Agriculture for improved nutrition: The current research landscape

Rachel Turner, Corinna Hawkes, Jeff Waage, Elaine Ferguson, Farhana Haseen, Hilary Homans, Julia Hussein, Deborah Johnston, Debbi Marais, Geraldine McNeill, and Bhavani Shankar

Abstract

Background. *Concern about food security and its effect on persistent undernutrition has increased interest in how agriculture could be used to improve nutritional outcomes in developing countries. Yet the evidence base for the impact of agricultural interventions targeted at improved nutrition is currently poor.*

Objective. *To map the extent and nature of current and planned research on agriculture for improved nutrition in order to identify gaps where more research might be useful.*

Methods. *The research, which was conducted from April to August 2012, involved developing a conceptual framework linking agriculture and nutrition, identifying relevant research projects and programs, devising and populating a "template" with details of the research projects in relation to the conceptual framework, classifying the projects, and conducting a gap analysis.*

Results. *The study identified a large number of research projects covering a broad range of themes and topics. There was a strong geographic focus on sub-Saharan Africa, and many studies were explicitly concerned with nutritional impacts on women and children. Although the study revealed a diverse and growing body of research, it also identified research gaps. Few projects consider the entire evidence chain linking agricultural input or practice to nutritional outcomes. There is comparatively little current research on indirect effects of agriculture on nutrition, or the effect of policies or governance, rather than technical interventions. Most research is focused on undernutrition and small farmer households, and few studies target consumers generally, urban populations, or nutrition-related noncommunicable diseases. There is very little work on the cost-effectiveness of agricultural interventions.*

Conclusions. *On the basis of these findings, we make suggestions for research investment and for broader engagement of researchers and disciplines in developing approaches to design and evaluate agricultural programs for improved nutrition.*

Key words: Agriculture, funding, global policy, malnutrition, nutrition

Introduction

Undernutrition, particularly among women and children, is a major threat to health in developing counties [1]. As the basis for food production, agriculture clearly makes a contribution to nutrition. Indeed, agricultural growth has been shown to increase the incomes of the very poorest [2] and improve child nutrition [3] more effectively than other sources of economic growth.

However, despite agricultural growth, undernutrition persists in low- and middle-income countries [4]. Until recently, most efforts to address this have focused on direct "nutrition-specific" interventions, such as food fortification and supplementation, rather than on indirect or "nutrition-sensitive" interventions, such as those related to agriculture. Yet, although nutrition-specific interventions have been found to be effective and cost-effective at reducing some of the burden of undernutrition, interventions on the underlying determinants of poor nutrition, including agriculture, are required if undernutrition is to be eliminated [5].

This realization has led to a wave of new governmental and nongovernmental organization-based

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agriculture–nutrition programs as well as research. However, two recent systematic reviews of agricultural interventions directed specifically at improved nutrition, one focusing on children [6] and the other on women and young children [7], reveal limited evidence of impact and a need for more and better-designed research. Although it appears that more research is currently being conducted in this field, there is little information on the pattern, design, and direction of these research efforts that might help determine whether it is being directed with greatest effect toward identifying appropriate agricultural interventions for improved nutrition.

It was with this in mind that research was commissioned to map current and planned research on agriculture for improved nutrition to identify gaps where more research might be useful. This, it was hoped, would assist the development of a more coherent framework for research in this area, which could be drawn upon by a range of partners. In addition, the project aimed to link researchers so that they might share methods and experience and improve the overall quality of research on agriculture for improved nutrition.

Methods

A mapping and gap analysis study was conducted between April and August 2012 by an interdisciplinary team of experts in agriculture, development, economics, health, and nutrition.

The first stage of the research involved developing a conceptual framework linking agriculture, food, and nutrition (**fig. 1**). This framework was used to characterize research projects in a comparable way and to analyze the gaps in research. Information about each project was captured in a template based on the boxes in the framework. The framework was also used to develop inclusion criteria for the types of projects which were mapped (**box 1**). All projects that had a stated objective of improving nutrition, even if nutritional status was not explicitly measured, and that included an agricultural component, were deemed relevant. Only current and planned research projects were included, thereby excluding most published research.

