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# The effects of food systems interventions on women's empowerment

A rapid evidence assessment

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## About this report

This report summarizes the available evidence on the effects of food systems interventions on women's empowerment. It presents new insights into the findings of the living Food Systems and Nutrition (FSN) Evidence and Gap Map (E&GM) commissioned by the German Federal Ministry for Economic Cooperation and Development through Deutsche Gesellschaft für Internationale Zusammenarbeit's (GIZ's) Knowledge for Nutrition Program. It presents the results of a rapid evidence assessment (REA) that synthesizes and appraises the evidence available on the effect of FSN interventions on women's empowerment. This report was made possible with generous support from GIZ.

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# **The effects of food systems interventions on women's empowerment: a rapid evidence assessment**

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In memory of our colleague and friend,  
**Kishore Kumer Basak**

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We dedicate this work to our friend and colleague Kishore Kumer Basak, who contributed to the design, coordination, and delivery of this project and many others at 3ie. We hope the depth of findings and contribution of this project will reflect the value he added to our work.

# Summary

## Background

Food insecurity, hunger, and malnutrition persist globally, with 783 million people facing chronic hunger in 2023 (WFP 2024). Women are disproportionately affected, representing 60 percent of those food insecure worldwide (WFP 2021). Gender norms and inequalities contribute to these disparities, influencing food security, nutrition, health, livelihoods, and rights (Feed the Future 2022; Maraka 2021). Gender-transformative interventions have shown positive impacts on nutrition-related outcomes (Berretta et al. 2023) and on addressing the root causes of gender inequalities.

Conversely, the impact of food systems and nutrition interventions on women's empowerment remains underexplored. Understanding how these interventions interact with gender dynamics can inform policymaking for transformative change, fostering inclusive and equitable food systems and sustainable development.

## Objectives

We conduct a rapid evidence assessment (REA) to examine the impact of food systems and nutrition (FSN) interventions on women's empowerment outcomes.

## Method

This REA utilizes data from the Food Systems and Nutrition Evidence and Gap Map E&GM, which GIZ commissioned and initially published in 2021 (Moore et al. 2021). The E&GM offers a comprehensive overview of the literature on food systems interventions and their impacts on food security and nutrition outcomes in low- and middle-income countries.

We established the rapid evidence assessment's inclusion criteria through consultation with GIZ/ German Federal Ministry for Economic Cooperation and Development experts and a stakeholder advisory group, focusing on participants from low- and middle-income countries, experimental and quasi-experimental impact evaluations, and interventions under the food supply chain, consumer behavior, and food environment categories. This assessment uses Naila Kabeer's definition of women's empowerment: "a process by which women who have been denied the ability to make strategic life choices acquire such an ability" (Kabeer 1999, 437).

Additionally, we conducted a targeted search for qualitative evidence, capturing data from included studies and supplementary sources related to the intervention types covered in included quantitative impact evaluations. We assessed the risk of bias using a 3ie tool, which considers methodological factors and potential biases in study design and analysis. A qualitative description of unintended effects, barriers, and facilitators complements the quantitative findings, drawing from both impact evaluations and qualitative evidence.

## Main results

The body of research on the effects of Food Security and Nutrition interventions on women's empowerment is sparse and unevenly distributed, comprising 44 quantitative studies, 9 linked quantitative papers, 62 qualitative evaluations, and 432 descriptive

qualitative papers across 42 programs in 19 countries. The most studied interventions are those related to the *food supply chain*, followed by *consumer behavior* and *food environment* interventions.

Meta-analyses revealed a small, yet statistically significant positive effect of FSN interventions on women's empowerment, particularly from *food supply chain* interventions, showing moderate effects on *collective action*, *leadership*, *empowerment indices*, and *access to economic resources*. *Consumer behavior* interventions also demonstrated positive effects on *economic resource access* and *decision-making*. No significant negative effects were found, though some outcomes had insufficient data for assessment, especially for *consumer behavior* and *food environment* interventions. Examination of potential sources of variation yielded minimal learning, likely due to limited evidence in certain intervention categories or missing data.

