Information File

Contents

Supplementary Table 1: Overview of studies that included a focus on local food production.

Study	Title	Aim	Study design	Type of intervention	Outcomes/Tools	Effectiveness on measured outcomes	Lessons/takeaways
Afele-Fa'amuli 2009 (S5)	Effectiveness of a Pilot Community Physical Activity and Nutrition Intervention in American Samoa	To assess the effectiveness of a pilot community physical activity and nutrition intervention in American Samoa	Non-randomised controlled before -after	**Nutrition education** – culturally appropriate strategies	**Nutrition knowledge score/ Nutrition survey**	**Nutrition knowledge** –increase in knowledge. Almost twice as many participants were able to identify correctly ≤50% of the high-fat foods. 68.2%. More participants were able to identify high fibre foods between base line and follow up.	Emphasises how important it is to develop culturally-appropriate/sensitive programs for effectiveness and ownership.
Aflague 2019 (S6)	Examining the Influence of Cultural Immersion on Willingness to Try Fruits and Vegetables among Children in Guam: The Traditions Pilot Study	To assess the effectiveness of 'cultural immersion' on willingness to try fruits and vegetables among children in Guam.	Non-randomised uncontrolled before -after	**Culturally adapted nutrition lessons** – planting/gardening local produce using traditional and modern practices.	**Dietary intake** (fruit and vegetables) and **willingness to try** fruit and vegetables/ **Adapted WillTry Tool**	**Dietary intake and willingness to try** - No significant change in willingness to try, or difference in post-FV intakes between the camps after adjusting for potential confounders in regression model.	Using existing community programmes to implement new interventions is a feasible approach to research in resource-limited environments. Future research involving cultural immersion should include methods and instruments that can help to capture the cultural context and impact of cultural exposure.
Aswani 2007 (S24)	Do Marine Protected Areas Affect Human Nutrition and Health? A Comparison between Villages in Roviana, Solomon Islands	To assess whether MPAs influenced local perceptions of governance, environmental change, livelihood strategies, and actual human nutrition and health.	Non-randomised controlled before-after study	Marine protected areas	**Dietary intake** - energy, protein, fat/ **24 hour recalls** and **food consumption survey.**	**Dietary intake** - members of villages with effective MPAs had higher energy and protein intakes (particularly marine-derived protein) than those that did not have MPAs or had ineffective ones. Poorest dietary protein/fat ratio was found in the village with the worst MPA governance (attributed to high dependency on cash that subsistence economy for livelihood security and to availability of cash rather than effective marine governance and management.	
Bhurosy 2013 (S3)	Effectiveness of a Theory-Driven Nutritional Education Program in Improving Calcium Intake among Older Mauritian Adults	To improve consumption of calcium-rich foods among older adults through a nutrition education program and gain a better understanding of	Non-randomised controlled before-after study	Education materials and sessions for increasing calcium intake	**Dietary intake** (calcium)/ **Food frequency questionnaire** - 35 item coded self-administered questionnaire.	**Dietary intake** - statistically significant higher mean calcium frequency scores post-intervention ($p < 0.001$).	Suggest that using a theory based (health belief model) nutrition education program and focusing on consumption of calcium rich foods (food-based approach) over calcium supplementation contributed to the success of the program and

		how sociodemographic factors predict calcium intake in this target group.					demonstrates feasibility of the approach among older Mauritian population.
Binford 2012 (S13)	A Garden-Based Nutrition Intervention In The Rural Dominican Republic - Impact On Vitamin A Rich Food Consumption And Household Food Security	To characterize the effect of a garden-based nutrition intervention on vitamin A food frequency and food security measures	Non-randomised controlled before -after	Garden based nutrition education, patio vegetable gardens, and laying hens	**Dietary intake** - vitamin A rich foods/ **Food frequency questionnaire**	**Dietary intake** - children in intervention communities averaged 48.3 servings of vitamin A rich foods/week compared to 44.0 servings/week in control communities. The increase in the all communities' vitamin A food frequency scores was attributed primarily to the large increase in mango and milk consumption. The consumption of garden-specific vitamin A rich foods (green leafy vegetables, carrots, beats) was greater in intervention than communities.	Implicitly emphasises the importance of pilot testing questions regarding food sources, food security and food consumption (e.g. serving size etc.) to ensure that data collected is accurate and in a suitable format for data analysis and interpretation of findings.
Fotu 2011 (S20)	Outcome results for the Ma'alahi Youth Project, a Tongan community-based obesity prevention programme for adolescents	To assess the effectiveness of Ma'alahi Youth Project; a community based intervention for the prevention of obesity in adolescents in Tonga	Non-randomised controlled before -after	Multifaceted intervention - community capacity building, social marketing, education and activities promoting physical activity and local fruit and vegetables	**Dietary intake** – frequency of breakfast, lunch from home. Servings/day fruit, vegetables, SSBs, fruit drink, and various snacks. **Purchase** - snack food from shop or takeaway after school/ **Questionnaires** – knowledge, behaviour and attitudes.	**Dietary intake** - no consistent evidence for improved dietary intake in the intervention group. Some evidence that aspects of diet worsened compared to the control group; SSB intake (OR (adj) 1.69 (p=0.005)), snacking after school (2.21 (0.001)), eating takeaway or fried foods after school (2.76(0.001)), breakfast consumption (0.63 (0.02)). However, reported purchasing of snack food from shop or take away reduced (OR 0.55 (p 0.001)).	Important to account for strong impact of socio-cultural factors on behaviours, particularly for populations where socio-cultural factors are strong determinants of eating, physical activity and body size perceptions.
Hanson 2011 (S14)	An Evaluation of a Nutrition Intervention in Kapinga Village on Pohnpei, Federated States of Micronesia	To encourage return to a more traditional diet to prevent disease, through growing local food, cooking classes, container gardening, and charcoal oven workshops.	Non-randomised uncontrolled before -after	Community-based promotion of container growing, charcoal oven cooking through workshops and classes	**Dietary intake** - frequency of consumption of staples (local starch food, rice, flour products), fruit and vegetables (local vegetables, local fruits, imported fruits, imported vegetables), protein (local fish and seafood, local meat, imported meat, eggs, imported fish and seafood), high fat foods (turkey tail, fried	**Dietary intake** – significant increase in local fruits consumption (1.2 to 2.9 ($p<0.001$) mean days/week), local vegetables consumption (2.8 to 4.6 ($p<0.001$), and imported vegetables (0.7 to 2.0 ($p<0.001$). Local fish and seafood consumption increased from 2.5 to 4.4 ($p<0.001$) mean days/week with no significant change in imported sources. There was a significant increase in local and imported meat sources (p 0.004; 0.03) and increase in both local and imported sources of starch/flour products, however the local source was not a significant increase (p 0.17; 0.06). There was also a significant increase in	Focus on more familiar and less sensitive traditional crops already planted in the village. Emphasise the importance of education and supervision as component of this type of intervention.

					foods), beverages and snacks (imported drinks with sugar, imported sugar foods, imported salty foods, local snack foods)/ **Food frequency questionnaire -** based on the Helen Keller International 7-day FFQ but modified for use in the FSM and further for Pohnpei.	imported sugary drinks and foods (p 0.011; 0.04).	
Kremer (S21)	Reducing unhealthy weight gain in Fijian adolescents: results of the Healthy Youth Healthy Communities study	To address the issue of adolescent obesity in Fiji.	Non-randomised controlled before-after study	Range of individual to school policy level interventions. Nutrition education focused on reducing energy dense and sugary food/drink, healthy food provision in schools. Included PA component.	**Dietary intake** - Fruit, vegetable, soft drink, fruit drink/cordial. **Questionnaire** -self-administered electronically.	**Dietary intake** - proportion consuming no vegetables/day increased in the intervention group (from 44% to 48%) compared to control group.	The sociocultural studies within the Pacific OPIC project reported that physical, economic and sociocultural forces are especially important determinants of adolescent dietary and activity habits and consequently point to a need for more comprehensive strategies to influence cultural values and expectations.

Supplementary Table 2: Study characteristics for all included studies.

Study ref	Study design	Local food promoted	Other local component	Study authors	Region/Country	Population/ subgroup studied	Sample size (loss to follow up)	Intervention	Control	Measured outcomes*	Tools	Effectiveness on outcomes of interest (to this review)
	Nutrition education											
S1	Individually randomised parallel group trial	No	No	Ang 2019	AIMS/ Singapore	Adults	512 (0%)	Front of package labelling/warning	Less information/detailed labelling.	**Purchase** - foods high in sugar.	**Online hypothetical grocery store**	**Purchase** - a text-only warning label generated a statistically significant reduction in labelled products purchased. None of the secondary outcomes (total sugar purchased (g), sugar purchased per dollar spent (g per $), total spending ($) and total expenditure on high-in-sugar products ($)) were statistically different across groups.)
S2	Non-randomised controlled pre/post-test study	No	No	deKorn 2017	AIMS/ Singapore	Hospital staff	IG:266 CG:299 (not repeat measures)	Plate with portion guidance.	Normal plate.	**Dietary intake** – carbohydrate, protein, vegetable.	**Plate** with recommended proportions displayed.	**Dietary intake** –after 6 months of the design plate, guideline adherence had significantly increased for vegetables and carbohydrates.
S3	Non-randomised controlled before-after study	Yes	Yes	Bhurosy 2013	AIMS/ Mauritius	Adults over 40 years	IG:98 (0%) CG:91 (0%)	Education materials and sessions for increasing calcium intake.	Education materials only.	**Dietary intake** - calcium	**Food frequency questionnaire** - 35 item coded self-administered questionnaire	**Dietary intake** - statistically significant higher mean calcium frequency scores post-intervention ($p < 0.001$).
S4	Non-randomised uncontrolled pre/post-test study	No	No	Cannoosamy 2016	AIMS/ Mauritius	Housewives	200 (0%)	Nutrition education – lectures and educational materials.	Pre-intervention	**Dietary intake** - fruit and vegetable. **Nutrition knowledge** score.	**FFQ –** specifically fruit and vegetables.	**Dietary intake** – significant increase in number of servings of fruit and vegetable (mean change +0.26 ($p < 0.001$). **Nutrition knowledge** - significant increase in the nutrition knowledge score (mean change +17.1, ($p < 0.001$)
S5	Non-randomised uncontrolled pre/post-test study	Yes	Yes	Afele Fa Amuli 2009	Pacific/ American Samoa	Adults	95 (0%)	Nutrition education – culturally appropriate strategies (also PA component)	Pre-intervention	**Nutrition knowledge** score	**Nutrition survey**	**Nutrition knowledge** –increase in knowledge. Almost twice as many participants were able to identify correctly ≤50% of the high-fat foods. 68.2%. More participants were able to identify high fibre foods between base line and follow up.

