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A Systematic Scoping Review of the Impacts of Community Food Production Initiatives in Kenya, Cameroon, and South Africa

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Abstract

Background—Even before the COVID-19 pandemic, one in two people in Africa were food insecure. The burden of malnutrition remains high (e.g. childhood stunting, anaemia in women of reproductive age) or are increasing (e.g. overweight and obesity). A range of coordinated actions are required to improve this situation, including increasing local food production and consumption. The aim of this review was to provide a systematic and comprehensive overview of recently published research into the health, social, economic, and environmental impacts of community food production initiatives (CFPIs) in Kenya, Cameroon and South Africa.

Methods—We searched eight electronic databases covering health, social, environmental, economic and agricultural sciences. Primary research studies published from 1 January 2014 to 31 December 2018 were considered. Data on geographic location, study design, type of CFPI and the impacts assessed were abstracted from eligible articles.

Findings—We identified 4828 articles, 260 of which required full-text review and 118 met our eligibility criteria. Most research was conducted in Kenya (53.4%) and South Africa (38.1%). The

categories of CFPIs studied were (in order of decreasing frequency): crop farming, livestock farming, unspecified farming, fisheries, home / school gardens, urban agriculture, and agroforestry. The largest number of studies were on the economic and environmental impacts of CFPIs, followed by their health and social impacts. The health impacts investigated included food security, nutrition status and dietary intake. One study investigated the potential impact of CFPIs on non-communicable diseases. Over 60% of studies investigated a single category of impact. Not one of the studies explicitly used a theoretical framework to guide its design or interpretation.

Conclusions—Our findings on research studies of CFPIs suggest the need for a greater focus on interdisciplinary research in order to improve understanding of the relationships between their health, environmental, economic, and social impacts. Greater use of explicit theoretical frameworks could assist in research design and interpretation, helping to ensure its relevance to informing coordinated intersectoral interventions and policy initiatives.

Keywords

Community Food Production Initiatives; Kenya; Cameroon; South Africa; food security; triple burden of malnutrition; Food and nutrition security; food production; environment and public health

1 Introduction

Diet, nutrition and food insecurity in Sub-Saharan Africa remain major public health concerns, with its people being some of the most nutritionally insecure in the world (1). Factors compounding the risk of malnutrition and poor health are conflict, climate variability, poor infrastructure, and a dietary transition towards processed and ultra-processed foods that are energy dense as well as high in refined sugars, saturated fats, and salt (2). This shift in dietary patterns, together with a decrease in physical activity, contribute to a rise in overweight and obesity that drives an increase in non-communicable diseases (NCDs) such as diabetes, cardiovascular disease and certain types of cancer (3). A shift in eating patterns, often attributed to urbanization and unhealthy lifestyles (4), frequently implies foods which are not meeting micronutrient needs and are driving what is known as a triple burden of malnutrition (TBM) - the coexistence of undernutrition, overnutrition and micronutrient deficiency (5).

The global burden of disease attributable to diet and nutritional status is disproportionately greater in low-and middle-income countries (LMICs) (3). The World Health Organization (WHO) estimates that in Africa, 27% of adults aged over 20 years are overweight and 8.0% are obese (6). At the same time, hunger is mounting in almost all African sub regions, making it the region with the highest prevalence of undernourishment at nearly 20% (1). Almost one in three (30%) children in Africa aged under 5 show evidence of stunting of growth as a result of poor nutrition. In women of reproductive age, over a third (38%) have anaemia (7).

Associated with these high rates of malnutrition are high levels of food insecurity, and even before COVID-19 these levels were increasing (8). In 2018 it is estimated that one in five (21.5%) Africans were severely food insecure and one in two (52.5%) were moderately or

severely food insecure (8). Climate change, conflict and economic downturns are core underlying drivers of food insecurity (8). Sadly, the impact of COVID-19 is expected to add substantially to the numbers of people experiencing food insecurity. Indeed, the World Food Programme warns that those suffering from acute hunger worldwide could double (9). Food shortages have been intensified by the lockdown measures and restrictions on trade flow. The impact on food systems has disproportionately affected the African continent. (9).