#### *Implications for policymakers and implementers*

- Policymakers and implementers can leverage the small-yet-positive effects of FSN interventions to empower women. These interventions show a statistically significant impact on various aspects of women's empowerment, particularly in areas like economic resources, decision-making, and leadership. There is no significant difference in outcomes between gender-specific and non-gender-specific interventions or different gender inequality contexts. However, there is limited evidence on consumer behavior and food environments, which needs consideration.
- Further, research from Berretta et al. (2023) highlighted the positive impacts of women's empowerment interventions on FSN outcomes such as food security and diet quality, despite the overall effects being small-to-moderate. This confirms a mutually positive connection between FSN and women's empowerment. To maximize their effect on women's empowerment, FSN interventions should address gender-restrictive norms and adopt a holistic, gender-transformative approach, ensuring women's active participation and benefit.
- Additionally, interventions must account for other vulnerabilities among women, such as age, poverty, rural residence, and education level, to ensure inclusive participation. Potential burdens and dependencies created by interventions, such as increased labor demands or administrative tasks, should be mitigated to sustain women's empowerment.
- Policymakers and implementers should aim to fill evidence gaps regarding the impact of FSN interventions on women's empowerment by incorporating gender frameworks into their designs and evaluations. This will help to build a robust body of evidence to guide future interventions.

#### *Implications for researchers*

- More evidence is needed on the effectiveness of specific FSN interventions on *women's empowerment*, especially within *consumer behavior* and *food environment* interventions.
- Research should also focus on underexplored outcomes like time use, women's rights, and self-esteem.
- Research should target underrepresented regions such as Latin America, the Caribbean, the Middle East and North Africa, East Asia and the Pacific, and central Africa.

- Researchers should enhance methodological rigor and transparency in both quantitative and qualitative studies to improve the evidence base. Future studies should also employ longer follow-up periods to build the evidence base around sustainable outcomes by measuring the potentially slow change of gender norms over time.
- The rapidly growing body of FSN and women's empowerment evidence necessitates regular updates to intervention effectiveness analyses and fills some of the research gaps identified in our review. Additionally, as of May 2024, the FSN E&GM includes 3,087 studies, highlighting the need to explore other synthesis gaps to better understand FSN interventions' impacts on development outcomes.



# Contents

<b>Acknowledgements .....</b>	<b>ii</b>
<b>Summary.....</b>	<b>iii</b>
<b>List of figures and tables.....</b>	<b>vii</b>
<b>Acronyms.....</b>	<b>ix</b>
<b>1. Background .....</b>	<b>1</b>
1.1 The issue .....	1
1.2 Aims and objectives.....	2
<b>2. Methods .....</b>	<b>2</b>
<b>3. Descriptive findings.....</b>	<b>5</b>
3.1 Search results.....	5
3.2 State of the evidence.....	7
3.3 Quality of the evidence .....	9
<b>4. Effects of food systems interventions on women's empowerment.....</b>	<b>11</b>
4.1 Food supply chains.....	11
4.2 Consumer behavior .....	37
4.3 Food environment.....	45
<b>5. Conclusion.....</b>	<b>49</b>
5.1 Summary of findings.....	49
5.2 Limitations of available studies.....	52
5.3 Strengths, limitations, and future directions.....	53
5.4 Implications for policymakers and researchers .....	54
<b>Online appendixes .....</b>	<b>58</b>
<b>References.....</b>	<b>59</b>

## List of figures and tables

Figure 1: Preferred reporting items for systematic reviews and meta-analyses (PRISMA) diagram .....	6
Figure 2: Number of quantitative IEs and SRs identified by year of publication .....	7
Figure 3: Map of studies by country .....	9
Figure 4: Risk of bias of included estimates.....	9
Figure 5: Summary of overall critical appraisal ratings of included primary qualitative studies, process evaluations, and mixed-method studies (n = 162).....	10
Figure 6: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of <i>food supply chain</i> interventions on <i>access to economic and livelihood resources</i> .....	13
Figure 7: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of <i>food supply chain</i> interventions on <i>ownership of land and assets</i> .....	15
Figure 8: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of <i>food supply chain</i> interventions on <i>control over resources</i> .....	17
Figure 9: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of <i>food supply chain</i> interventions on <i>time use</i> .....	19
Figure 10: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of <i>food supply chain</i> interventions on <i>decision-making</i> .....	21
Figure 11: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of <i>food supply chain</i> interventions on <i>women's rights</i> .....	23
Figure 12: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of <i>food supply chain</i> interventions on <i>collective action and leadership</i> .....	24
Figure 13: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of <i>food supply chain</i> interventions on <i>gender-transformative outcomes</i> .....	26
Figure 14: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of <i>food supply chain</i> interventions on <i>women's self-esteem</i> .....	27
Figure 15: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of <i>food supply chain</i> interventions on <i>other empowerment outcomes and indices</i> .....	29
Figure 16: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of <i>consumer behavior</i> interventions on <i>access to economic resources and livelihood</i> .....	38
Figure 17: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of <i>consumer behavior</i> interventions on <i>control over resources</i> .....	40
Figure 18: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of <i>consumer behavior</i> interventions on <i>decision-making</i> .....	41
Figure 19: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of <i>consumer behavior</i> interventions on <i>other empowerment outcomes and indices</i> .....	43