S6	Non-randomised uncontrolled pre/post-test study	Yes	Yes	Aflague 2019	Pacific/ Guam	3-12 year old summer camp children	105 (6%)	Culturally adapted nutrition lessons	Pre-intervention	**Dietary intake** - fruit and vegetable. **Willingness to try** fruit and vegetables.	**Adapted WillTry Tool**	**Dietary intake and willingness to try** - No significant change in willingness to try, or difference in post-FV intakes between the camps after adjusting for potential confounders in regression model.
S7	Non-randomised uncontrolled pre/post test study	No	No	Pinto 2014	Caribbean/ Puerto Rico	School children (8th grade)	32 (16%)	Nutrition education (also PA component).	Pre-intervention	**Dietary intake** – daily energy and fibre, fruit and vegetable.	**24 hour dietary recall –** three times.	**Dietary intake** - no significant changes between baseline and post intervention kcal intake, fruit, vegetable or fibre consumption.
S8	Cluster-randomised parallel-group trial	No	No	Francis 2010	Caribbean/ Trinidad and Tobago	Primary school children (10-11 years)	IG:281 (12%) CG:299 (25%) TG:579 (18%)	Nutrition lessons on the six food groups, sources of nutrients and types of food (also PA component).	No intervention.	**Dietary intake** – servings/day and in last 24 hours of; fruit, vegetable, soda, fried food, HFSS. **Nutrition knowledge** score. **Attitudes** to eating.	**Modified block FFQ** with resources including display pictures and actual serving sizes of cook and raw vegetables, beverages, juices and fruits. **'Basic nutrition test'** (developed for study). **Children's Eating Attitude Test-26 (ChEAT26).**	**Dietary intake** - intervention was not significantly associated with fruit and vegetable intakes. In multivariate regression equations controlling for age, gender, BMI and baseline value, intervention was significantly associated with lower intake levels of fried foods, sodas, HFSS foods. **Nutrition knowledge** – in multivariate regression equations controlling for age, gender, BMI and baseline value, intervention was significantly associated with higher knowledge scores. **Attitude** - intervention was not significantly associated with ChEAT26 score.
	Nutrition education plus additional support											
S9	Individually-randomised parallel-group trial	No	Yes	Li 2019	AIMS/ Singapore	Overweight/ obese pregnant women - clinic	IG:15 (20%) CG:15 (7%) TG:30 (13%)	Food coaching app that provides support and guidance on healthy choices.	Standard educational materials on basic nutrition principles and recommended gestational weight gain.	**Dietary intake** - energy, carbohydrate, protein, total fat, cholesterol, calcium, dietary fiber, sodium	**24-hour dietary recall** – 3 x covering 2 weekdays, one weekend day. **Self-administered 3-day food diary.**	**Dietary intake** - no significant differences in changes between control and intervention groups.

S10	Individually-randomised parallel-group trial	No	No	Halperin 2018	Caribbean/ Puerto Rico	University/college students (18-19 years)	IG:20 (10%) CG:21 (0%) TG:41 (5%)	Support sessions focusing on stress reduction and mindfulness approach to diet and PA changes.	Standard care – provision of basic educational materials on diet and PA.	**Dietary intake** – bread, SSB (self-reported).	**Food frequency questionnaire** (multicultural).	**Dietary intake** - insignificant reduction in consumption of soda or bread between the control and intervention group.
S11	Non-randomised uncontrolled pre/post test study	No	No	White 2006	Caribbean/ Trinidad and Tobago	Women (40-60 years)	Pre:42 Post:44 (not repeat measures)	Health-focused support meetings to promote fruit and veg consumption (also promoted PA and cervical screening).	Pre-intervention	**Dietary intake** - daily and 7 day fruit and vegetables.	**Food frequency questionnaire** - based on previous 7 days.	**Dietary intake** – reduction in proportion consuming >5 and >4 servings/day (pretest: 26.19% consuming >5 serving/day; 45.24% >4 servings per day. At 6 months, 6.98% > 5 /d; 18.61% > 4/d)
S12	Non-randomised controlled before-after study	No	No	Webb 2016	Caribbean/ Trinidad and Tobago	Individuals with Type 2 Diabetes – clinic	IG:86 (0%) CG:36 (0%) TG:122 (0%)	Nutrition counselling from Registered Dietitian.	No counselling.	**Nutrition knowledge** score (mean). **Attitude** score (mean) **Practice** score (mean)	**27-item KAP structured questionnaire** – for nutrition knowledge.	**Practice** - patients receiving nutrition counselling were more likely than those not receiving counselling to not drink soft drinks ($p < 0.001$), consume fast foods ($p < 0.001$) and drink alcohol ($p = 0.003$) but were equally likely to drink at least eight glasses of water daily.
	Nutrition education plus practical skills											
S13	Non-randomised controlled before-after study	Yes	Yes	Binford 2012	Caribbean/ Dominican republic	Pregnant women and children	43 (42%)	Nutrition education, patio vegetable gardens, and laying hens – building self-efficacy by providing vit A rich foods.	No intervention.	**Dietary intake** - vitamin A rich foods	**Food frequency questionnaire.**	**Dietary intake** - children in intervention communities averaged 48.3 servings of vitamin A rich foods/week compared to 44.0 servings/week in control communities. The increase in the all communities' vitamin A food frequency scores was attributed primarily to the large increase in mango and milk consumption. The consumption of garden-specific vitamin A rich foods (green leafy vegetables, carrots, beats) was greater in intervention than communities.
S14	Non-randomised uncontrolled	Yes	Yes	Hanson 2011	Pacific/ Federated States of Micronesia	Adults	75 (10%)	Workshops on container gardening, charcoal oven	Pre-intervention.	**Dietary intake** - frequency of consumption of staples (local	**Food frequency questionnaire -** based on the Helen Keller	**Dietary intake** – significant increase in local fruits consumption (1.2 to 2.9 ($p<0.001$) mean days/week),

	pre/post test study							use and recipe demonstrations.		starch food, rice, flour products), fruit and vegetables (local vegetables, local fruits, imported fruits, imported vegetables), protein (local fish and seafood, local meat, imported meat, eggs, imported fish and seafood), high fat foods (turkey tail, fried foods), beverages and snacks (imported drinks with sugar, imported sugar foods, imported salty foods, local snack foods)	International 7-day FFQ but modified for use in the FSM and further for Pohnpei.	local vegetables consumption (2.8 to 4.6 (p<0.001), and imported vegetables (0.7 to 2.0 (p<0.001). Local fish and seafood consumption increased from 2.5 to 4.4 (p<0.001) mean days/week with no significant change in imported sources. There was a significant increase in local and imported meat sources (p 0.004; 0.03) and increase in both local and imported sources of starch/flour products, however the local source was not a significant increase (p 0.17; 0.06). There was also a significant increase in imported sugary drinks and foods (p 0.011; 0.04).
S15	Non-randomised uncontrolled pre/post test study	No	No	Goh 2017	AIMS/ Singapore	Patients and carers - clinic	Unclear.	Nutrition education including cooking demonstrations and food samples to try at home.	Pre-intervention.	**Dietary intake** - whole grains (self-reported). **Nutrition knowledge** – wholegrain specific	**Questionnaire** – administered via telephone interview	**Dietary intake** - self reported increase in the frequency of consumption and purchasing of whole grains (84% of participants reported positive changes in their dietary habits.). **Nutrition knowledge** – statistically significant increase in knowledge score.
	Actual or hypothetical tax											
S16	Interrupted time series study	No	No	Alvarado 2019	Caribbean/ Barbados	Whole population (Barbados)		10% taxes on sugar sweetened beverages (SSBs)	No tax	**Sales** - SSBs (weekly volume in millitres sold per capita for SSBs and non-SSBs, carbonated- SSBs, other SSBs, water and other non-SSBs).	**Electronic point-of-sale data**	**Sales** - 10% tax was associated with a 4.3% (95%CI 3.6 to 4.9%) decrease in grocery store sales of SSBs and 5.2% (95%CI 4.5 to 5.9%) increase in sales of non-SSBs.

S17	Individually-randomised multi-arm parallel-group trial	No	No	Doble 2020	AIMS/ Singapore	Adults	IG1:271 (20%) IG2: 298 (14%) IG3: 282 (20%) CG: 293 (17%) TG:1144 (18%)	Hypothetical tax on high calorie products (online)	No hypothetical tax (online).	**Purchase** – proportion of taxed products, kcal per serving, kcal/$, total spend, taxed produced in $	**Online hypothetical grocery store** - NUSMart.	**Purchase** - statistically significant 3.35 percentage point decrease in purchases (95 % CI -6.01 to -0.5) in the explicit tax arm compared to control. Insignificant changes in implicit tax arm compared to control (0.08, 95 % CI -3.31 to 1.77) or in the fake tax arm compared to the control (2.59, 95 % CI -5.04 to 0.00).
	Advertising/marketing regulations											
S18	Non-randomised uncontrolled pre/post test study	No	No	Lwin 2020	AIMS/ Singapore	School children (10-17 years)	2818 (0%)	Reduced children's exposure to marketing and advertising of energy dense nutrient poor food and drink.	No information – pre intervention.	**Dietary intake** - sugary foods, high sodium and fat food in comparison to consumption of fruits and vegetables and nutrient dense foods. **Purchase** - snacks (sweets and potato chips, burgers) fruit, vegetables.	**Food consumption survey** – self reported **Home food inventory checklist** (56 items)	**Dietary intake** - significant reduction in self-reported consumption of potato chips and candies post-implementation compared to pre-implementation. Mean(SD) scores pre and post: Chips 1.97(0.72) to 1.91(0.69); Candies 2.18(0.89) to 1.92(0.85) (note scores 1= consume none to 4= consume every day). No sig change in fruit, veg or burger. **Purchase** – household stock of unhealthy convenience foods (selected processed foods) reduced (from mean(SD) 721.65(806.94) to 526.16(736.11) p=0.001). No significant difference in amount of fruit/vegeatables.
	Food provision											
S19	Non-randomised controlled before-after study	No	No	Preston 2013	Caribbean/ Puerto Rico	School children (5th, 8th, 1th grade)	IG:189 (0%) CG:132 (0%) TG:321 (0%)	Free healthy school meals.	No free school meals.	**Dietary intake** – energy (total calories, % protein, % carbohydrate, % fat and % saturated fat), vitamins (A, B1, B2, B3, B6, B9, B12, C, D, E),	**24-hour recall. –** three to four in one week. **Minnesota Nutrient Data System 32** – to analyse nutrient intake from recalls.	**Dietary intake** –generally few significant improvements in diet over on –participants. Non-participants had a significantly lower energy (kcal) intake than participants (mean(SD) 2177 ± 728 vs 2378 ± 792). No significant difference in energy requirements or macronutrients (% EAR or AMDR for total fat,