A list of eligible research projects was obtained through consultation with individual researchers, academic organizations, nongovernmental organizations (NGOs), funders, and others working or interested in agriculture–nutrition research (**box 2**). A total of 135 organizations were included in a contacts list, 131 of which were contacted directly by e-mail.

The template was completed by the research team for each project on the basis of information provided by individual researchers, documentation provided by donors or information available online, or through a combination of these methods. One hundred of the 151 projects identified were "fully mapped," meaning

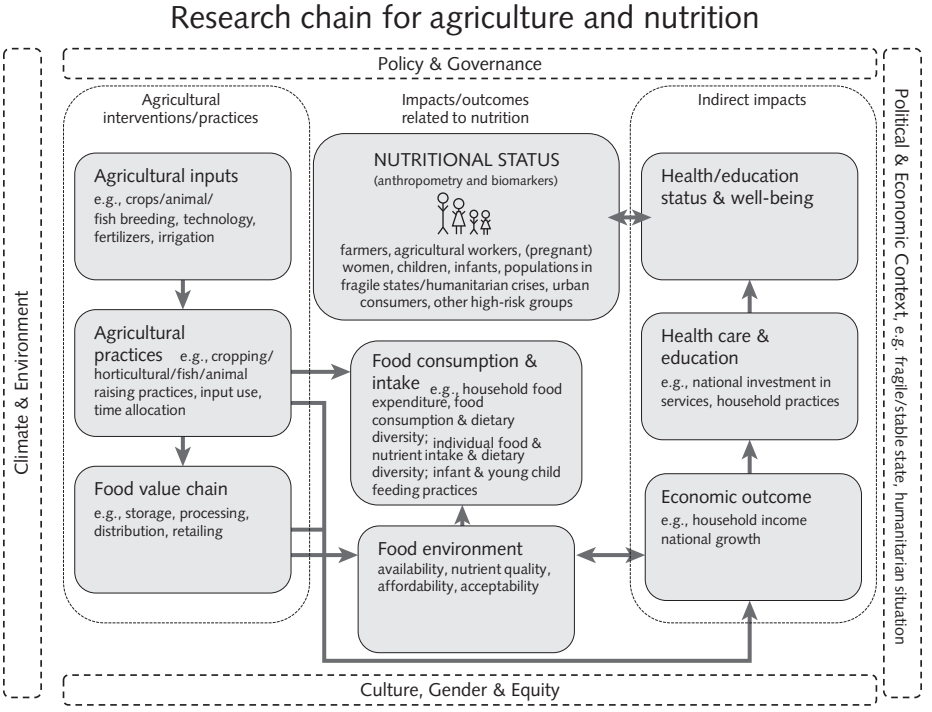

FIG. 1. Conceptual framework for research on agriculture for improved nutrition

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there was sufficient information available to complete the full template.

A mapping and gap analysis was conducted by characterizing the range of projects, grouping them according to theme and research type, and examining the extent to which the different pathways through the conceptual framework were explored.

A detailed account of the methodology is available [8].

Conceptual framework

The conceptual framework was developed by a team comprising agriculture, nutrition, and health specialists. Several frameworks already exist for linking agriculture and nutrition [9–10]. Drawing on existing frameworks [9–11], this framework incorporates both the direct links (e.g., the production and then consumption of nutritious food) and the indirect links (e.g., through income and health) between agriculture and nutrition. Where it is distinctly different from previous frameworks is that it conceptualizes the linkages as a *chain*, so enabling identification of what researchers are measuring along the chain, and accommodating the impacts of agriculture on nutrition on all groups (e.g., rural and urban, those inside and outside the food value chain, agricultural and nonagricultural households).