Table 1: Summary of inclusion criteria determining study eligibility for the REA .....	3
Table 2: Distribution of quantitative IEs by intervention-outcome pairing .....	8
Table 3: List of food supply chain interventions .....	11
Table 4: Barriers, facilitators and unintended consequences of <i>food supply chain</i> interventions .....	30
Table 5: List of consumer behavior interventions.....	37
Table 6: Barriers, facilitators, and unintended consequences of <i>consumer behavior</i> interventions .....	43
Table 7: List of food environment interventions .....	46
Table 8: Barriers, facilitators, and unintended consequences of <i>food environment</i> interventions .....	47
Table 9: Summary of the meta-analyses results.....	51

## Acronyms

<b>A&amp;T</b>	Alive & Thrive Initiative
<b>CI</b>	Confidence interval
<b>DVSK</b>	Deploying Vegetable Seed Kits to Tackle Malnutrition in Kenya, Uganda, Tanzania and Liberia
<b>EACSLA</b>	Empowerment and Community Support and Learning Alliance in Nepal
<b>E&amp;GM</b>	Evidence and gap map
<b>FSN</b>	Food systems and nutrition
<b>GIZ</b>	Deutsche Gesellschaft Für Internationale Zusammenarbeit
<b>IE</b>	Impact evaluation
<b>KnK</b>	Kukua Ni Kujifunza Project
<b>L&amp;MICs</b>	Low- and middle-income countries
<b>PROACT</b>	Promoting Opportunities for All to Rise and Capture Transformation
<b>REA</b>	Rapid evidence assessment
<b>SMD</b>	Standardized mean difference
<b>SR</b>	Systematic review
<b>TMRI</b>	Transfer Modality Research Initiative
<b>WELHPB</b>	Women's Economic Leadership through Horticulture Planting-Material Business Project

# 1. Background

## 1.1 The issue

Food insecurity, hunger, and malnutrition<sup>1</sup> persist as pressing global challenges. Data from the World Food Programme highlight that, in 2023, as many as 783 million people were facing chronic hunger (WFP 2024), and data from the Food and Agriculture Organization shows that, despite regional disparities, numbers have increased in recent years (FAO et al. 2023). In the global struggle against food insecurity, malnutrition, and hunger, women are more vulnerable than men. Women often eat last and least, are more likely to live in extreme poverty, and are often more vulnerable to famine and food crises (WFP 2021). As a result, women represent 60 percent of all food insecure people in the world, and in nearly two thirds of countries, women are more likely than men to report food insecurity (WFP 2021).

Deep-rooted gender norms and gender inequalities can be both causes and catalysts of gender disparities in food security and nutrition. Food insecurity, malnutrition, and hunger affect genders differently, both biologically and socially, and are highly influenced by gender norms; they are also linked to health, livelihood, income, and sociopolitical rights.

In addition, women participate in all aspects of food systems (e.g., farming, trade, marketing, care), yet they face challenges and barriers to participating in and benefiting from these very systems, including restrictions on their education, access to resources, economic opportunities, decision-making power, and control over time use (Oseni et al. 2015; Backiny-Yetna and McGee 2015; Kilic, Palacios-López, and Goldstein 2015). Empowering women might contribute to improved food security by removing barriers to their autonomy and participation in food systems (Feed the Future 2022; Maraka 2021).

In this iterative process, food systems and nutrition are linked to women's empowerment, and might lead to mutually positive outcomes (SPRING 2014). Addressing hunger requires a multifaceted approach that intertwines food security, gender equality, and women's empowerment. Recent work from Berretta et al. (2023) demonstrated that gender-transformative and women's empowerment interventions had a positive and statistically significant effect on nutrition-related outcomes, including food security, affordability, availability, and diet quality and adequacy. This evidence suggests that gender-transformative interventions can contribute to improved food security by challenging gender norms and specifically targeting gender groups to address the root causes of gender inequalities.

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<sup>1</sup> As per the Food and Agriculture Organization of the United Nations, a person is food insecure “when they lack regular access to enough safe and nutritious food for normal growth and development and an active and healthy life due to unavailability of food and/or lack of resources to obtain food” (FAO 2024). This definition directly relates to the concept of hunger, which the organization defines as “an uncomfortable or painful sensation caused by insufficient consumption of dietary energy that becomes chronic when the person does not consume a sufficient amount of calories on a regular basis to live a normal, active and healthy life” (FAO 2024) and to the concept of nutrition, which encompasses the provision of necessary nutrients for health and growth.