										minerals (calcium, iron, magnesium, phosphorous, potassium, zinc) and cholesterol, fiber, sodium, trans-fatty acids.		sat fat, trans fat, carbohydrate, protein). % consuming < EAR was significantly lower in the participant group for six out of 17 vitamins and minerals, when adjusted for energy intake; Vitamin A, B1, Folate, Iron, Magnesium, Zinc, and mean % AI for calcium was significantly greater in participants when adjusted. Authors considered study didn't address high intake of fat and sat fat or sodium which is concern.
	Multi-level intervention											
S20	Non-randomised controlled before-after study	Yes	Yes	Fotu 2011	Pacific/ Tonga	Secondary school children (11 to 19 years)	IG:1083 (25%) CG:139 6 (36%)	Complex multifaceted intervention (included capacity building, social marketing, community vegetable garden and planting fruit trees).	No intervention.	**Dietary intake** – frequency of breakfast, lunch from home. Servings/day fruit, vegetables, SSBs, fruit drink, and various snacks. **Purchase** - snack food from shop or takeaway after school.	**Questionnaires** – knowledge, behaviour and attitudes.	**Dietary intake** - no consistent evidence for improved dietary intake in the intervention group. Some evidence that aspects of diet worsened compared to the control group; SSB intake (OR (adj) 1.69 (p=0.005)), snacking after school (2.21 (0.001)), eating takeaway or fried foods after school (2.76(0.001)), breakfast consumption (0.63 (0.02)). However, reported purchasing of snack food from shop or take away reduced (OR 0.55 (p 0.001)).
S21	Non-randomised controlled before-after study	Yes	Yes	Kremer 2011	Pacific/ Fiji	Secondary school children (13-18 years)	IG:879 (67%) CG:206 9 (55%)	Range of individual to school policy level interventions. Nutrition education focused on reducing energy dense and sugary food/drink, healthy food provision in schools. Included PA component.	No intervention.	**Dietary intake** - Fruit, vegetable, soft drink, fruit drink/cordial.	**Questionnaire** - self-administered electronically.	**Dietary intake** - proportion consuming no vegetables/day increased in the intervention group (from 44% to 48%) compared to control group.

S22	Non-randomised uncontrolled pre/post test study	No	No	Pillay 2017	Pacific/ Fiji	Adults	Pre:169 Post:272 (not repeat measures)	Range of interventions at individual to policy level to promote salt reduction. Targeted food producers, retailers, consumers – education to reformulation of products.	Pre-intervention.	**Dietary intake** - mean population salt intake	**24 hour urine samples** **Food frequency questionnaire** - stated in protocol but not mentioned in this paper.	**Dietary intake** – no significant reduction in mean salt intake from 24-h urine samples (11.7 grams per day (g/d) at baseline and 10.3 g/d after 20 months (difference: -1.4 g/day, 95% CI -3.1 to 0.3, p = 0.115). Statistically significant reduction in female salt intake in the Central Division (-3.34 (-6.07 to -0.61); p = 0.017) but no differential impact in relation to age or ethnicity.
S23	Non-randomised uncontrolled pre/post test study	No	No	Trieu 2017	Pacific/ Samoa	Adults	479 (39%)	Community level increasing awareness through media and advocacy to reduce salt.	Pre-intervention	**Dietary intake** salt. **Nutrition knowledge, attitude and behaviour** - salt related.	**24 hour urinary salt excretion** **STEPS survey**	**Dietary intake** - no significant difference in mean salt intake (P=0.588) as measured by 24-h urinary excretion after raking the samples and adjusting for potential confounders. **Nutrition knowledge attitude and behaviour** - significant increase in the proportion of participants who understood that high salt consumption could cause serious health problems (from 81 to 90%, P=0.049); decrease in always or often add salt to food when eating (from 50 to 33%, P=0.002) and always or often ate processed foods (from 60 to 49%, P=0.020); increase in using one or more methods to control salt intake (from 73 to 93%, P<0.001), particularly through the use of spices rather than salt in cooking (from 48 to 76%, P<0.001); no change in the proportion who knew the recommended daily salt intake was less than 5 g (22 vs. 20%, P=0.638) or who thought that they consumed too much salt and that lowering salt was important in their diet (P>0.183 for each).; reductions in the proportion of the population who

												reported controlling their salt intake through either checking the sodium on packaged food labels (from 43 to 29%, P=0.015) or avoiding eating out (from 62 to 40%, P<0.001).
	Restriction											
S24	Non-randomised controlled before-after study	Yes	Yes	Aswani 2007	Pacific/ Solomon Island	Adults	IG:519 CG:55	Marine protected areas	No marine protected area	**Dietary intake** - energy, protein, fat.	**Dietary recalls –** every hour (between 7am-8pm) for one week. Food consumption **survey.**	**Dietary intake** - members of villages with effective MPAs had higher energy and protein intakes (particularly marine-derived protein) than those that did not have MPAs or had ineffective ones. Poorest dietary protein/fat ratio was found in the village with the worst MPA governance (attributed to high dependency on cash that subsistence economy for livelihood security and to availability of cash rather than effective marine governance and management.

Supplementary Figure 1: Risk of bias for individual studies.

Randomised studies (Cochrane ROB 2)	Bias for randomisation	Bias for deviation from intended intervention	Bias for missing data	Bias for measurement of outcomes	Bias in selection of reported result	Overall ROB
Ang 2019						
Doble 2020						
Francis 2010						
Halperin 2018						
Li 2019						

Non-randomised studies (Cochrane ROBINS-I)	Bias for confounding	Bias for selection of participants into the study	Bias for classification of interventions	Bias for deviation from intended intervention	Bias for missing data	Bias for measurement of outcomes	Bias in selection of reported result	Overall ROB
Afele-Faamuli 2009*								
Aflague 2019*								
Alvarado 2019								
Aswani 2007*								
Bhurosy 2013*								
Binford 2012*								
Cannoosamy 2016								
deKorn 2017								
Fotu 2011*								
Goh 2017								
Hanson 2011*								
Kremer2011*								
Lwin 2020								
Pillay 2017								
Pinto 2014								
Preston 2013								
Trieu 2017								
Webb 2016								
White2006								

Key: green = low risk, yellow = moderate/some concern risk, red = high/serious risk, blue = critical risk.
*indicates the studies which applied a local food approach.

Supplementary Box 1: Search terms for Medline

Search identification number	Search terms	Results
1	(Anguilla.tw) OR (Antigua.tw) OR (Antilles.tw) OR (Aruba.tw) OR (Bahamas.tw) OR (Barbuda.tw) OR (Barbados.tw) OR (Belize.tw) OR (Bermuda.tw) OR (Caicos.tw) OR (Caledonia.tw) OR (Caribbean.tw) OR (Cayman.tw) OR (Comoros.tw) OR ("Cook Islands".tw) OR (Cuba.tw) OR (Curacao.tw) OR (Dominica.tw) OR (Dominican.tw) OR (Fiji.tw) OR (Grenada.tw) OR (Grenadines.tw) OR (Guadeloupe.tw) OR (Guam.tw) OR (Haiti.tw) OR (Jamaica.tw) OR (Kiribati.tw) OR (Lesotho.tw) OR ("Saint Lucia".tw) OR ("St. Lucia".tw) OR (Maarten.tw) OR (Madagascar.tw) OR (Maldives.tw) OR (Marshall.tw) OR (Martinique.tw) OR (Mauritius.tw) OR (Melanesia.tw) OR (Micronesia.tw) OR (Montserrat.tw) OR (Nauru.tw) OR (Nevis.tw) OR (Niue.tw) OR (Pacific.tw) OR (Palau.tw) OR (Papua.tw) OR (Polynesia.tw) OR (Principe .tw) OR (Kitts.tw) OR (Samoa.tw) OR ("Sao Tomé".tw) OR (Seychelles.tw) OR (Singapore.tw) OR ("small island developing states" .tw) OR (Solomon.tw) OR (Suriname.tw) OR (Timor-Leste.tw) OR (Tonga.tw) OR (Trinidad.tw) OR (Tobago.tw) OR (Tokelau.tw) OR (Turks.tw) OR (Tuvalu.tw) OR ("Puerto Rico".tw) OR (Marianas.tw) OR (Martinique.tw) OR (Vanuatu.tw) OR (Verde.tw) OR ("Saint Vincent".tw) OR ("St. Vincent".tw) OR ("Virgin Islands".tw)	113648
2 (these terms base on keywords from GBD dietary risk factors and synonyms for SSB used in another review on SSB tax (Backhoeler 2019)	Diet/ OR diet*.tw OR Nutrients/ OR nutrient.tw OR Food/ OR food.tw. OR Nutrition Surveys/ or Nutrition Assessment/ OR nutrition*.tw OR Sugar-Sweetened Beverages/ OR "sugar sweetened beverage$".tw OR SSB.tw OR Fruit/ OR fruit*.tw OR Vegetables/ OR vegetable*.tw OR Micronutrients/OR micronutrient.tw OR macronutrient.tw OR "dietary diversity".tw OR Whole Grains/ OR wholegrain*.tw OR Dietary Fiber/ OR fibre.tw OR legume*.tw OR pulses.tw OR nut.tw OR seed.tw OR milk.tw OR Red Meat/ OR red meat.tw OR processed meat.tw OR calcium.tw OR Fatty Acids, Omega-3/ OR Carbonated Beverages/ or carbonated beverage.tw OR soda*.tw OR Beverages/ OR Energy Drinks/ OR energy drink*.tw OR soft	3012651

	drink*.tw OR Seafood/ OR fish.tw OR seafood.tw OR Sodium, Dietary/ OR sodium.tw OR salt.tw	
3	assessment.tw OR intervention*.tw OR evaluation.tw OR experiment*.tw OR program*.tw OR strateg*.tw OR initiative.tw OR polic*.tw OR project.tw OR scheme.tw OR plan.tw OR task.tw OR method*.tw OR treatment.tw OR tool.tw OR education*.tw OR tax*.tw OR incentiv*.tw OR communit*.tw OR household*.tw	13368517
4	1 and 2 and 3	8775
5	2000:2020. (sa_year)	7422