Improving food security and decreasing the burdens of malnutrition in African countries requires coordinated actions across the food system. One broad category of action is supporting increased local food production and consumption, not only as a means to improve food security and nutrition but also for other potential benefits, including economic, social and environmental.

The systematic scoping review reported in this paper has been undertaken as part of a programme of work into the upstream determinants of, and potential population level interventions to improve, diet and physical activity in Africa and the Caribbean. The aim of this review is to provide a systematic and comprehensive overview of the published evidence on the health, social, economic and environmental impacts of community food production initiatives (CFPIs) in Kenya, Cameroon and South Africa. In meeting this aim, it is intended that the review will help to inform further research, including new interrogation of the published literature, such as through full systematic reviews, and new primary research. This review complements and builds on the methodology of a similar systematic scoping review of research conducted in Small Island Developing States (SIDS) (11).

2 Methods

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidance for scoping reviews (12, Appendix A). As appropriate for a scoping review, the protocol (Appendix B) was developed iteratively, informed by the results of initial literature searches, consultation with the wider project team and lessons learnt from previous work (11).

Key terms and definitions

In accordance with the NOVA classification criteria and in line with the review undertaken in SIDS, CFPIs were defined as approaches to improving food and nutrition security that are (a) owned and managed locally; and (b) produce either fresh or minimally-processed foods for local consumption. This definition includes agriculture of all types (livestock, crop, etc), home or backyard gardening, aquaculture and fishing (11, 12).

Choice of countries

The African countries chosen as the focus for this scoping review work are part of the Global Diet and Activity (GDAR) network (13), which is a global health partnership whose overall goal is to identify and intervene on the upstream determinants non-communicable diseases. GDAR is coordinated from the University of Cambridge, UK, with partners in Cameroon, Kenya and South Africa. GDAR also includes partners in the Caribbean, and as

part of a related project a similar systematic scoping review of studies on the impacts of CFPIs in Small Island Developing States was undertaken (11).

Identifying studies

A search was conducted from 1 to 6 May 2019 in the following databases: MEDLINE (via PubMed); EMBASE; CINAHL; Web of Science for: Conference Proceedings Citation Index, Science Citation Index Expanded, and ISI (Science Citation Index); SCOPUS; ASSIA (Applied Social Sciences Index and Abstracts); Econlit; AGRIS (hosted by FAO); PubAg (United States Department of Agriculture); AFROLIB (WHO Regional Office Database for Africa). The search was not restricted by language, but it excluded articles published before January 2014 and after December 2018. This timeframe was informed by our interest in the current status of published research in this area, and a pilot study was conducted to better understand the specificity of the criteria, observe any potential discrepancies between screeners and better understand the approximate number of screeners needed to complete both title and abstract and full text screening. A description of the pilot study which informed the search strategy is listed in Appendix C.

Study selection and inclusion exclusion criteria

Citations identified by the database search were downloaded into the online bibliographic database, Rayyan (Qatar Computing Research Institute, Data Analytics, Doha, Qatar). Results were screened independently based on title and abstract by 14 assessors – seven pairs, ensuring 100% of documents were double screened against the inclusion and exclusion criteria outlined in Table 1. Conflicts were resolved by discussion with a third-party reviewer. If a document did not explicitly indicate the inclusion criteria, an inclusive approach was taken, and it was considered for full-text screening. Full-text screening was double screened by 14 assessors using RedCap software (Research Electronic Data Capture), which also facilitated the data abstraction.

Data charting and synthesis

Full-text screening was conducted alongside data abstraction. Each document was examined stepwise as follows: (i) Is the publication primary research?; (ii) Does the publication concern some aspect of food production within the geographical area of interest?; (iii) Is the food production owned or managed locally?; (iv) Is the food predominantly produced for local consumption?; (v) Does the publication describe health, social, economic or environmental impacts of CFPIs?

Only those documents that were affirmative (“yes”) for all five screening questions above, were included in the review. The data abstraction form (Appendix D) for eligible articles included details on the impacts assessed, study methods used, and whether a theoretical framework on the proposed relationships between the initiative and outcomes was presented.

In line with the scoping review methodology, study quality was not assessed nor were meta-analyses performed (14). In addition to the descriptive narrative, the results were summarised and presented in tables.