However, while food systems and nutrition interventions may bring positive women's empowerment outcomes, evidence of this effect is sparse. By examining how interventions in food supply chains, environments, and consumer behaviors interact with gender dynamics, policymakers and researchers will gain a more nuanced understanding of their impact on women's empowerment. Ultimately, leveraging this understanding can pave the way for transformative change, fostering inclusive and equitable food systems that empower women and promote sustainable development.

## 1.2 Aims and objectives

In this report, we present a rapid evidence assessment on the effect of food systems and nutrition interventions on women's empowerment outcomes. Our primary objective is to identify and describe the available evidence on the effect of FSN interventions on women's empowerment outcomes. To achieve this objective, we draw on the studies included in the FSN evidence and gap map (E&GM) as of November 2023 (Storhaug et al. 2023). We aim to address the following research questions:

- What are the effects of food systems and nutrition interventions on outcomes related to women's empowerment?
- Are there unintended consequences, including adverse effects, of these interventions? Which factors are reported as barriers to and facilitators of effectiveness?
- Do effects vary by context, intervention features, or other moderators?
- What evaluation design strategies are used?

All questions will be considering a gender-transformative lens. As per UNICEF's definition, gender-transformative approaches are "concerned with redressing gender inequalities, removing structural barriers, such as unequal roles and rights, and empowering disadvantaged populations. They aim both to change overall structures than underpin gender inequality and to contribute to lasting change in individuals' lives" (Marcus et al. 2022, 2). Our REA will analyze FSN interventions that integrate gender-transformative approaches into their program design, as well as those that do not, to compare their respective effects on women's empowerment outcomes.

## 2. Methods<sup>2</sup>

This REA relies on evidence gathered in the FSN E&GM, and thus did not undertake a new search and screening of quantitative evidence. The FSN E&GM was commissioned by GIZ and was first published in 2021 (Moore et al. 2021); E&GMit provides an overview of the literature on food systems interventions on food security and nutrition outcomes in low- and middle-income countries (L&MICs).

This is one of 3ie's largest E&GMs, initially including 1,838 impact evaluations (IEs) and 178 systematic reviews (SRs) (Moore et al. 2021). Since then, it has become a living E&GM document, updated quarterly for the past 2.5 years (Storhaug et al. 2023)<sup>3</sup>. Our

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<sup>2</sup> The full details of the methods are available in the Research Protocol (Basak et al. 2024).

<sup>3</sup> Six updates have been undertaken since the initial map was published in 2021. More information about the FSN E&GM is available on the project page:

<https://www.3ieimpact.org/research/food-systems-and-nutrition-evidence-and-gap-map>

REA draws from 2,338 IEs included in the FSN E&GM as of November 2023. As of May 2024, the map comprises 3,026 IEs and 244 SRs. The E&GM followed a standardized process, including consultations with experts, literature searches, and screening (Moore et al. 2021). It covered evidence from 12 academic bibliographic databases and 31 sector-specific databases and websites, ensuring a diverse range of publications, and used both manual and automated screening techniques to identify relevant studies.

The inclusion criteria for the REA were established in collaboration with experts from GIZ/the German Federal Ministry for Economic Cooperation and Development and with a stakeholder advisory group (Table 1). The criteria included participants from L&MICs, specific intervention categories, and quantitative and qualitative IE study designs. We excluded studies focusing on women's empowerment interventions (already covered in Berretta et al. 2023), ongoing studies, and studies covered by fewer than six studies in the FSN E&GM (areas in which we would not be able to draw strong conclusions).

**Table 1: Summary of inclusion criteria determining study eligibility for the REA**

Criteria	Description
Participants	People of any age and gender residing in L&MICs. Excluding studies targeting participants with a clinical condition
Interventions <sup>4</sup>	Food systems and nutrition interventions within the following categories: <ul style="list-style-type: none"> <li>- <i>Food supply chain</i></li> <li>- <i>Consumer behavior</i></li> <li>- <i>Food environment</i></li> </ul> Descriptions of included interventions are available in Appendix A.
Comparison	Business as usual, including pipeline and waitlist controls and alternative interventions
Outcome	Measures of women's empowerment within the following categories: <ul style="list-style-type: none"> <li>- <i>Resources</i></li> <li>- <i>Agency</i></li> <li>- <i>Achievements</i></li> </ul> Descriptions of included outcomes are available in Appendix A. <sup>5</sup>
Study designs	Quantitative IEs, qualitative evaluations, and SRs: <ul style="list-style-type: none"> <li>- For quantitative IEs, we include studies using an experimental or quasi-experimental design.</li> <li>- For qualitative evaluations, we include qualitative studies collecting primary data using mixed-method or qualitative methods, descriptive quantitative studies, and process evaluations focusing on interventions included in the quantitative IEs. Note that the original FSN E&amp;GM did not include qualitative evaluations.</li> </ul> Descriptions of included study designs are available in Appendix B.