Supplementary Box 2: Narrative overview of effectiveness of local and non-local food approaches

Effectiveness of local food approach to outcome-related components

All nine studies in Table 2 applied a local approach to outcome-related components. This included promoting locally produced food and traditional dietary behaviours such as traditional cooking techniques or foods of cultural significance (n=8),[S3, S5, S6, S13, S14, S20, S21, S24] or applying locally-relevant tools to outcomes measures. [S9] Five of these interventions included a practical food production component, such as teaching skills for planting and harvesting own produce. [S6, S13, S14, S20, S21]

Of the eight studies that specifically promoted locally produced food, four showed significant improvements in dietary intake and one study that did not measured dietary intake, showed significant improvement in nutrition knowledge. Two of the effective interventions that demonstrated improved dietary intake were garden-based nutrition interventions. One targeted pregnant women and children in rural Dominican Republic to improve consumption of locally produced food rich in Vitamin A. [S13] The intervention provided garden-based nutrition education, vegetable gardens and laying hens and assessed intake using a FFQ, to significantly increase consumption of any vitamin A rich food, and garden specific vitamin A rich foods in intervention than control communities. The second study aimed to encourage the return to traditional diets to prevent disease in Pohnpei (Federated States of Micronesia), through growing local food using container gardening, and classes on cooking and using charcoal ovens. [S14] This mixed-methods study took a unique approach in focusing on food source as part of their context-specific assessment of dietary intake – distinguishing between consumption of local and imported foods, and found significant increases in the consumption of local and imported fruit and vegetables, local and imported meat, local fish and seafood, imported starch/flour, and imported surgery drinks and foods (Supplementary Table 1).

A third effective intervention that used a local approach to improve dietary intake, was the implementation of Marine Protected Areas (MPAs) in the Solomon Islands. [S24] The study aimed to assess the impact of protecting fish stocks on food security for local communities. Authors observed variation in effectiveness of MPAs in protecting fish stocks, but residents in villages with effective MPAs had higher energy and protein intakes (particularly marine-derived) than those that had ineffective or no MPA. Poorest dietary protein/fat ratio was found in the village with the worst MPA governance, and this was attributed to availability of

and high dependency on cash over subsistence for livelihood security, rather than effective marine governance and management.

The final local intervention that was effective in improving dietary intake, was a quasi-experimental study in Mauritius that applied an educational approach to increase consumption of locally produced sources of calcium such as milk, fish and dark green leafy vegetables, amongst adults aged 40+ years.(S3)

Three other studies included a practical local food production component, similar to the first two garden-based studies described, but these were not shown to effectively improve diet. One of these studies was conducted in Guam, targeted school-aged children and involved the implementation of culturally adapted nutrition lessons at a summer camp. (S6) Local food production was promoted through skill acquisition and taught participants how to grow and cook their own produce using modern and traditional practices whilst emphasising the impacts of imported versus local food. The study used an adapted *WillTry* tool to assess dietary intake and 'willingness to try' various items, but showed no significant change in dietary intake, or willingness to try, post-intervention. S6) The other two were separate arms of the regional Pacific Obesity Prevention in Communities Project in Fiji (S21) and Tonga, (S20) which involved quasi-experimental studies of community and school-based interventions that included some emphasis on local food production and consumption through vegetable gardens or agricultural training, as a way of building capacity for schools and communities to create solutions to food insecurity.(S20) Despite these studies providing no evidence for significant effects on dietary intake, the Tongan study did have a significant effect on reducing purchasing of some unhealthy food items, including snack foods from a shop or takeaway. (S20)

One of the nine studies did not measure dietary intake but evaluated change in nutrition knowledge as the primary outcome measure. This study implemented culturally-appropriate strategies to educate adults in American Samoa about nutrition, and demonstrated an increase in knowledge about items such as high-fat and high-fibre foods post intervention. (S5)

Only one study, which was a randomised controlled trial conducted in Singapore, considered the unique nutritional composition of local food in their outcome measure, by analysing dietary records using an online nutrient analysis software which was derived from locally available foods.(S9) The intervention targeted overweight and obese pregnant women with a food coaching app that provided guidance on healthy choices and resulted in no significant changes to macro or micronutrient intakes.(S9) Although the intervention itself did not apply a local approach or focus on the consumption of locally produced foods, it is worth noting that this study was the only study to specifically acknowledge nutrient variation according to food source, and apply that to their analysis; however the findings reported in the manuscript are not specifically discussed in the context of this application.

Effectiveness of non-local food approach (n=15)

Twelve of these studies measured the impact of intervention on dietary intake. Two of these 12 studies were significantly effective, four showed some significant improvement on some, but not other, measures of dietary intake, and six showed no evidence to be effective.

The two studies that were effective, applied an education approach to teach adults about nutrition via lessons and educational materials. (S4, S15) Both were quasi-experimental studies conducted in the AIMS region, used FFQs to assess dietary intake outcomes and

demonstrated significant improvements in diet. One targeted housewives in Mauritius and significantly increased the number of servings of fruit and vegetables consumed compared to pre-intervention, [S4] and the other targeted patients and carers attending general outpatients clinic in Singapore with nutrition information, cooking demonstrations and provision of healthy food samples. [S15] The evaluation focused on wholegrain consumption and found a significant increase in frequency of consumption and purchasing of wholegrains. Both of these interventions also measured nutrition knowledge and showed significant improvements in knowledge scores post intervention.

The four studies that demonstrated mixed effectiveness included educational intervention, food provision and regulations on advertising and marketing. One study targeted hospital staff in Singapore to assess the impact of a plate displaying portion guidance compared to a normal plate and found increased vegetable and reduced carbohydrate proportion over six months, but no significant change in proportion of protein.[S2] One study evaluated a free school meals intervention in Puerto Rico. [S19] Using 24-hour recall method researchers found a significant improvement in nutrient intake for some (six of the 17) vitamins and minerals, but no significant improvements in macronutrient or sodium intake. A Trinidad-based study that used nutrition education to target fruit and vegetable intake in school-aged children, showed no significant association between intervention and fruit or vegetable intake in multivariable regression, but provided evidence that the intervention was associated with lower intakes of fried food, soda and food high fat salt and sugar, and improvements in nutrition knowledge.[S8] Similar to that study, the final study to show a mixed effect demonstrated significant reductions in the consumption of two out of three unhealthy items measured (chips, sweets, burgers), but no improvements in fruit and vegetable intake. This intervention, targeting children, was conducted in Singapore and implemented a national policy-level restriction on advertising and marketing of energy dense, nutrient poor food and drink to children.[S18] This study also measured the impact of intervention on purchase of specific food items, and provided evidence of a significant reduction in purchasing of selected processed/convenience foods, but no difference in fruit or vegetable purchasing.

Two of the six interventions that were ineffective at changing dietary intake, applied a support/guidance approach to empower participants to improve dietary intake [12, 15,], and one implemented school-based nutrition education. One targeted women aged 40-60 years in Trinidad and Tobago and implemented health-focused support meetings, specifically to promote fruit and vegetable intake, but demonstrated a reduction in fruit and vegetable consumption following the intervention.[S11] One targeted university students, in Puerto Rico, with support sessions that focused on stress reduction and mindfulness to improve diet and physical activity, but showed no significant reduction in consumption of the two variables assess, SSB or bread, between control and intervention groups. [S10] Another intervention that was ineffective, was the implementation of school-based nutrition and physical activity lessons in Puerto Rico that showed no significant effect on fruit, vegetable, fibre or energy intake, post intervention.[S7]

Finally, two community level interventions, one in Fiji and the other in Samoa, applied a range of interventions as part of salt reduction programmes.[S22, S23] The Fiji study involved multilevel intervention from individual to national policy level and targeted stakeholders across the food system from producers (advocating for reformulation) through to consumer education. [S22] In Samoa, a community level media campaign advocated for reducing salt intake. [S23] Both used non-randomised, uncontrolled pre/post-test designs and measured salt intake through 24-hour urinary salt excretion, and reported no significant reduction in mean salt intake. However, the Samoan study also measured nutrition (specifically salt-

related) knowledge, attitude and behaviour and showed some significant, positive effect on these outcomes.(S23)

The other four of the 15 studies that did not focus on locally produced food, did not measure dietary intake, but evaluated, and showed mixed intervention effects on, other outcomes; purchasing, (S1, S17) sales (S16) or nutrition knowledge (16). Two studies measured purchases from an online hypothetical grocery store and were based in Singapore; (S1,S17) one assessed the impact of a hypothetical tax of high calorie items on purchase and expenditure, (S17) and the other assessed the impact of various types of food labelling (information) on product choice.(S1) Both found statistically significant changes in some of the purchasing behaviours measured. The explicit tax was associated with a decrease in unhealthy food purchases, which was not shown in the implicit or fake tax arm of the study,(S17) and a text-only warning label was associated with a significant reduction in purchase of labelled products; however, there was no difference in total sugar purchased or total expenditure on high-sugar products.(S1)

One study evaluated the impact of a national 10% tax on sugar-sweetened beverages (SSBs) in Barbados and showed a significant decrease in grocery store sales of SSBs, which was primarily driven by a reduction in carbonated SSB sales, and an increase in sales of non-SSB including significant increase in sales of bottled water. (S16)

The final study, conducted in Trinidad and Tobago, measured the impact of a dietitian-led nutrition counselling intervention on nutrition knowledge, and targeted adults with Type 2 Diabetes.(S12) There was no significant difference in total knowledge score when comparing the intervention and control (no counselling) groups, but did demonstrate a significant improvement in attitude and practice scores amongst those who received the intervention compared to the control.