3 Results

A total of 4842 articles were identified from eight databases. After removing duplicates, 4595 articles were screened at title and abstract level. Of these, 3790 articles (82.5%) did not meet the inclusion criteria. There was disagreement between reviewers for 687 articles (14.9%), and after discussion with a third reviewer, 142 of these were included. Thus, 260 articles were eligible for full text screening. Of these, 118 records were included in the review (Figure 1) (15–132)

Of the 118 studies included for full-text review, over half of the research was conducted in Kenya (n= 63 studies; 53.4%), followed by South Africa (n = 45 studies; 38.1%) and Cameroon (n=10 studies; 8.5%). The research applied a range of quantitative (n = 63 studies; 53.4%), qualitative (n = 19 studies; 16.1%) and mixed method (n = 36 studies; 30.5%) approaches to evaluate the impacts of CFPIs. A majority of the studies had a cross-sectional design (n = 70 studies; 59%). Structured interviews, focus group discussion, and interviewer and self-completion questionnaires were the most common methods of data collection in assessing the impacts of CFPIs.

Aspects of study design and data collection methods are described as appropriate in the detailed sections on the types of impacts that were assessed.

Types of CFPIs by country

Five major types of CFPIs were identified in collating the results: farming, fisheries, gardens, urban agriculture and agroforestry. Farming was further categorized by crop, livestock and unspecified (Table 2).

The most commonly evaluated CFPI was crop farming (n = 59 studies; 50.0%) and included a range of impacts across all three countries. Crop farming mainly consisted of smallholders and focused on a variety of crops, with maize most commonly specified (20,22,27,30,33,40,55,58,65,132). Livestock farming was only identified in Kenya and South Africa, with seven studies (25.9% of the 27 studies reporting livestock farming) focused on dairy farming (17,29,38,40,52,62,79).

Studies identifying gardens as a CFPI were predominantly from South Africa (87.5%), as were studies focusing on urban agriculture (80%). In contrast, studies focused on fisheries were predominantly conducted in Kenya (66.7%). Agroforestry was the least reported CFPI, with only two studies identified in Kenya.

Impacts of CFPIs by country

In collating the results, health, economic, environmental and social impacts of CFPIs were observed. Most studies examining impacts of CFPIs focused on the economic impact (n = 80, 67.8%), followed by environmental impacts (n=48, 40.7%) and health impacts (n=47, 39.8%). Social impacts (n = 27, 22.9%) were least examined. One study, from Kenya, examined all four impacts, 15 studies (12.7%) evaluated three impacts, 30 studies (25.4%) assessed two impacts, and 72 studies (61.0%) only examined one impact. The studies that

evaluated multiple impacts most commonly looked at economic and health (n=21), economic and social (n=20) and economic and environmental (n=19).

Kenya

The 68 studies conducted in Kenya assessed a total of 123 different impacts across the four impact categories. About 44% of the studies (n=30) evaluated the health impacts of CFPIs which were mainly concentrated around crop and livestock farming. About 73% of the studies (n=46) evaluated economic impacts with over half of those impacts coming from crop farming CFPIs. Of these studies, 28 (41.2%) focused on only one impact category, whereas the others focused on a multitude of impacts – primarily economic and health (n=17), and economic and environmental (n=16).

Cameroon

In Cameroon, 10 studies looked at 16 health, social, economic and environmental impacts (Figure 2). All of the CFPIs explored in these studies were centred around farming – with one study in the fisheries category looking exclusively at fishponds owned by household farms (109). Health impacts were least evaluated, (n=2, 20.0%), while economic impacts were most prominent, with seven of 10 studies (70.0%) discussing economic impacts of CFPIs. A majority of these studies were looked at in isolation of the other impacts, with seven out of 10 studies only assessing one impact.

South Africa

The 45 studies from South Africa looked at 63 health, social, economic and environmental impacts (Figure 2). As with studies in both Kenya and Cameroon, the majority of impacts were found in crop farming. Economic impacts were the most commonly assessed (n=27; 42.9%). There were 15 health impacts evaluated (23.8%), mainly in gardens (76,78,117–119) and crop farming initiatives (16,80,106,126,127).