<sup>4</sup> We define an intervention as an activity or set of activities implemented in real-life settings by individuals or institutions, with the aim of creating a change for the people exposed to it. It then covers both internal or external, national or international, programs and policies implemented at the international, regional, national, or subnational level. It is then used as a synonym to the following non-exhaustive list: treatment, initiative, program, project, policy, activity, etc.

<sup>5</sup> Our definition of women's empowerment draws on Naila Kabeer's definition: "... a process by which women who have been denied the ability to make strategic life choices acquire such an ability" (Kabeer 1999, 437). More information about our approach to women's empowerment and gender equality is available in our Protocol (Basak et al. 2024).

Criteria	Description
Language	Studies in English
Publication date	All studies published from 2000 onwards
Status of studies	Completed quantitative IEs and qualitative evaluations
Publication status	Studies published in any outlet, including peer-reviewed journals, working paper series, organizational reports, and unpublished author manuscripts (e.g., documents shared by advisory group members, dissertations).

To gain insights into the unintended consequences of the interventions, and to identify barriers to and facilitators of effectiveness, we have undertaken an additional search for qualitative evidence and gathered data from two sources:

- Descriptive and qualitative data from the included experimental and quasi-experimental studies; and
- A targeted search for additional evidence on the interventions covered by the included experimental and quasi-experimental studies to provide additional detail on these factors.

To be included, these papers must be related to interventions evaluated in the included quantitative IEs and be one or more of the following types of studies: a qualitative study collecting primary data using qualitative methods and meeting our minimum standards (Appendix C), a descriptive study, a process evaluation, or a project document.

Double-coded data extraction was performed by trained reviewers and involved capturing various aspects of the studies, including descriptive data, methodological information, quantitative and qualitative data, and cost information. Reviewers independently coded the data, and disagreements were resolved through discussion. The research team ensured consistency and reviewed the data extraction process.

To facilitate cross-study comparisons, standard effect sizes were calculated based on the outcome measures reported in the studies. Dependent effect sizes, arising from multiple publications or studies based on the same data, were addressed by linking related papers and selecting one main study for data extraction.

Unit-of-analysis issues, such as allocation and analysis at different levels, were assessed, and adjustments were made if necessary. Efforts were made to obtain missing data by contacting study authors. The risk of bias in the included studies was assessed by two independent reviewers using 3ie's risk-of-bias tool (Basak et al. 2024), and considered factors such as confounding, missing outcome data, and biases in study design and analysis. Finally, when data was available, we also conducted a moderator analysis (e.g., intervention year, unit of analysis, evaluation method, length of follow-up or exposure, and multi-component interventions including gender-specific design, gender inequality context, or hunger and nutrition contexts).

We also conducted a qualitative synthesis of the unintended effects, barriers to, and facilitators of interventions' effects. This information was extracted both from the quantitative IEs (when this information was available in the study) and the qualitative evidence.



We gathered a significant amount of qualitative evidence and used a thematic synthesis approach with an inductive coding technique to synthesize them (Thomas and Harden 2008). To identify descriptive themes, we used EPPI-Reviewer®'s line-by-line coding tool (Thomas et al. 2023). We grouped codes with common descriptive themes into higher-level analytical themes and organized them under analytical themes related to the program context, design, implementation, and population characteristics that influenced any of the three broad themes (i.e., unintended consequences of the program, and barriers and facilitators that influenced intervention effects). We presented these findings for each intervention domain.

### 3. Descriptive findings

#### 3.1 Search results

A total of 2,338 IEs were included in the FSN E&GM (Figure 1) as of November 2023. We identified 44 unique studies<sup>6</sup> in this body of evidence (2% of the map's quantitative IEs) with a focus on the effects of FSN interventions on *women's empowerment* outcomes. In addition, we identified 62 qualitative and process evaluations and 432 project documentation and descriptive evidence resources. E&GM More information about descriptive findings is available in Appendix D.

Fifty percent of the 44 included quantitative IEs were randomized trials (n = 22). Among quasi-experimental designs, statistical matching (n = 11) and difference-in-difference and fixed effects regressions (n = 9) were among the most common quasi-experimental methods applied in the literature. They are complemented by two studies using regression-discontinuity design and one study using instrumental variables.