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Supplementary Information File

Contents

Supplementary Table 1: Overview of studies that included a focus on local food production.

Study	Title	Aim	Study design	Type of intervention	Outcomes/Tools	Effectiveness on measured outcomes	Lessons/takeaways
Afele-Fa'amuli 2009 (S5)	Effectiveness of a Pilot Community Physical Activity and Nutrition Intervention in American Samoa	To assess the effectiveness of a pilot community physical activity and nutrition intervention in American Samoa	Non-randomised controlled before -after	**Nutrition education** – culturally appropriate strategies	**Nutrition knowledge score/ Nutrition survey**	**Nutrition knowledge** –increase in knowledge. Almost twice as many participants were able to identify correctly ≤50% of the high-fat foods. 68.2%. More participants were able to identify high fibre foods between base line and follow up.	Emphasises how important it is to develop culturally-appropriate/sensitive programs for effectiveness and ownership.
Aflague 2019 (S6)	Examining the Influence of Cultural Immersion on Willingness to Try Fruits and Vegetables among Children in Guam: The Traditions Pilot Study	To assess the effectiveness of 'cultural immersion' on willingness to try fruits and vegetables among children in Guam.	Non-randomised uncontrolled before -after	**Culturally adapted nutrition lessons** – planting/gardening local produce using traditional and modern practices.	**Dietary intake** (fruit and vegetables) and **willingness to try** fruit and vegetables/ **Adapted WillTry Tool**	**Dietary intake and willingness to try** - No significant change in willingness to try, or difference in post-FV intakes between the camps after adjusting for potential confounders in regression model.	Using existing community programmes to implement new interventions is a feasible approach to research in resource-limited environments. Future research involving cultural immersion should include methods and instruments that can help to capture the cultural context and impact of cultural exposure.
Aswani 2007 (S24)	Do Marine Protected Areas Affect Human Nutrition and Health? A Comparison between Villages in Roviana, Solomon Islands	To assess whether MPAs influenced local perceptions of governance, environmental change, livelihood strategies, and actual human nutrition and health.	Non-randomised controlled before-after study	Marine protected areas	**Dietary intake** - energy, protein, fat/ **24 hour recalls** and **food consumption survey.**	**Dietary intake** - members of villages with effective MPAs had higher energy and protein intakes (particularly marine-derived protein) than those that did not have MPAs or had ineffective ones. Poorest dietary protein/fat ratio was found in the village with the worst MPA governance (attributed to high dependency on cash that subsistence economy for livelihood security and to availability of cash rather than effective marine governance and management.	
Bhurosy 2013 (S3)	Effectiveness of a Theory-Driven Nutritional Education Program in Improving Calcium Intake among Older Mauritian Adults	To improve consumption of calcium-rich foods among older adults through a nutrition education program and gain a better understanding of	Non-randomised controlled before-after study	Education materials and sessions for increasing calcium intake	**Dietary intake** (calcium)/ **Food frequency questionnaire** - 35 item coded self-administered questionnaire.	**Dietary intake** - statistically significant higher mean calcium frequency scores post-intervention ($p < 0.001$).	Suggest that using a theory based (health belief model) nutrition education program and focusing on consumption of calcium rich foods (food-based approach) over calcium supplementation contributed to the success of the program and

		how sociodemographic factors predict calcium intake in this target group.					demonstrates feasibility of the approach among older Mauritian population.
Binford 2012 (S13)	A Garden-Based Nutrition Intervention In The Rural Dominican Republic - Impact On Vitamin A Rich Food Consumption And Household Food Security	To characterize the effect of a garden-based nutrition intervention on vitamin A food frequency and food security measures	Non-randomised controlled before -after	Garden based nutrition education, patio vegetable gardens, and laying hens	**Dietary intake** - vitamin A rich foods/ **Food frequency questionnaire**	**Dietary intake** - children in intervention communities averaged 48.3 servings of vitamin A rich foods/week compared to 44.0 servings/week in control communities. The increase in the all communities' vitamin A food frequency scores was attributed primarily to the large increase in mango and milk consumption. The consumption of garden-specific vitamin A rich foods (green leafy vegetables, carrots, beats) was greater in intervention than communities.	Implicitly emphasises the importance of pilot testing questions regarding food sources, food security and food consumption (e.g. serving size etc.) to ensure that data collected is accurate and in a suitable format for data analysis and interpretation of findings.
Fotu 2011 (S20)	Outcome results for the Ma'alahi Youth Project, a Tongan community-based obesity prevention programme for adolescents	To assess the effectiveness of Ma'alahi Youth Project; a community based intervention for the prevention of obesity in adolescents in Tonga	Non-randomised controlled before -after	Multifaceted intervention - community capacity building, social marketing, education and activities promoting physical activity and local fruit and vegetables	**Dietary intake** – frequency of breakfast, lunch from home. Servings/day fruit, vegetables, SSBs, fruit drink, and various snacks. **Purchase** - snack food from shop or takeaway after school/ **Questionnaires** – knowledge, behaviour and attitudes.	**Dietary intake** - no consistent evidence for improved dietary intake in the intervention group. Some evidence that aspects of diet worsened compared to the control group; SSB intake (OR (adj) 1.69 (p=0.005)), snacking after school (2.21 (0.001)), eating takeaway or fried foods after school (2.76(0.001)), breakfast consumption (0.63 (0.02)). However, reported purchasing of snack food from shop or take away reduced (OR 0.55 (p 0.001)).	Important to account for strong impact of socio-cultural factors on behaviours, particularly for populations where socio-cultural factors are strong determinants of eating, physical activity and body size perceptions.
Hanson 2011 (S14)	An Evaluation of a Nutrition Intervention in Kapinga Village on Pohnpei, Federated States of Micronesia	To encourage return to a more traditional diet to prevent disease, through growing local food, cooking classes, container gardening, and charcoal oven workshops.	Non-randomised uncontrolled before -after	Community-based promotion of container growing, charcoal oven cooking through workshops and classes	**Dietary intake** - frequency of consumption of staples (local starch food, rice, flour products), fruit and vegetables (local vegetables, local fruits, imported fruits, imported vegetables), protein (local fish and seafood, local meat, imported meat, eggs, imported fish and seafood), high fat foods (turkey tail, fried	**Dietary intake** – significant increase in local fruits consumption (1.2 to 2.9 ($p<0.001$) mean days/week), local vegetables consumption (2.8 to 4.6 ($p<0.001$), and imported vegetables (0.7 to 2.0 ($p<0.001$). Local fish and seafood consumption increased from 2.5 to 4.4 ($p<0.001$) mean days/week with no significant change in imported sources. There was a significant increase in local and imported meat sources (p 0.004; 0.03) and increase in both local and imported sources of starch/flour products, however the local source was not a significant increase (p 0.17; 0.06). There was also a significant increase in	Focus on more familiar and less sensitive traditional crops already planted in the village. Emphasise the importance of education and supervision as component of this type of intervention.

					foods), beverages and snacks (imported drinks with sugar, imported sugar foods, imported salty foods, local snack foods)/ **Food frequency questionnaire -** based on the Helen Keller International 7-day FFQ but modified for use in the FSM and further for Pohnpei.	imported sugary drinks and foods (p 0.011; 0.04).	
Kremer (S21)	Reducing unhealthy weight gain in Fijian adolescents: results of the Healthy Youth Healthy Communities study	To address the issue of adolescent obesity in Fiji.	Non-randomised controlled before-after study	Range of individual to school policy level interventions. Nutrition education focused on reducing energy dense and sugary food/drink, healthy food provision in schools. Included PA component.	**Dietary intake** - Fruit, vegetable, soft drink, fruit drink/cordial. **Questionnaire** -self-administered electronically.	**Dietary intake** - proportion consuming no vegetables/day increased in the intervention group (from 44% to 48%) compared to control group.	The sociocultural studies within the Pacific OPIC project reported that physical, economic and sociocultural forces are especially important determinants of adolescent dietary and activity habits and consequently point to a need for more comprehensive strategies to influence cultural values and expectations.

Supplementary Table 2: Study characteristics for all included studies.

Study ref	Study design	Local food promoted	Other local component	Study authors	Region/Country	Population/ subgroup studied	Sample size (loss to follow up)	Intervention	Control	Measured outcomes*	Tools	Effectiveness on outcomes of interest (to this review)
	Nutrition education											
S1	Individually randomised parallel group trial	No	No	Ang 2019	AIMS/ Singapore	Adults	512 (0%)	Front of package labelling/warning	Less information/detailed labelling.	**Purchase** - foods high in sugar.	**Online hypothetical grocery store**	**Purchase** - a text-only warning label generated a statistically significant reduction in labelled products purchased. None of the secondary outcomes (total sugar purchased (g), sugar purchased per dollar spent (g per $), total spending ($) and total expenditure on high-in-sugar products ($)) were statistically different across groups.)
S2	Non-randomised controlled pre/post-test study	No	No	deKorn 2017	AIMS/ Singapore	Hospital staff	IG:266 CG:299 (not repeat measures)	Plate with portion guidance.	Normal plate.	**Dietary intake** – carbohydrate, protein, vegetable.	**Plate** with recommended proportions displayed.	**Dietary intake** –after 6 months of the design plate, guideline adherence had significantly increased for vegetables and carbohydrates.
S3	Non-randomised controlled before-after study	Yes	Yes	Bhurosy 2013	AIMS/ Mauritius	Adults over 40 years	IG:98 (0%) CG:91 (0%)	Education materials and sessions for increasing calcium intake.	Education materials only.	**Dietary intake** - calcium	**Food frequency questionnaire** - 35 item coded self-administered questionnaire	**Dietary intake** - statistically significant higher mean calcium frequency scores post-intervention ($p < 0.001$).
S4	Non-randomised uncontrolled pre/post-test study	No	No	Cannoosamy 2016	AIMS/ Mauritius	Housewives	200 (0%)	Nutrition education – lectures and educational materials.	Pre-intervention	**Dietary intake** - fruit and vegetable. **Nutrition knowledge** score.	**FFQ –** specifically fruit and vegetables.	**Dietary intake** – significant increase in number of servings of fruit and vegetable (mean change +0.26 ($p < 0.001$). **Nutrition knowledge** - significant increase in the nutrition knowledge score (mean change +17.1, ($p < 0.001$)
S5	Non-randomised uncontrolled pre/post-test study	Yes	Yes	Afele Fa Amuli 2009	Pacific/ American Samoa	Adults	95 (0%)	Nutrition education – culturally appropriate strategies (also PA component)	Pre-intervention	**Nutrition knowledge** score	**Nutrition survey**	**Nutrition knowledge** –increase in knowledge. Almost twice as many participants were able to identify correctly ≤50% of the high-fat foods. 68.2%. More participants were able to identify high fibre foods between base line and follow up.