Detailed description of types of impacts

The four broad impact categories – health, social, economic, environmental – were further divided into sub-categories based on the specific impacts that were assessed.

The distribution of impacts evaluated across 118 included studies show that the most reported impact sub-category overall was under economic impacts. This was the sub-category of household income & wealth and it was reported by 15 studies in Kenya, 9 in South Africa and 3 in Cameroon, which accounts for 22.8% of studies (n=27) overall.

Economic welfare & security was reported as an impact in 26 studies (22.0%), followed closely by production/catch/yield (Economic) and agrobiodiversity (Environmental) both discussed within 23 studies each (19.5%).

Health

The types of health impacts that were assessed covered seven sub-categories. In order of frequency, they were food security, nutrition status, dietary intake, malnutrition, communicable diseases, indirect benefits and NCDs (Table 3). Food security was the leading

health impact of CFPIs assessed, with 17 studies evaluating it (38.4% of the 44 studies reporting on health impacts). These studies most commonly looked at food security as a standalone health impact, where the premise of the study was to assess food security within the household as a result of a particular programme (47,96,118) or as a case study or evaluation of current community food production practices (16,21,46,67,74,121). When food security was evaluated in conjunction with other health impacts, they were almost exclusively nutrition status, dietary intake or malnutrition (18,21,48,71,78,117,127).

Both nutrition status (34.1%; n = 15) and dietary intake (31.8%; n = 14) were also prominent health impacts evaluated.

Social

Social impacts covered five categories: i) gender empowerment, ii) knowledge transfer and capacity building, iii) social capital, iv) education, and v) job opportunities (Table 4). Of these, gender empowerment, knowledge transfer and social capital were the most often studied. Of the 24 studies that evaluated social impacts of CFPIs, 31 social impacts were assessed.

Gender empowerment, knowledge transfer and capacity building, and social capital were evaluated in nine studies (37.5%) each, often overlapping. The nine studies discussing gender empowerment assessed the influence and impact of CFPIs on empowering women. Social capital was the social impact most often evaluated alone, with six studies (66.7% of the nine studies reporting on social capital) reporting it exclusively.

Job opportunities and education were only explored in studies from Kenya, with education linked to food security and nutrition status (67,91) and a positive impact on job opportunities within a community because of a CFPI (47,51). Gender empowerment in Kenya was the most reported social impact sub-category overall, evaluated by six studies (5.1%). Knowledge transfer & capacity building was the most prominent impact sub-category in South Africa (n=4 studies), while social capital was most studied in Cameroon (n= 2 studies).

Economic

Economic impacts covered six categories. In order of frequency, they were household income and wealth, economic welfare and security, production/catch/yield, profitability and revenue, cost, and technical efficiency. Of the 73 studies that evaluated economic impacts of CFPIs, 97 economic impacts were assessed (Table 5).

Twenty-seven of these studies (37.0%) evaluated household income and wealth, though economic welfare and security (n = 26; 35.6%) and production/catch/yield (n = 23; 31.5%) were the most prominent impacts assessed. Economic welfare and security often overlapped with both household income and wealth (n = 7 studies) (35,54,55,63,90,114,124) and with production/catch/yield (n = 6 studies) (16,49,82,102,124,132), showing the diverse nature of economic welfare and security, and the possible link to other economic impacts of CFPIs.

Environmental

Environmental impacts covered four categories. In order of frequency, they were agrobiodiversity, water availability, soil quality and greenhouse gases, and air pollution. Of the 40 studies that evaluated environmental impacts of CFPIs, 48 environmental impacts were assessed (Table 6).

The most prominent environmental impact was agrobiodiversity, with 23 studies (57.5%) evaluating this impact, while the impact that was least assessed was greenhouse gases and air pollution, with six studies (15%). Agrobiodiversity often encompassed conservation initiatives and diversifying species or crops, which were intended to improve agrobiodiversity. CFPIs assessing agrobiodiversity were often programmes and initiatives working with communities to think and act longer term and more sustainably, such as interventions at a household level to support sustainable self-provisioning of crops, livestock or fishing as a source of affordable nutrients (45,50,122). Studies reporting assessments of practices already in place as opposed to new initiatives demonstrated the negative impact on agrobiodiversity, such as loss of crops and livestock (46), changes in fish populations because of overfishing (66) and changes of land use or cover (87,89).