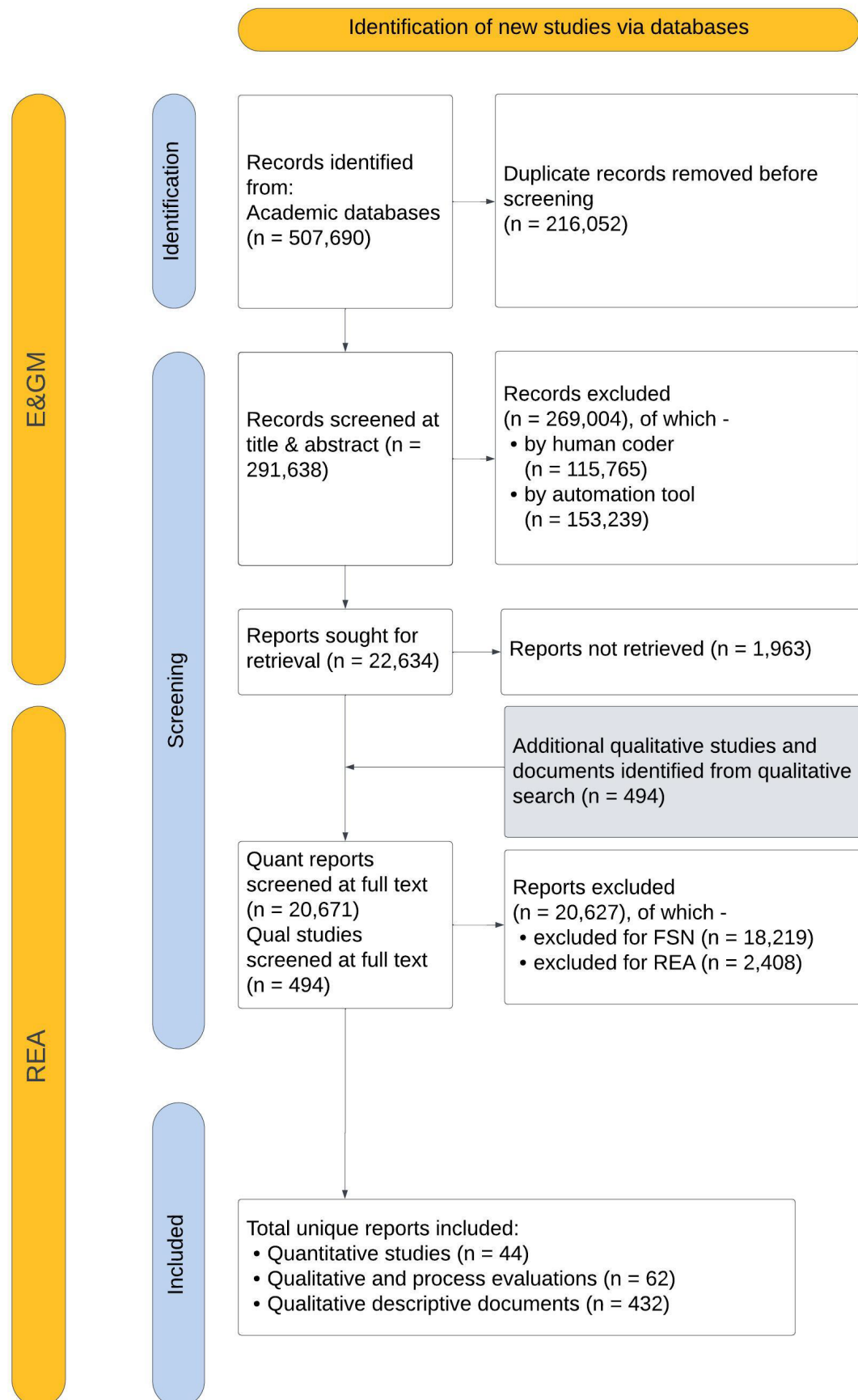
Regarding follow-up periods, we observed a short timeframe between the end of the intervention and the start of the evaluation, with an average follow-up period of two months. Close to 80 percent of the studies measured the effect of interventions immediately after the end of implementation. Only two studies measured the effect of interventions over a year after their implementation, and the longest follow-up period was five years after implementation (IFAD 2015).

This body of quantitative evidence is completed by 20 primary qualitative studies and 42 mixed-method studies.

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<sup>6</sup> We initially identified 60 studies as meeting the E&GM classification criteria; however, 11 studies were excluded during the extraction process due to missing data or methodology and/or outcome measures that did not meet our inclusion criteria.