The framework shown in **figure 1** presents the different pathways that link agricultural practices or interventions with nutrition-related outcomes either directly or indirectly. Change in nutritional status is the endpoint and is placed centrally in this framework. Measurements of changes in "nutritional status" using anthropometry or biomarkers are shown as the endpoint of a pathway of research, providing the strongest evidence that an agricultural practice or intervention affects nutrition. Changes in the "food environment" and "food consumption and intake" describe the pathway that links agricultural change to changes in nutritional status, but provide a different level of evidence of a change in nutritional status than its direct

BOX 1. Inclusion and exclusion criteria

Inclusion criteria

The research must:

- Be focused on low- and middle-income countries
- Have a stated objective of contributing to improved nutritional outcomes (even if food intake or nutritional status is not explicitly considered or measured)
- Target a potential interaction between agriculture and nutrition, such as agricultural interventions to improve nutrition and their evaluation, the influence of agricultural practices and food value chains on nutrition, governance and policy processes through which agriculture and nutrition are linked, and links between agricultural productivity and/or growth and nutrition at a macro scale
- Include an agricultural component, even when the main focus is on the food value chain, e.g., be related back in some way to food production (local farms/ farmers/fishermen) and not just the end of the supply chain, such as retail, catering, food promotion, or labeling
- Include an assessment of the relationship between agriculture and a measure of food consumption and/or nutritional status, or, at the very least (and provided the project has a stated nutritional objective), with the food environment
- Be current or planned (next 5 years), though the start date may be in the past
- Have a research evaluation component
- Constitute a major research activity (i.e., be of a reasonable size)

Exclusion criteria

- Research on foods with no agricultural component (e.g., fortification)
- Research on zoonotic or other agriculture-associated diseases (note: later in the project, work on aflatoxins was included)
- Basic science research at the interface of agriculture, nutrition, and health, such as plant and animal breeding (but including biofortification)

BOX 2. Information sources for project list

- The multidisciplinary research team conducting the study
- An external advisory panel, including representatives from the Bill and Melinda Gates Foundation, the Department for International Development (DFID), the US Agency for International Development (USAID), and the Consultative Group for International Agricultural Research (CGIAR) A4N program
- Members of the European Initiative for Agricultural Research for Development (EIARD)
- Governmental and nongovernmental funding organizations, e.g., the Canadian International Development Agency (CIDA), the International Development Research Centre (IDRC)
- The Agriculture and Nutrition Community of Practice hosted by the United Nations Standing Committee on Nutrition
- A Leverhulme Centre for Integrative Research on Agriculture and Health (LCIRAH)-hosted university network on agricultural, nutritional, and health research
- A "snowballing" process involving asking all individuals identified through the different sources for information about other relevant groups or projects
- Searching websites of relevant organizations for projects, e.g., all CGIAR research centers

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measurement. Measurements of food consumption and intake include dietary diversity, individual food and nutrient intake, and infant and young feeding practices, whereas measurements of "food environment" include the availability, affordability, acceptability, and nutritional quality of food locally.

If nutritional impacts can be considered the endpoint of this "research chain," agricultural practices or interventions constitute the start. These are shown in the left-hand column and relate to changes in "agricultural inputs," e.g., new crop varieties, such as biofortified crops; "agricultural practices," such as home gardening; or the "food value chain," meaning the mechanisms by which agricultural outputs reach the consumer in the form of nutritious food products via storage, processing, distribution, and retail systems.

The boxes in the right-hand column capture the potential indirect links between agricultural change and nutrition in a given context. For example, changes in both agricultural practices and the food environment can increase agricultural employment and farm incomes, allowing farming households to buy more, and more healthy, foods, while increased production generally can reduce prices, making healthy foods more affordable to consumers. Agriculture can also contribute to national economic growth, which might improve access to healthcare and education and ultimately health and education status and well-being. Health status also links back to nutritional status through, for example, the effects of infectious disease such as diarrhea or HIV on nutrition.

Finally, around the borders of the conceptual framework, broader or "macro-level" factors that can influence agricultural practices and nutritional outcomes are presented. These include policy and governance; culture, gender, and equity; climate and environment; and the political and economic context.

The framework can be "run" for different projects to illustrate the extent to which a piece of research considers the different pathways and links between agriculture and nutrition. The point of characterizing the different projects in this way is to help build a picture of where gaps occur in the "chain of evidence" linking an agricultural change to a nutritional outcome.