S6	Non-randomised uncontrolled pre/post-test study	Yes	Yes	Aflague 2019	Pacific/ Guam	3-12 year old summer camp children	105 (6%)	Culturally adapted nutrition lessons	Pre-intervention	**Dietary intake** - fruit and vegetable. **Willingness to try** fruit and vegetables.	**Adapted WillTry Tool**	**Dietary intake and willingness to try** - No significant change in willingness to try, or difference in post-FV intakes between the camps after adjusting for potential confounders in regression model.
S7	Non-randomised uncontrolled pre/post test study	No	No	Pinto 2014	Caribbean/ Puerto Rico	School children (8th grade)	32 (16%)	Nutrition education (also PA component).	Pre-intervention	**Dietary intake** – daily energy and fibre, fruit and vegetable.	**24 hour dietary recall –** three times.	**Dietary intake** - no significant changes between baseline and post intervention kcal intake, fruit, vegetable or fibre consumption.
S8	Cluster-randomised parallel-group trial	No	No	Francis 2010	Caribbean/ Trinidad and Tobago	Primary school children (10-11 years)	IG:281 (12%) CG:299 (25%) TG:579 (18%)	Nutrition lessons on the six food groups, sources of nutrients and types of food (also PA component).	No intervention.	**Dietary intake** – servings/day and in last 24 hours of; fruit, vegetable, soda, fried food, HFSS. **Nutrition knowledge** score. **Attitudes** to eating.	**Modified block FFQ** with resources including display pictures and actual serving sizes of cook and raw vegetables, beverages, juices and fruits. **'Basic nutrition test'** (developed for study). **Children's Eating Attitude Test-26 (ChEAT26).**	**Dietary intake** - intervention was not significantly associated with fruit and vegetable intakes. In multivariate regression equations controlling for age, gender, BMI and baseline value, intervention was significantly associated with lower intake levels of fried foods, sodas, HFSS foods. **Nutrition knowledge** – in multivariate regression equations controlling for age, gender, BMI and baseline value, intervention was significantly associated with higher knowledge scores. **Attitude** - intervention was not significantly associated with ChEAT26 score.
	Nutrition education plus additional support											
S9	Individually-randomised parallel-group trial	No	Yes	Li 2019	AIMS/ Singapore	Overweight/ obese pregnant women - clinic	IG:15 (20%) CG:15 (7%) TG:30 (13%)	Food coaching app that provides support and guidance on healthy choices.	Standard educational materials on basic nutrition principles and recommended gestational weight gain.	**Dietary intake** - energy, carbohydrate, protein, total fat, cholesterol, calcium, dietary fiber, sodium	**24-hour dietary recall** – 3 x covering 2 weekdays, one weekend day. **Self-administered 3-day food diary.**	**Dietary intake** - no significant differences in changes between control and intervention groups.

S10	Individually-randomised parallel-group trial	No	No	Halperin 2018	Caribbean/ Puerto Rico	University/college students (18-19 years)	IG:20 (10%) CG:21 (0%) TG:41 (5%)	Support sessions focusing on stress reduction and mindfulness approach to diet and PA changes.	Standard care – provision of basic educational materials on diet and PA.	**Dietary intake** – bread, SSB (self-reported).	**Food frequency questionnaire** (multicultural).	**Dietary intake** - insignificant reduction in consumption of soda or bread between the control and intervention group.
S11	Non-randomised uncontrolled pre/post test study	No	No	White 2006	Caribbean/ Trinidad and Tobago	Women (40-60 years)	Pre:42 Post:44 (not repeat measures)	Health-focused support meetings to promote fruit and veg consumption (also promoted PA and cervical screening).	Pre-intervention	**Dietary intake** - daily and 7 day fruit and vegetables.	**Food frequency questionnaire** - based on previous 7 days.	**Dietary intake** – reduction in proportion consuming >5 and >4 servings/day (pretest: 26.19% consuming >5 serving/day; 45.24% >4 servings per day. At 6 months, 6.98% > 5 /d; 18.61% > 4/d)
S12	Non-randomised controlled before-after study	No	No	Webb 2016	Caribbean/ Trinidad and Tobago	Individuals with Type 2 Diabetes – clinic	IG:86 (0%) CG:36 (0%) TG:122 (0%)	Nutrition counselling from Registered Dietitian.	No counselling.	**Nutrition knowledge** score (mean). **Attitude** score (mean) **Practice** score (mean)	**27-item KAP structured questionnaire** – for nutrition knowledge.	**Practice** - patients receiving nutrition counselling were more likely than those not receiving counselling to not drink soft drinks ($p < 0.001$), consume fast foods ($p < 0.001$) and drink alcohol ($p = 0.003$) but were equally likely to drink at least eight glasses of water daily.
	Nutrition education plus practical skills											
S13	Non-randomised controlled before-after study	Yes	Yes	Binford 2012	Caribbean/ Dominican republic	Pregnant women and children	43 (42%)	Nutrition education, patio vegetable gardens, and laying hens – building self-efficacy by providing vit A rich foods.	No intervention.	**Dietary intake** - vitamin A rich foods	**Food frequency questionnaire.**	**Dietary intake** - children in intervention communities averaged 48.3 servings of vitamin A rich foods/week compared to 44.0 servings/week in control communities. The increase in the all communities' vitamin A food frequency scores was attributed primarily to the large increase in mango and milk consumption. The consumption of garden-specific vitamin A rich foods (green leafy vegetables, carrots, beats) was greater in intervention than communities.
S14	Non-randomised uncontrolled	Yes	Yes	Hanson 2011	Pacific/ Federated States of Micronesia	Adults	75 (10%)	Workshops on container gardening, charcoal oven	Pre-intervention.	**Dietary intake** - frequency of consumption of staples (local	**Food frequency questionnaire -** based on the Helen Keller	**Dietary intake** – significant increase in local fruits consumption (1.2 to 2.9 ($p<0.001$) mean days/week),

	pre/post test study							use and recipe demonstrations.		starch food, rice, flour products), fruit and vegetables (local vegetables, local fruits, imported fruits, imported vegetables), protein (local fish and seafood, local meat, imported meat, eggs, imported fish and seafood), high fat foods (turkey tail, fried foods), beverages and snacks (imported drinks with sugar, imported sugar foods, imported salty foods, local snack foods)	International 7-day FFQ but modified for use in the FSM and further for Pohnpei.	local vegetables consumption (2.8 to 4.6 (p<0.001), and imported vegetables (0.7 to 2.0 (p<0.001). Local fish and seafood consumption increased from 2.5 to 4.4 (p<0.001) mean days/week with no significant change in imported sources. There was a significant increase in local and imported meat sources (p 0.004; 0.03) and increase in both local and imported sources of starch/flour products, however the local source was not a significant increase (p 0.17; 0.06). There was also a significant increase in imported sugary drinks and foods (p 0.011; 0.04).
S15	Non-randomised uncontrolled pre/post test study	No	No	Goh 2017	AIMS/ Singapore	Patients and carers - clinic	Unclear.	Nutrition education including cooking demonstrations and food samples to try at home.	Pre-intervention.	**Dietary intake** - whole grains (self-reported). **Nutrition knowledge** – wholegrain specific	**Questionnaire** – administered via telephone interview	**Dietary intake** - self reported increase in the frequency of consumption and purchasing of whole grains (84% of participants reported positive changes in their dietary habits.). **Nutrition knowledge** – statistically significant increase in knowledge score.
	Actual or hypothetical tax											
S16	Interrupted time series study	No	No	Alvarado 2019	Caribbean/ Barbados	Whole population (Barbados)		10% taxes on sugar sweetened beverages (SSBs)	No tax	**Sales** - SSBs (weekly volume in millitres sold per capita for SSBs and non-SSBs, carbonated- SSBs, other SSBs, water and other non-SSBs).	**Electronic point-of-sale data**	**Sales** - 10% tax was associated with a 4.3% (95%CI 3.6 to 4.9%) decrease in grocery store sales of SSBs and 5.2% (95%CI 4.5 to 5.9%) increase in sales of non-SSBs.

S17	Individually-randomised multi-arm parallel-group trial	No	No	Doble 2020	AIMS/ Singapore	Adults	IG1:271 (20%) IG2: 298 (14%) IG3: 282 (20%) CG: 293 (17%) TG:1144 (18%)	Hypothetical tax on high calorie products (online)	No hypothetical tax (online).	**Purchase** – proportion of taxed products, kcal per serving, kcal/$, total spend, taxed produced in $	**Online hypothetical grocery store** - NUSMart.	**Purchase** - statistically significant 3.35 percentage point decrease in purchases (95 % CI -6.01 to -0.5) in the explicit tax arm compared to control. Insignificant changes in implicit tax arm compared to control (0.08, 95 % CI -3.31 to 1.77) or in the fake tax arm compared to the control (2.59, 95 % CI -5.04 to 0.00).
	Advertising/marketing regulations											
S18	Non-randomised uncontrolled pre/post test study	No	No	Lwin 2020	AIMS/ Singapore	School children (10-17 years)	2818 (0%)	Reduced children's exposure to marketing and advertising of energy dense nutrient poor food and drink.	No information – pre intervention.	**Dietary intake** - sugary foods, high sodium and fat food in comparison to consumption of fruits and vegetables and nutrient dense foods. **Purchase** - snacks (sweets and potato chips, burgers) fruit, vegetables.	**Food consumption survey** – self reported **Home food inventory checklist** (56 items)	**Dietary intake** - significant reduction in self-reported consumption of potato chips and candies post-implementation compared to pre-implementation. Mean(SD) scores pre and post: Chips 1.97(0.72) to 1.91(0.69); Candies 2.18(0.89) to 1.92(0.85) (note scores 1= consume none to 4= consume every day). No sig change in fruit, veg or burger. **Purchase** – household stock of unhealthy convenience foods (selected processed foods) reduced (from mean(SD) 721.65(806.94) to 526.16(736.11) p=0.001). No significant difference in amount of fruit/vegeatables.
	Food provision											
S19	Non-randomised controlled before-after study	No	No	Preston 2013	Caribbean/ Puerto Rico	School children (5th, 8th, 1th grade)	IG:189 (0%) CG:132 (0%) TG:321 (0%)	Free healthy school meals.	No free school meals.	**Dietary intake** – energy (total calories, % protein, % carbohydrate, % fat and % saturated fat), vitamins (A, B1, B2, B3, B6, B9, B12, C, D, E),	**24-hour recall. –** three to four in one week. **Minnesota Nutrient Data System 32** – to analyse nutrient intake from recalls.	**Dietary intake** –generally few significant improvements in diet over on –participants. Non-participants had a significantly lower energy (kcal) intake than participants (mean(SD) 2177 ± 728 vs 2378 ± 792). No significant difference in energy requirements or macronutrients (% EAR or AMDR for total fat,