South Africa had the highest proportion of studies that evaluated urban agriculture initiatives (n=4 of 5 (80%)). These studies aimed to demonstrate that urban agriculture is a good model for socioeconomically marginalised populations with the potential to reduce negative environmental impacts (15,41,45,119).

Studies assessing the impact of CFPIs on water availability (n = 11; 27.5%) evaluated both water accessibility and quality, such as pressure exerted on water resources and land by farmers (86) or the increased water pollution (95). Soil quality was discussed in the context of soil fertility from use of land (22,41) and all eight studies assessing soil quality were crop or livestock farming CFPIs.

Theoretical Frameworks

None of the studies reviewed made explicit use of a theoretical framework on the relationships between the CFPIs and the impacts being studied to guide their hypotheses and analyses. Similarly, not one study derived a theoretical framework, or interpreted their findings within the context of an existing theoretical framework, on how CFPIs impact health, economic, social and environmental well-being.

4 Discussion

Our aim was to provide a systematic and comprehensive overview of research evidence on the health, social, economic and environmental impacts of CFPIs in Cameroon, Kenya and South Africa published over a recent 5-year period (2014 to 2018). This was undertaken to complement and to help inform a programme of work into the upstream determinants of diet and related non-communicable diseases in these three countries (13). We found a large amount of published research studies, with there being significantly more studies and therefore CFPIs and impacts measured, in Kenya and South Africa than in Cameroon. The volume of publications suggests a significant interest in community initiatives and a

recognition of the potential importance of CFPIs for health, social, economic and environmental well-being in Cameroon, Kenya and South Africa.

However, there was a relative lack of studies in certain areas and the majority of studies were cross sectional in design, unable therefore to properly investigate causal relationships. Findings indicate a predominance of research focusing on the environmental impact of CFPIs, and very limited evidence of CFPI impact on health and social wellbeing, particularly NCDs, education and job opportunities. The lack of evidence on relationships to the risk of NCDs across all countries – with only 1 of the 118 studies evaluating NCDs – is significant given the increasing burden of these conditions in Sub-Saharan Africa (2,6). This also highlights the need for larger prospective studies that look not only into determinants but also disease and health end points and emphasises that it is critical that future research also focuses on health and social implications of CFPIs if we want to make sure that NCDs-related SDG targets are met for these countries.

The evidence collated in this review supports the argument that community food production programmes and initiatives benefit health, economic and social wellbeing and support sustainability within the environment. Food security problems are often dealt with in silos, with relevant sectors and institutions often not collaborating to ensure their policies consistently support food security (1). The fact that only 46 studies (38.9%) in this review covered more than one type of impact suggests that there is room for more inter or transdisciplinary research to inform policy aimed at improving food security and nutrition. It is noteworthy that none of the identified studies explicitly used or proposed a theoretical framework on the relationships between CFPIs and impacts to guide their study design or the interpretation and presentation of their findings.

The FAO Africa Regional Overview of Food Security and Nutrition indicates that coordinated food system wide policy initiatives, including in local food production, handling, storage and processing, food trade and marketing, consumer demand, food preparation and preferences should be explored as policy tools, in order to identify the most effective ways to support healthy diets and wellbeing at a national level. The disproportionate effect that COVID-19 is having across countries in Africa on food insecurity has amplified the importance of understanding the evidence that exists on the role of CFPIs in tackling food insecurity and malnutrition and where new research is required.

As research in this area further evolves, there is also the potential to construct coherent and comprehensive methodological approaches for monitoring and evaluating CFPIs and their associated impacts, underpinned by bespoke and well-founded causal frameworks that are tested and refined iteratively as evidence grows.

This systematic scoping review has identified a number of areas for potential further exploration, including full systematic reviews focussed on specific areas, such as how CFPIs relate to dietary quality and other outcomes in local populations.

Strengths and Limitations

The main strength of our review is the extensive coverage of the state of research. The broad range of disciplines covered as well as the extensive and comprehensive search strategy that was undertaken across health, social sciences, economics, agriculture and regional databases greatly reduced the risk of bias of skewing screening towards a particular discipline. The databases were identified with input from a multidisciplinary team, with a diverse range of backgrounds including public health nutrition, social science, health economics and agriculture. Further strengths of our review include the approach taken for literature screening and data abstraction, where two assessors reviewed each article. This increased the likelihood of literature that met the inclusion criteria being included in the final review.