Results

Broader research programs, funding, and organizational leads

A total of 151 current or planned research projects were identified. The majority (n = 133; 88%) were part of a larger program or funding initiative, some of which were entirely about agriculture–nutrition research.

Projects reported a large number of different funders (46 in total), but five dominated investment in this area: the Bill and Melinda Gates Foundation (BMGF), the Canadian International Development Agency (CIDA), Canada's International Development Research Centre (IDRC), the UK Department for International Development (DFID) and the US Agency for International Development (USAID). The largest proportion (n = 57; 38%) of projects were led by Consultative Group for International Agricultural Research (CGIAR) centers, followed by universities (n = 44; 29%) (**table 1**). Lead organizations tended to be either international or from North America or Europe, and only a handful were actually based in low- or middle-income countries. However, almost all projects included an organization in a low- or middle-income country as a partner.

Regional focus of research and target groups

The majority of research projects are being undertaken in countries in sub-Saharan Africa (n = 93; 62%). South Asia was the second most common regional target (n = 36; 24%).

There was a significant emphasis on women and children (**table 2**). Although some research targeted broader communities or did not specify exact groups, where a target was specified it was most often children (n = 46; 30%) and/or women (n = 46; 30%). In 18 (12%) projects, children under 2 years of age or in the "1,000-day period" (from conception until 2 years of age) were identified as a specific target. Pregnant or breastfeeding women were also identified as a focus in 10 (7%) projects.

Projects tended to focus on rural households either generally (n = 16; 11%) or specifically in relation to farming or fishing households (n = 24; 16%), or concentrate on the poor or vulnerable (n = 14; 9%) or the rural poor (n = 6; 4%). There were many overlaps

TABLE 1. Type of organization leading the research projects

Organization	No.
CGIAR center	57
University	44
Nongovernmental organization	20
Research institute	13
Consultancy firm	7
UN body	4
International organization	2
Other, e.g., hospital	2
Not known	2
Total	151

CGIAR, Consultative Group for International Agricultural Research

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between these groups, as the poor, and certainly the rural poor, tended to be subsistence farmers. Very few projects (n = 3; 2%) specifically targeted urban populations or identified men as a unique group (n = 2; 1%), as opposed to their being included in the broader community or in other groups such as farmers and fishermen.

Agricultural themes

The projects were classified by their *main* agricultural theme (**table 3**). Twenty-seven projects (18%) involved research on biofortification; 17 focused on the technology associated with breeding biofortified crops, and 10 looked at the value chains associated with getting biofortified foods to market, having them consumed, and ultimately changing the nutritional status of specific groups. Targets of biofortification included beans, cassava, legumes, maize, pearl millet, rice, and sweet potato.

Nearly half (n = 71; 47%) of the projects were concerned with improving the production of nutritious foods. These included the 17 biofortification crop breeding projects as well as projects examining specific agricultural technologies (n = 15; 10%), home gardening or homestead production (n = 11; 7%), traditional/indigenous or local foods (n = 11; 7%), aquacultural technology (n = 7; 5%), and agrobiodiversity (n = 5; 3%). Most of this research aimed at either increasing

TABLE 2. Groups specifically targeted in 151 research projects and the number of projects targeting each group. Note that a project may target more than one group.

Group	No.
Projects that focus on children	46
1,000-day period and/or children under 2	18
Children over 2/all children	32
Projects that focus on women	46
Pregnant or breastfeeding women	10
Mothers generally/women of reproductive age	12
Women	24
Rural generally	16
Farming or fishing households	24
Rural poor	6
Poor/extremely poor/vulnerable in general	14
Urban	3
Men	2