										minerals (calcium, iron, magnesium, phosphorous, potassium, zinc) and cholesterol, fiber, sodium, trans-fatty acids.		sat fat, trans fat, carbohydrate, protein). % consuming < EAR was significantly lower in the participant group for six out of 17 vitamins and minerals, when adjusted for energy intake; Vitamin A, B1, Folate, Iron, Magnesium, Zinc, and mean % AI for calcium was significantly greater in participants when adjusted. Authors considered study didn't address high intake of fat and sat fat or sodium which is concern.
	Multi-level intervention											
S20	Non-randomised controlled before-after study	Yes	Yes	Fotu 2011	Pacific/ Tonga	Secondary school children (11 to 19 years)	IG:1083 (25%) CG:139 6 (36%)	Complex multifaceted intervention (included capacity building, social marketing, community vegetable garden and planting fruit trees).	No intervention.	**Dietary intake** – frequency of breakfast, lunch from home. Servings/day fruit, vegetables, SSBs, fruit drink, and various snacks. **Purchase** - snack food from shop or takeaway after school.	**Questionnaires** – knowledge, behaviour and attitudes.	**Dietary intake** - no consistent evidence for improved dietary intake in the intervention group. Some evidence that aspects of diet worsened compared to the control group; SSB intake (OR (adj) 1.69 (p=0.005)), snacking after school (2.21 (0.001)), eating takeaway or fried foods after school (2.76(0.001)), breakfast consumption (0.63 (0.02)). However, reported purchasing of snack food from shop or take away reduced (OR 0.55 (p 0.001)).
S21	Non-randomised controlled before-after study	Yes	Yes	Kremer 2011	Pacific/ Fiji	Secondary school children (13-18 years)	IG:879 (67%) CG:206 9 (55%)	Range of individual to school policy level interventions. Nutrition education focused on reducing energy dense and sugary food/drink, healthy food provision in schools. Included PA component.	No intervention.	**Dietary intake** - Fruit, vegetable, soft drink, fruit drink/cordial.	**Questionnaire** - self-administered electronically.	**Dietary intake** - proportion consuming no vegetables/day increased in the intervention group (from 44% to 48%) compared to control group.

S22	Non-randomised uncontrolled pre/post test study	No	No	Pillay 2017	Pacific/ Fiji	Adults	Pre:169 Post:272 (not repeat measures)	Range of interventions at individual to policy level to promote salt reduction. Targeted food producers, retailers, consumers – education to reformulation of products.	Pre-intervention.	**Dietary intake** - mean population salt intake	**24 hour urine samples** **Food frequency questionnaire** - stated in protocol but not mentioned in this paper.	**Dietary intake** – no significant reduction in mean salt intake from 24-h urine samples (11.7 grams per day (g/d) at baseline and 10.3 g/d after 20 months (difference: -1.4 g/day, 95% CI -3.1 to 0.3, p = 0.115). Statistically significant reduction in female salt intake in the Central Division (-3.34 (-6.07 to -0.61); p = 0.017) but no differential impact in relation to age or ethnicity.
S23	Non-randomised uncontrolled pre/post test study	No	No	Trieu 2017	Pacific/ Samoa	Adults	479 (39%)	Community level increasing awareness through media and advocacy to reduce salt.	Pre-intervention	**Dietary intake** salt. **Nutrition knowledge, attitude and behaviour** - salt related.	**24 hour urinary salt excretion** **STEPS survey**	**Dietary intake** - no significant difference in mean salt intake (P=0.588) as measured by 24-h urinary excretion after raking the samples and adjusting for potential confounders. **Nutrition knowledge attitude and behaviour** - significant increase in the proportion of participants who understood that high salt consumption could cause serious health problems (from 81 to 90%, P=0.049); decrease in always or often add salt to food when eating (from 50 to 33%, P=0.002) and always or often ate processed foods (from 60 to 49%, P=0.020); increase in using one or more methods to control salt intake (from 73 to 93%, P<0.001), particularly through the use of spices rather than salt in cooking (from 48 to 76%, P<0.001); no change in the proportion who knew the recommended daily salt intake was less than 5 g (22 vs. 20%, P=0.638) or who thought that they consumed too much salt and that lowering salt was important in their diet (P>0.183 for each).; reductions in the proportion of the population who

												reported controlling their salt intake through either checking the sodium on packaged food labels (from 43 to 29%, P=0.015) or avoiding eating out (from 62 to 40%, P<0.001).
	Restriction											
S24	Non-randomised controlled before-after study	Yes	Yes	Aswani 2007	Pacific/ Solomon Island	Adults	IG:519 CG:55	Marine protected areas	No marine protected area	**Dietary intake** - energy, protein, fat.	**Dietary recalls –** every hour (between 7am-8pm) for one week. Food consumption **survey.**	**Dietary intake** - members of villages with effective MPAs had higher energy and protein intakes (particularly marine-derived protein) than those that did not have MPAs or had ineffective ones. Poorest dietary protein/fat ratio was found in the village with the worst MPA governance (attributed to high dependency on cash that subsistence economy for livelihood security and to availability of cash rather than effective marine governance and management.

Supplementary Figure 1: Risk of bias for individual studies.

Randomised studies (Cochrane ROB 2)	Bias for randomisation	Bias for deviation from intended intervention	Bias for missing data	Bias for measurement of outcomes	Bias in selection of reported result	Overall ROB
Ang 2019						
Doble 2020						
Francis 2010						
Halperin 2018						
Li 2019						

Non-randomised studies (Cochrane ROBINS-I)	Bias for confounding	Bias for selection of participants into the study	Bias for classification of interventions	Bias for deviation from intended intervention	Bias for missing data	Bias for measurement of outcomes	Bias in selection of reported result	Overall ROB
Afele-Faamuli 2009*								
Aflague 2019*								
Alvarado 2019								
Aswani 2007*								
Bhurosy 2013*								
Binford 2012*								
Cannoosamy 2016								
deKorn 2017								
Fotu 2011*								
Goh 2017								
Hanson 2011*								
Kremer2011*								
Lwin 2020								
Pillay 2017								
Pinto 2014								
Preston 2013								
Trieu 2017								
Webb 2016								
White2006								

Key: green = low risk, yellow = moderate/some concern risk, red = high/serious risk, blue = critical risk.
*indicates the studies which applied a local food approach.

Supplementary Box 1: Search terms for Medline

Search identification number	Search terms	Results
1	(Anguilla.tw) OR (Antigua.tw) OR (Antilles.tw) OR (Aruba.tw) OR (Bahamas.tw) OR (Barbuda.tw) OR (Barbados.tw) OR (Belize.tw) OR (Bermuda.tw) OR (Caicos.tw) OR (Caledonia.tw) OR (Caribbean.tw) OR (Cayman.tw) OR (Comoros.tw) OR ("Cook Islands".tw) OR (Cuba.tw) OR (Curacao.tw) OR (Dominica.tw) OR (Dominican.tw) OR (Fiji.tw) OR (Grenada.tw) OR (Grenadines.tw) OR (Guadeloupe.tw) OR (Guam.tw) OR (Haiti.tw) OR (Jamaica.tw) OR (Kiribati.tw) OR (Lesotho.tw) OR ("Saint Lucia".tw) OR ("St. Lucia".tw) OR (Maarten.tw) OR (Madagascar.tw) OR (Maldives.tw) OR (Marshall.tw) OR (Martinique.tw) OR (Mauritius.tw) OR (Melanesia.tw) OR (Micronesia.tw) OR (Montserrat.tw) OR (Nauru.tw) OR (Nevis.tw) OR (Niue.tw) OR (Pacific.tw) OR (Palau.tw) OR (Papua.tw) OR (Polynesia.tw) OR (Principe .tw) OR (Kitts.tw) OR (Samoa.tw) OR ("Sao Tomé".tw) OR (Seychelles.tw) OR (Singapore.tw) OR ("small island developing states" .tw) OR (Solomon.tw) OR (Suriname.tw) OR (Timor-Leste.tw) OR (Tonga.tw) OR (Trinidad.tw) OR (Tobago.tw) OR (Tokelau.tw) OR (Turks.tw) OR (Tuvalu.tw) OR ("Puerto Rico".tw) OR (Marianas.tw) OR (Martinique.tw) OR (Vanuatu.tw) OR (Verde.tw) OR ("Saint Vincent".tw) OR ("St. Vincent".tw) OR ("Virgin Islands".tw)	113648
2 (these terms base on keywords from GBD dietary risk factors and synonyms for SSB used in another review on SSB tax (Backhoeler 2019)	Diet/ OR diet*.tw OR Nutrients/ OR nutrient.tw OR Food/ OR food.tw. OR Nutrition Surveys/ or Nutrition Assessment/ OR nutrition*.tw OR Sugar-Sweetened Beverages/ OR "sugar sweetened beverage$".tw OR SSB.tw OR Fruit/ OR fruit*.tw OR Vegetables/ OR vegetable*.tw OR Micronutrients/OR micronutrient.tw OR macronutrient.tw OR "dietary diversity".tw OR Whole Grains/ OR wholegrain*.tw OR Dietary Fiber/ OR fibre.tw OR legume*.tw OR pulses.tw OR nut.tw OR seed.tw OR milk.tw OR Red Meat/ OR red meat.tw OR processed meat.tw OR calcium.tw OR Fatty Acids, Omega-3/ OR Carbonated Beverages/ or carbonated beverage.tw OR soda*.tw OR Beverages/ OR Energy Drinks/ OR energy drink*.tw OR soft	3012651

	drink*.tw OR Seafood/ OR fish.tw OR seafood.tw OR Sodium, Dietary/ OR sodium.tw OR salt.tw	
3	assessment.tw OR intervention*.tw OR evaluation.tw OR experiment*.tw OR program*.tw OR strateg*.tw OR initiative.tw OR polic*.tw OR project.tw OR scheme.tw OR plan.tw OR task.tw OR method*.tw OR treatment.tw OR tool.tw OR education*.tw OR tax*.tw OR incentiv*.tw OR communit*.tw OR household*.tw	13368517
4	1 and 2 and 3	8775
5	2000:2020. (sa_year)	7422