**Figure 1: Preferred reporting items for systematic reviews and meta-analyses (PRISMA) diagram**

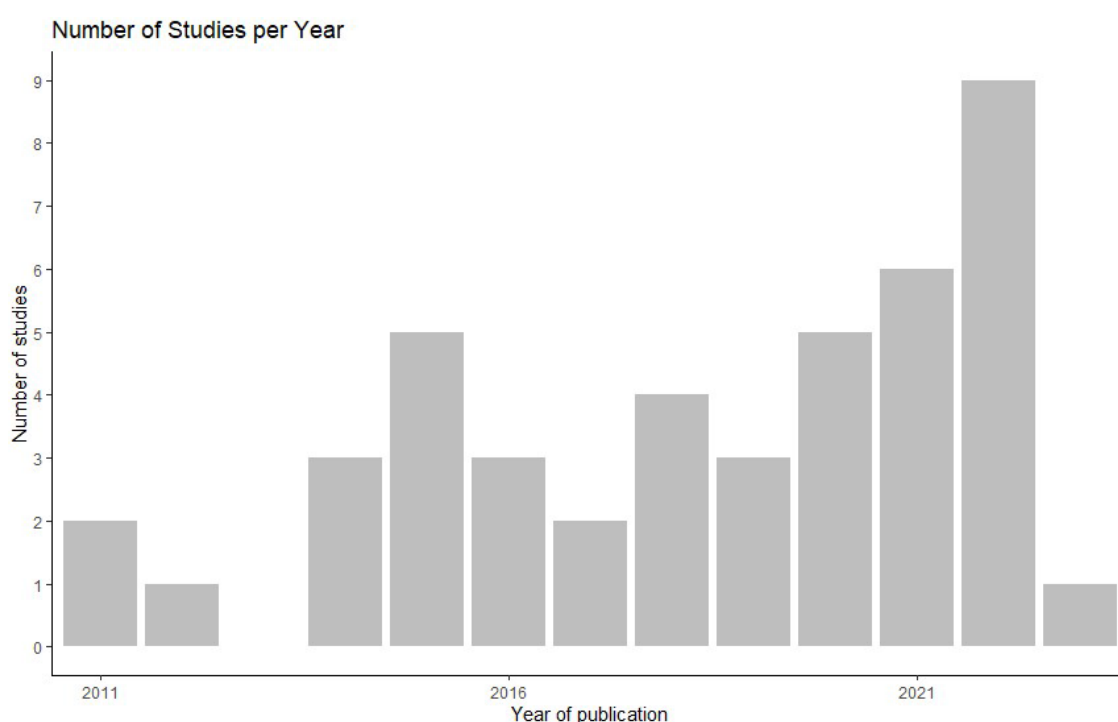


## 3.2 State of the evidence

### 3.2.1 Growth of the evidence base

We observed an increase in the number of quantitative IEs examining the effect of FSN interventions on *women's empowerment* outcomes, especially since 2017. We found that 93 percent of the quantitative IEs identified ( $n = 41$ ) were published in the last decade, with no includable studies published between 2000 and 2010. This accounted for a nearly thirteen-fold increase in quantitative IEs on this topic after this period—from three quantitative IEs published by 2013 to 44 published by 2023.

**Figure 2: Number of quantitative IEs and SRs identified by year of publication**



*Note: The values for 2023 represent a mid-year figure reflecting publications through July 2023.*

### 3.2.2 Intervention and outcome coverage

Evidence on the effect of FSN interventions on *women's empowerment* outcomes is not evenly distributed between our included interventions and outcomes. Despite the FSN E&GM's large intervention framework, only some interventions from each category provided evidence on *women's empowerment* outcomes. Many FSN interventions were therefore not included in this REA due to lack of evidence (Table 2), namely:

- *Food supply chains* ( $n = 36$ ) is the largest intervention category and provides evidence on outcomes such as *decision-making* ( $n = 22$ ), *access to economic and livelihood resources* ( $n = 15$ ), *ownership of land and assets* ( $n = 15$ ), and *other empowerment* outcomes ( $n = 15$ ). This intervention category is particularly driven by studies focusing on *education programs* ( $n = 14$ ) relating to food production, such as farmer fields schools.

However, our body of evidence only includes interventions related to production systems, and there was not enough evidence available on other aspects of the food supply chain such as storage and distribution, processing and packaging, or food loss and waste management.

- *Consumer behavior* (n = 8) is the second-largest intervention category despite its gap in coverage compared to *food supply chain* interventions. It focuses on *control over resources* (n = 5) and *access to economic and livelihood resources* (n = 5). Most studies in this category focus on *classes* interventions (n = 9) for nutrition and healthy eating.  
However, similar to the *food supply chain* category, some aspects of *consumer behavior*, such as social marketing campaigns, door-to-door campaigns, or professional services, did not have enough evidence available to be covered by our REA.
- *Food environment* (n = 5) is a small intervention category and does not provide evidence for all outcomes within our scope. Some evidence is available on outcomes related to *decision-making* and *other empowerment* outcomes and indices (both n = 2). However, *direct provision of food* is the only type of intervention covered by our body of evidence, as the rest of relevant evidence did not provide enough studies or allow us to analyze areas such as food subsidies, cash transfers, social protection and insurance, or food taxes.