TABLE 3. Main agricultural themes of the research projects

Broad themes	Specific themes	No.
Agricultural production of nutritious[a] foods	Biofortification (crop breeding)	17
	Agricultural development and technology	15
	Traditional, indigenous, and local foods	11
	Home gardening and homestead production	11
	Aquacultural technology development	7
	Other	5
	Agrobiodiversity	5
	Total	71
Value chains	Of nutritious foods	10
	Specific to biofortification	10
	Not specified	2
	Total	22
Agricultural growth or development more broadly		21
Multisectoral nutrition projects that include agriculture		7
Reducing or understanding impact of aflatoxin contamination		4
Policy, research, data, and methodology	Governance, capacity-building, and policy analysis	6
	Development of methodology	4
	Collection and analysis of datasets	6
	Total	16
Other		7
Not known		3
Total		151

a. Nutritious, or nutrient-rich, foods are foods with a high nutrient content. They include animal-source foods (fish, meat, eggs, and dairy products), fruits and vegetables, and traditional local crops (including neglected and underutilized species and wild foods).

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consumption of nutritious foods generally or increasing access to a mix of specific nutritious foods such as fruit, vegetables, and livestock. A few focused on one specific commodity or food group, such as fish ($n = 12$) or animal-source foods ($n = 9$).

A total of 22 (15%) projects focused on the food value chain, including the 10 biofortification value chain projects. The nonbiofortification value chain projects included projects directed at reducing barriers or bottlenecks in the process by which nutritious products, such as beans or fish, reach local people, or improving their marketability or accessibility.

Twenty-one (14%) projects were concerned with agricultural growth and development more broadly and its effects on nutrition. These projects did not focus on specific interventions but rather sought to understand how changing patterns of agricultural growth or practices and technology have or can affect development, the food environment, and nutrition. Examples of projects included those that looked at the relationship between non-food-based agriculture and nutrition, such as cotton cropping, the cause of continuing malnutrition in the face of sustained agricultural growth, and anthropological and economic research aimed at understanding how different livelihoods and institutional arrangements influence food consumption.

Seven (5%) projects looked at the impact of agriculture on nutrition alongside other policy areas such as health and the economy. A small number of projects ($n = 4$; 3%) evaluated the impact of aflatoxin contamination on nutrition.

Six (4%) projects focused on governance and/or capacity-building or policy analysis, looking at such questions as how to create an environment that ensures existing political and economic resources are used effectively to improve nutrition. Four (3%) were primarily concerned with the development of methodologies in agriculture–nutrition, and another six (4%) with developing or analyzing new or existing datasets to capture the relationship between agriculture and nutrition and provide better indicators and comparisons between regions, groups, or other variables.

Discussion

Strengths and limitations of this study

This is the first time the broader agriculture–nutrition research landscape has been mapped in a way that allows comparison of projects in the kind of evidence that they are gathering. The efforts of a multidisciplinary team have ensured that the full range of measurements linking agricultural change to improved nutrition is captured in a single conceptual framework.

However, the study has a number of limitations. It is probable that the sample of projects is incomplete and is biased toward organizations based in English-speaking countries for which information was most easily obtained. By the close of the relatively short data collection period, the research team had, for instance, been unable to identify any projects in China, which is likely to reflect a failure of identification rather than a lack of research.

The quality and depth of information obtained for different projects also varied, as the template was completed both by members of the research team and by researchers on specific projects, using a variety of sources, e.g., documentation provided or information online. In some cases, considerable information was available about a project, whereas in others, only limited data were obtained. Although in some cases researchers were asked to check the template for their project, in most cases this was not possible, either because the information had been obtained from a donor or other individual or because of time constraints. In addition, for projects that were in the planning stage, much of the detail of the research was yet to be worked out, and therefore information such as specific outcome measures was not available.

For these reasons, quantitative analysis was only possible around areas for which we had good coverage, which were mainly descriptive aspects of the research such as affiliation with broader research programs, source of funding, organization lead, and main focus of research. The gap analysis employed a more qualitative methodology of looking across and within projects and, although numbers are in some cases quoted, the point is to highlight the pattern and direction of the body of research rather than draw attention to specific figures.