Supplementary Box 2: Narrative overview of effectiveness of local and non-local food approaches

Effectiveness of local food approach to outcome-related components

All nine studies in Table 2 applied a local approach to outcome-related components. This included promoting locally produced food and traditional dietary behaviours such as traditional cooking techniques or foods of cultural significance (n=8),[S3, S5, S6, S13, S14, S20, S21, S24] or applying locally-relevant tools to outcomes measures. [S9] Five of these interventions included a practical food production component, such as teaching skills for planting and harvesting own produce. [S6, S13, S14, S20, S21]

Of the eight studies that specifically promoted locally produced food, four showed significant improvements in dietary intake and one study that did not measured dietary intake, showed significant improvement in nutrition knowledge. Two of the effective interventions that demonstrated improved dietary intake were garden-based nutrition interventions. One targeted pregnant women and children in rural Dominican Republic to improve consumption of locally produced food rich in Vitamin A. [S13] The intervention provided garden-based nutrition education, vegetable gardens and laying hens and assessed intake using a FFQ, to significantly increase consumption of any vitamin A rich food, and garden specific vitamin A rich foods in intervention than control communities. The second study aimed to encourage the return to traditional diets to prevent disease in Pohnpei (Federated States of Micronesia), through growing local food using container gardening, and classes on cooking and using charcoal ovens. [S14] This mixed-methods study took a unique approach in focusing on food source as part of their context-specific assessment of dietary intake – distinguishing between consumption of local and imported foods, and found significant increases in the consumption of local and imported fruit and vegetables, local and imported meat, local fish and seafood, imported starch/flour, and imported surgery drinks and foods (Supplementary Table 1).

A third effective intervention that used a local approach to improve dietary intake, was the implementation of Marine Protected Areas (MPAs) in the Solomon Islands. [S24] The study aimed to assess the impact of protecting fish stocks on food security for local communities. Authors observed variation in effectiveness of MPAs in protecting fish stocks, but residents in villages with effective MPAs had higher energy and protein intakes (particularly marine-derived) than those that had ineffective or no MPA. Poorest dietary protein/fat ratio was found in the village with the worst MPA governance, and this was attributed to availability of

and high dependency on cash over subsistence for livelihood security, rather than effective marine governance and management.

The final local intervention that was effective in improving dietary intake, was a quasi-experimental study in Mauritius that applied an educational approach to increase consumption of locally produced sources of calcium such as milk, fish and dark green leafy vegetables, amongst adults aged 40+ years.(S3)

Three other studies included a practical local food production component, similar to the first two garden-based studies described, but these were not shown to effectively improve diet. One of these studies was conducted in Guam, targeted school-aged children and involved the implementation of culturally adapted nutrition lessons at a summer camp. (S6) Local food production was promoted through skill acquisition and taught participants how to grow and cook their own produce using modern and traditional practices whilst emphasising the impacts of imported versus local food. The study used an adapted *WillTry* tool to assess dietary intake and 'willingness to try' various items, but showed no significant change in dietary intake, or willingness to try, post-intervention. S6) The other two were separate arms of the regional Pacific Obesity Prevention in Communities Project in Fiji (S21) and Tonga, (S20) which involved quasi-experimental studies of community and school-based interventions that included some emphasis on local food production and consumption through vegetable gardens or agricultural training, as a way of building capacity for schools and communities to create solutions to food insecurity.(S20) Despite these studies providing no evidence for significant effects on dietary intake, the Tongan study did have a significant effect on reducing purchasing of some unhealthy food items, including snack foods from a shop or takeaway. (S20)

One of the nine studies did not measure dietary intake but evaluated change in nutrition knowledge as the primary outcome measure. This study implemented culturally-appropriate strategies to educate adults in American Samoa about nutrition, and demonstrated an increase in knowledge about items such as high-fat and high-fibre foods post intervention. (S5)

Only one study, which was a randomised controlled trial conducted in Singapore, considered the unique nutritional composition of local food in their outcome measure, by analysing dietary records using an online nutrient analysis software which was derived from locally available foods.(S9) The intervention targeted overweight and obese pregnant women with a food coaching app that provided guidance on healthy choices and resulted in no significant changes to macro or micronutrient intakes.(S9) Although the intervention itself did not apply a local approach or focus on the consumption of locally produced foods, it is worth noting that this study was the only study to specifically acknowledge nutrient variation according to food source, and apply that to their analysis; however the findings reported in the manuscript are not specifically discussed in the context of this application.

Effectiveness of non-local food approach (n=15)

Twelve of these studies measured the impact of intervention on dietary intake. Two of these 12 studies were significantly effective, four showed some significant improvement on some, but not other, measures of dietary intake, and six showed no evidence to be effective.

The two studies that were effective, applied an education approach to teach adults about nutrition via lessons and educational materials. (S4, S15) Both were quasi-experimental studies conducted in the AIMS region, used FFQs to assess dietary intake outcomes and

demonstrated significant improvements in diet. One targeted housewives in Mauritius and significantly increased the number of servings of fruit and vegetables consumed compared to pre-intervention, [S4] and the other targeted patients and carers attending general outpatients clinic in Singapore with nutrition information, cooking demonstrations and provision of healthy food samples. [S15] The evaluation focused on wholegrain consumption and found a significant increase in frequency of consumption and purchasing of wholegrains. Both of these interventions also measured nutrition knowledge and showed significant improvements in knowledge scores post intervention.

The four studies that demonstrated mixed effectiveness included educational intervention, food provision and regulations on advertising and marketing. One study targeted hospital staff in Singapore to assess the impact of a plate displaying portion guidance compared to a normal plate and found increased vegetable and reduced carbohydrate proportion over six months, but no significant change in proportion of protein.[S2] One study evaluated a free school meals intervention in Puerto Rico. [S19] Using 24-hour recall method researchers found a significant improvement in nutrient intake for some (six of the 17) vitamins and minerals, but no significant improvements in macronutrient or sodium intake. A Trinidad-based study that used nutrition education to target fruit and vegetable intake in school-aged children, showed no significant association between intervention and fruit or vegetable intake in multivariable regression, but provided evidence that the intervention was associated with lower intakes of fried food, soda and food high fat salt and sugar, and improvements in nutrition knowledge.[S8] Similar to that study, the final study to show a mixed effect demonstrated significant reductions in the consumption of two out of three unhealthy items measured (chips, sweets, burgers), but no improvements in fruit and vegetable intake. This intervention, targeting children, was conducted in Singapore and implemented a national policy-level restriction on advertising and marketing of energy dense, nutrient poor food and drink to children.[S18] This study also measured the impact of intervention on purchase of specific food items, and provided evidence of a significant reduction in purchasing of selected processed/convenience foods, but no difference in fruit or vegetable purchasing.

Two of the six interventions that were ineffective at changing dietary intake, applied a support/guidance approach to empower participants to improve dietary intake [12, 15,], and one implemented school-based nutrition education. One targeted women aged 40-60 years in Trinidad and Tobago and implemented health-focused support meetings, specifically to promote fruit and vegetable intake, but demonstrated a reduction in fruit and vegetable consumption following the intervention.[S11] One targeted university students, in Puerto Rico, with support sessions that focused on stress reduction and mindfulness to improve diet and physical activity, but showed no significant reduction in consumption of the two variables assess, SSB or bread, between control and intervention groups. [S10] Another intervention that was ineffective, was the implementation of school-based nutrition and physical activity lessons in Puerto Rico that showed no significant effect on fruit, vegetable, fibre or energy intake, post intervention.[S7]

Finally, two community level interventions, one in Fiji and the other in Samoa, applied a range of interventions as part of salt reduction programmes.[S22, S23] The Fiji study involved multilevel intervention from individual to national policy level and targeted stakeholders across the food system from producers (advocating for reformulation) through to consumer education. [S22] In Samoa, a community level media campaign advocated for reducing salt intake. [S23] Both used non-randomised, uncontrolled pre/post-test designs and measured salt intake through 24-hour urinary salt excretion, and reported no significant reduction in mean salt intake. However, the Samoan study also measured nutrition (specifically salt-

related) knowledge, attitude and behaviour and showed some significant, positive effect on these outcomes.(S23)

The other four of the 15 studies that did not focus on locally produced food, did not measure dietary intake, but evaluated, and showed mixed intervention effects on, other outcomes; purchasing, (S1, S17) sales (S16) or nutrition knowledge (16). Two studies measured purchases from an online hypothetical grocery store and were based in Singapore; (S1,S17) one assessed the impact of a hypothetical tax of high calorie items on purchase and expenditure, (S17) and the other assessed the impact of various types of food labelling (information) on product choice.(S1) Both found statistically significant changes in some of the purchasing behaviours measured. The explicit tax was associated with a decrease in unhealthy food purchases, which was not shown in the implicit or fake tax arm of the study,(S17) and a text-only warning label was associated with a significant reduction in purchase of labelled products; however, there was no difference in total sugar purchased or total expenditure on high-sugar products.(S1)

One study evaluated the impact of a national 10% tax on sugar-sweetened beverages (SSBs) in Barbados and showed a significant decrease in grocery store sales of SSBs, which was primarily driven by a reduction in carbonated SSB sales, and an increase in sales of non-SSB including significant increase in sales of bottled water. (S16)

The final study, conducted in Trinidad and Tobago, measured the impact of a dietitian-led nutrition counselling intervention on nutrition knowledge, and targeted adults with Type 2 Diabetes.(S12) There was no significant difference in total knowledge score when comparing the intervention and control (no counselling) groups, but did demonstrate a significant improvement in attitude and practice scores amongst those who received the intervention compared to the control.

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