We acknowledge that we used the term ‘impact’ as a ‘catch all’ that includes potential impacts, outcomes and associations. As is the case with a systematic scoping review, we did not attempt to evaluate the risk of bias or quality of the studies. Rather we aimed to provide an overview of the literature and the potential impacts as reported by the authors. Two further limitations are that firstly we only included research from 3 countries, chosen as they are part of a larger programme (13). A second limitation is that our findings essentially provide a recent ‘snapshot’ of published research studies in this area, being limited to a 5-year period and to published, but not grey, literature.

5 Conclusion

In this systematic scoping review, we have summarised published research from a broad range of disciplines into the impacts of CFPIs in three African countries. The evidence we found was largely limited to descriptive studies focussing on a single outcome or impact measure. These studies have been undertaken within the context of the urgent need for coordinated food system wide interventions to address the very high and growing levels of food insecurity and all types of malnutrition. This need has become even more acute and urgent with the disruptions to food systems caused by the COVID-19 pandemic.

While we cannot claim the countries reported on are representative of other parts of Africa, we believe that what we present provides an interesting and useful snapshot that can help to guide further work. We found a large number of studies across a broad range of impacts, which suggests that more focussed, in-depth, evidence appraisals in the form of full systematic reviews would be worthwhile. However, we also found that the vast majority of studies were cross sectional, thus unable to investigate longitudinal relationships, and that they typically had a narrow, often single, disciplinary focus. In addition, none of the studies we identified made use of an explicit theoretical framework on the links between CFPIs and the outcomes of interest.

The need for transdisciplinary research is emphasized in a 2015 IPES Food report (134), within which the authors make the case for a ‘new transdisciplinary science of sustainable food systems.’ Our scoping review, while only representing a ‘snapshot’ in three countries, suggests that such research in these countries is at best infrequent. Ideally, the design of such research should be guided by the use of explicit theoretical frameworks that hypothesize the relationships between CFPIs and their impacts (133,134).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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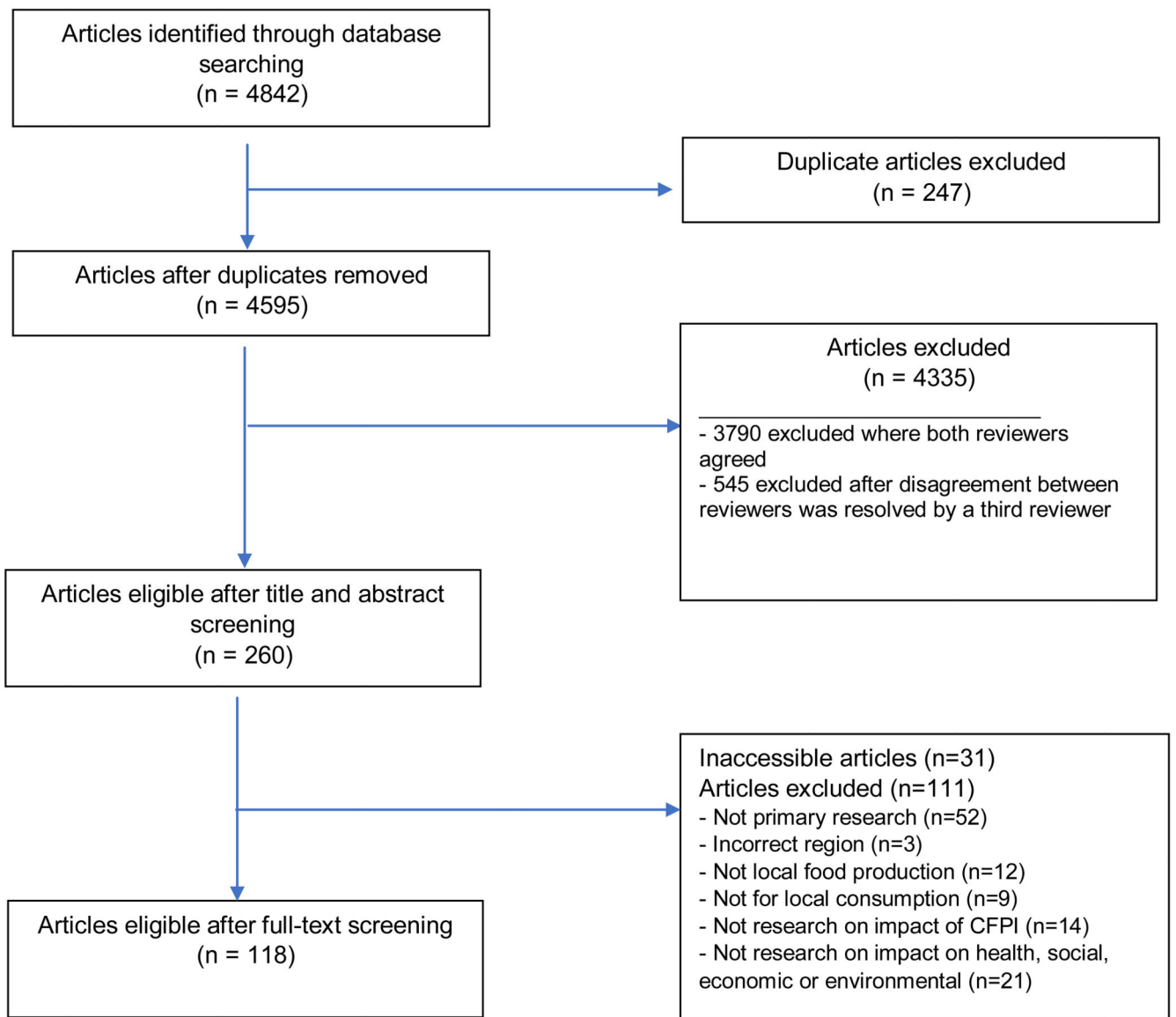