Gaps in research along the direct pathway between agriculture and nutrition

The conceptual framework was used to analyze gaps in impact pathways from agriculture to nutrition. Looking at the 100 fully mapped projects, we evaluated the extent to which evidence was gathered on the direct pathway between an agricultural practice or intervention and a nutritional outcome (from the left-hand to the middle boxes in **fig. 1**). The analysis found that many projects omitted measuring effects at certain steps in the process. The main gaps identified in specific projects were a lack of measurement or consideration of nutritional status, the food environment, the food value chain, and cost-effectiveness.

Just under half ($n = 43$; 43%) of the projects measured nutritional status. Of those that did not, 37 measured food consumption, 11 relied on food environment measurements, and 7 did not collect any nutrition or food data (despite having a stated aim of changing nutritional outcomes). Although consumption data could be conceived as a proxy for nutritional status,

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evidence of actual change in nutritional status is needed if we are to compare the effectiveness of agricultural interventions with that of more nutrition-specific interventions such as infant food fortification. However, food consumption data are required in addition to nutritional outcomes, as nutritional status can change as a result of nondietary factors.

The food environment was another link that was often missing, particularly factors associated with affordability such as food prices, changes in market availability in specific settings, and food acceptability. Without this component, projects are unlikely to be able to realistically assess uptake of specific products or goods or the impact of specific interventions at a local, national, regional, or global level. Such a gap highlights the need for a more multidisciplinary approach to agriculture–nutrition that incorporates economic and behavioral research on factors affecting the availability and acceptability of nutritious food.

Almost half (n = 46; 46%) of the projects did not measure how agricultural activities or interventions led to changes along the food value chain. Understanding this mechanism is essential to understanding how and why nutritional change might or might not occur and shows a failure to consider the diversity of households that might be differentially affected by their participation in the value chain process. Finally, a relatively small number of projects, 19 out of the 100 fully mapped projects, attempted to provide some measure of cost-effectiveness.

Despite the preponderance of projects exhibiting gaps in the research chain, some well-designed evaluations of agricultural development projects did come close to measuring outcomes along all the steps in the direct pathway between an agricultural intervention or practice and nutritional outcomes. This suggests that some of the current research will help develop the evidence base further, meeting the need identified by the two systematic reviews for more rigorous, well-designed studies [6, 7].

In addition, biofortification research appears to be an area where considerable effort is being made to measure effects at all steps leading to nutritional outcomes. For each biofortified crop, research is being conducted on breeding (the agricultural science components) as well as the value chain, food environment, consumption, and nutritional change, thereby completing the direct pathway. Previously published research on the orange-fleshed sweet potato exemplifies this [12, 13], and the current research projects suggest that evidence will be available soon for other biofortified crops.

Gaps in research on indirect impacts of agriculture on nutrition

We found substantially fewer studies (about one-third of the fully mapped projects) that are measuring indirect effects (i.e., the right-hand boxes in the conceptual framework shown in **fig. 1**) relative to direct effects. This is perhaps not surprising, as indirect effects may pose greater problems of measurement and attribution than direct effects. However, the links between agricultural change, economic change, and nutrition (both under- and overnutrition) via changes in food consumption and access to healthcare and education are critically important, because they operate at a large scale and thus have the potential to have impacts at the level of entire populations. Of those projects that did look at indirect effects at the household level, either by measuring farming or rural household income (n = 15) or by measuring poverty (n = 10), none appeared to be measuring the effect of improved income and expenditure on nutrition, such as through changes in the purchase or consumption of food. For the most part, projects that measured the economic impacts of agricultural activity tended to have the twin aims of improving nutrition *and* income, but not improving income *for* improved nutrition. In addition, few of the projects looked at the effects of interventions on communities or groups outside of the immediate research participants, and so most did not measure the broader effects of agricultural change on other local households or the wider effects on the food environment, education, or health.

At a national level, only two projects appeared to be looking at the broader relationship between agriculture-related growth and nutritional outcomes.

Gaps in policy and governance research

The conceptual framework included a number of macrofactors that influence the context in which agriculture is able to influence nutrition. Due to restrictions on time, the analysis focused only on policy and governance.