Figure 1. Flowchart of the literature search and screening

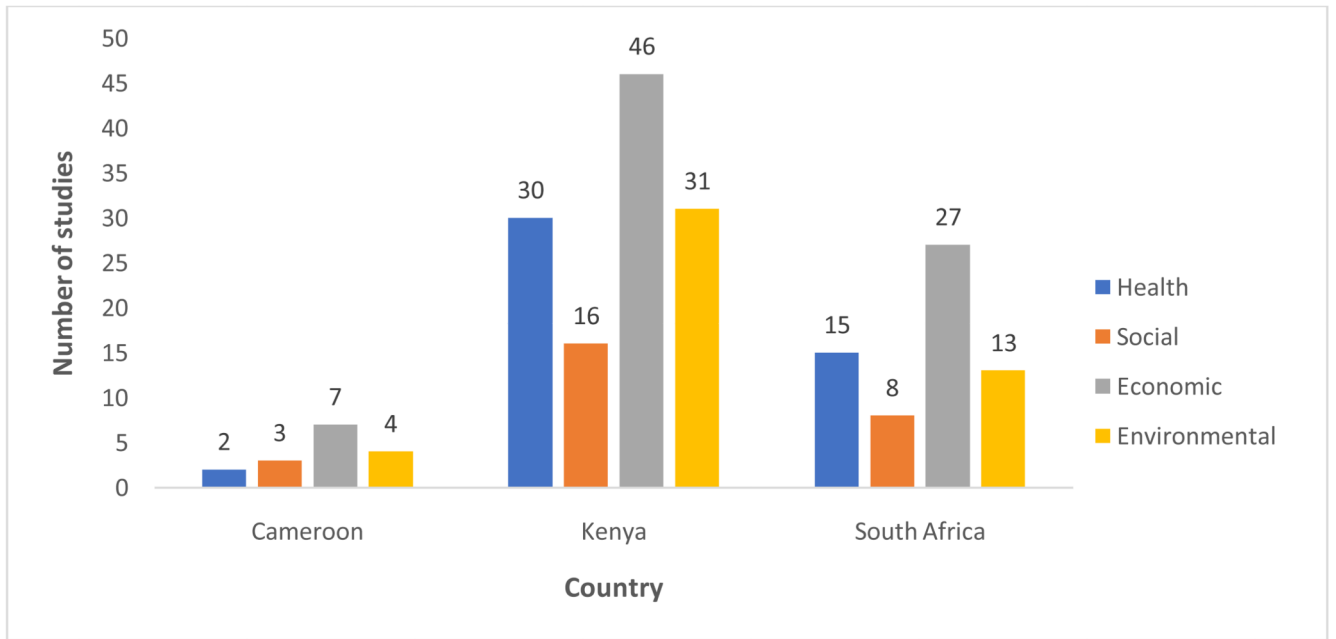


Figure 2. Number of impact categories by country

Table 1
Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Study type	Primary research	Non-primary research, including systematic reviews and meta-analyses
Country of research	Cameroon (Cameroun), Kenya and/or South Africa	All except Cameroon (Cameroun), Kenya and/or South Africa
Outcome	Study examines health, social or economic impact of community-based food production initiatives	Focused specifically on treatment or intervention targeting a diagnosed illness, disease or condition
Timeframe:	Published between January 2014 and December 2018	Published before January 2014 and after December 2018

Table 2
Matrix showing the number and type of CFPIs by country

Country (number of studies)	Types of CFPI						
	Urban Agriculture	Farming-Crop	Farming-Livestock	Farming-Unspecified	Fisheries	Agroforestry	Gardens
Cameroon (10)	0	6	0	3	1	0	0
Kenya (68)	1	32	18	6	8	2	1
S. Africa (50)	4	21	9	6	3	0	7
Total (128)	5	59	27	15	12	2	8

NB: the figures denote the number of studies in each category, with some studies including more than one type of CFPI. The shade of colour represents the quantiles based on total distribution of studies shown in table. The darker the colour, the higher the number of studies.

Table 3
Matrix showing number and types of health impacts of CFPIs investigated by country

Country (no. studies)	Types of Health Impacts						
	Nutrition status	Dietary intake	NCDs	Communicable Disease	Malnutrition	Food security	Indirect benefits
Cameroon (2)	1	0	0	0	0	1	0
Kenya (39)	10	9	0	3	5	10	2
S. Africa 21	4	5	1	2	2	6	1
Total (62)	15	14	1	5	7	17	3

NB: the figures indicate the number of studies in each category, with some studies including more than one category. The shade of colour represents the quantiles based on total distribution of types of impacts. The darker the colour, the higher the number of studies.

Table 4
Matrix showing types of social impacts of CFPIs investigated by country

Country (no. studies)	Types of Social Impacts				
	Gender empowerment	Knowledge transfer & capacity building	Education	Job opportunities	Social capital
Cameroon (3)	1	0	0	0	2
Kenya (19)	6	5	2	2	4
S. Africa (9)	2	4	0	0	3
Total (31)	9	9	2	2	9

NB: the figures indicate the number of studies in each category, with some studies including more than one category. The shade of colour represents the quantiles based on total distribution of types of impacts. The darker the colour, the higher the number of studies.

Table 5
Matrix showing types of economic impacts of CFPIs investigated by country

Country (no. studies)	Types of Economic Impacts					Cost	Profitability & Revenue
	Household income & wealth	Economic Welfare & security	Production/ Catch/ Yield	Technical efficiency			
Cameroon (8)	3	2	2	1		0	0
Kenya (54)	15	11	16	1		3	8
S. Africa (35)	9	13	5	1		1	6
Total (97)	27	26	23	3		4	14

NB: the figures indicate the number of studies in each category, with some studies including more than one category. The shade of colour represents the quantiles based on total distribution of types of impacts. The darker the colour, the higher the number of studies.

Table 6
Matrix showing types of environmental impacts of CFPIs investigated by country

Country (no. studies)	Types of Environmental Impacts			
	Agrobiodiversity	Soil Quality	Water availability	Greenhouse gases & pollution
Cameroon (6)	3	0	2	1
Kenya (31)	15	4	8	4
S. Africa (11)	5	4	1	1
Total (48)	23	8	11	6

NB: the figures indicate the number of studies in each category, with some studies including more than one category. The shade of colour represents the quantiles based on total distribution of types of impacts. The darker the colour, the higher the number of studies.