Twenty-five of the 100 fully mapped research projects included an explicit aim of influencing policy through developing some form of guidance or governance structures for government. The policy focus included developing tools for policy makers and other decision makers for assessing the nutritional impact of agricultural projects, developing cross-sectoral policy platforms for agriculture–nutrition, and facilitating rollout or implementation of specific government policies.

However, there were surprisingly few (n = 5) projects conducting research on policies that influence the relationship between agriculture and nutrition on a broader level. There were no projects that looked at the methods and metrics that could be used to conduct this type of agriculture–nutrition policy research.

Only 5 of the 100 fully mapped projects conducted research on governance issues, that is, research on policy processes and institutions that affect the ability

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to scale up the lessons learned from more technical, smaller-scale research.

Nutrition-related health and target group gaps

Apart from the general lack of an indirect link to health, two major nutrition-related health gaps emerged, one related to maternal nutrition and the other concerning overnutrition and associated diet-related noncommunicable diseases. Although 46 projects targeted women, those targeting pregnant or breastfeeding women ($n = 10$) tended to focus on the nutritional impacts on the child rather than on the mother, suggesting that the maternal nutritional component was not well addressed along the continuum of care. However, other studies looking more broadly at women of reproductive age did collect data on women's nutritional status, such as body mass index and anemia.

There is growing concern that agriculture may contribute to problems of overnutrition in low- and middle-income countries, such as an increase in noncommunicable diseases [14–16]. In our study, however, only four projects were concerned with noncommunicable diseases. This probably reflects the extremely small number of projects targeting urban consumers ($n = 3$), but it is also a reflection of the lack of consideration of the problem overall.

Very few research projects ($n = 3$) targeted groups with specific communicable diseases that affect nutrition, and the only projects that did targeted people living with HIV. In addition, research did not tend to be focused on the least-developed countries and on humanitarian situations or fragile states, raising the question of whether the research is being directed to the poorest of the poor.

Gaps in research in agriculture–nutrition methods and metrics

Very few projects were looking explicitly at the development of methodologies or metrics in agriculture–nutrition research as a way of improving the quality and comparability of data. Given the problems of poor-quality studies identified in recent reviews of this field, this seems a significant gap.

Conclusions and recommendations

This study has identified a very large range of current and planned research on agriculture for improved nutrition. But it also identified some critical gaps.

First, gaps were identified in research extending through the *direct* pathway from agriculture to nutrition, through the food value chain and including measurements of the food environment, individual food intake or dietary diversity, infant and young feeding practices, and nutritional status.

There were also critical gaps in research on the *indirect* effects of changes in agricultural practices on nutrition, acting through income and economic growth; on the effects of agricultural policy change on nutrition; on governance as it relates to the development of agriculture-for-nutrition policies and programs; and on the cost-effectiveness of agricultural interventions.

Finally, there is a clear gap in research on broader target groups, particularly nonrural populations and men, the relationship between agriculture and nutrition-related noncommunicable diseases, and people living in fragile and postconflict states, as well as research on methods and metrics.

From this mapping exercise and gap analysis, we conclude that there is interesting and valuable research under way on measuring the nutritional impact of agricultural interventions. This will go some way toward addressing the lack of evidence for effects revealed by recent systematic reviews of the published literature, but there remains a clear gap in the measurement of nutrition-related outcomes in research projects. This needs to be addressed by greater effort in these areas and broader cooperation between agriculture and nutrition researchers in generating appropriate experimental designs and metrics. In addition to this conclusion, our analysis also suggests that it would be desirable to extend the focus of current research to consider the effects of agricultural interventions on different target groups and effects acting through more indirect pathways of changing livelihoods and policies.

Authors' contributions

All authors contributed to the conception and design of the study, provided guidance and oversight during the conduct of the research, and commented on draft manuscripts. Corinna Hawkes and Jeff Waage had overall responsibility for the project. Corinna Hawkes and Rachel Turner conducted data collection and analysis. Corinna Hawkes, Jeff Waage, and Rachel Turner were responsible for final interpretation of the data and drafting the manuscript.

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