We also noted that none of the included studies provided evidence of the effect of interventions on *gender-transformative policymaking and systems*.

**Table 2: Distribution of quantitative IEs by intervention-outcome pairing**

	Food supply chain	Consumer behavior	Food environment	Grand total
Decision-making	22	3	2	26
Other empowerment outcomes and indices	15	3	2	19
Access to economic and livelihood resources	15	5		18
Ownership of land and assets	15	2		16
Control over resources	11	5	1	14
Collective action and leadership	11	1		11
Gender-transformative outcomes	8	1		10
Self-esteem	8	1	1	9
Time use	6	1	1	6
Women's rights	5			5
<b>Grand total</b>	<b>36</b>	<b>8</b>	<b>5</b>	<b>44</b>

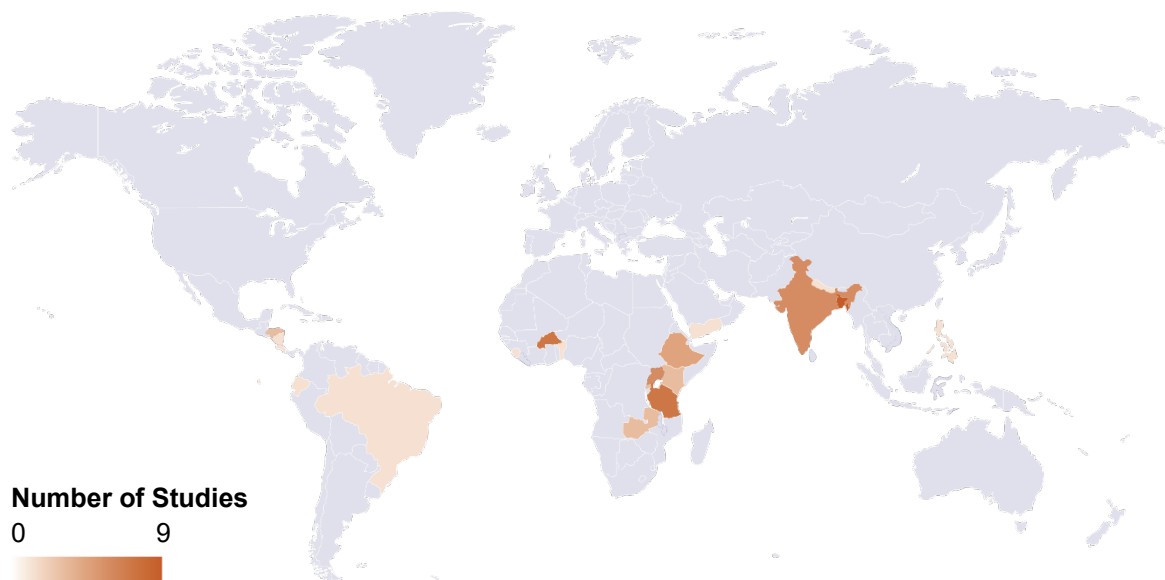
The distribution of quantitative IE is reflected in the qualitative evidence, which primarily focuses on *food supply chains* (n = 52), followed by *consumer behavior* (n = 3) and *food environment* (n = 2).

### 3.2.3 Geographic distribution of studies

Of the 44 studies on the effects of FSN interventions on women's empowerment outcomes, we found evaluations of interventions in 19 L&MICs (complemented by one evaluation focusing on multiple countries and regions). Half of all interventions featured in these studies took place in Sub-Saharan Africa (n = 22). South Asia was the second most-prevalent region (n = 14), with a small cluster of evaluations in Latin America and the Caribbean (n = 6). We observed a gap in evidence in the Middle East and North Africa (n

= 1) and East Asia and the Pacific (n = 1). The largest concentration of studies examines interventions located in South Asia and Sub-Saharan Africa, with Bangladesh accounting for nine studies, followed by Burkina Faso (6 studies), Tanzania (6), and India (4). Other countries were covered by three studies or fewer (Figure 3).

**Figure 3: Map of studies by country**



**3.3 Quality of the evidence**

**3.3.1 Risk of bias in included quantitative studies**

Our results included data from 130 selected estimates among the 44 included quantitative IEs. We found that 68% of the included estimates were rated as having a high risk of bias, 31% were considered to have some concerns related to their risk of bias, and the remaining 1% were assessed as having a low risk of bias (Figure 4; more information on the quality of evidence is available in Appendix D).

**Figure 4: Risk of bias of included estimates**

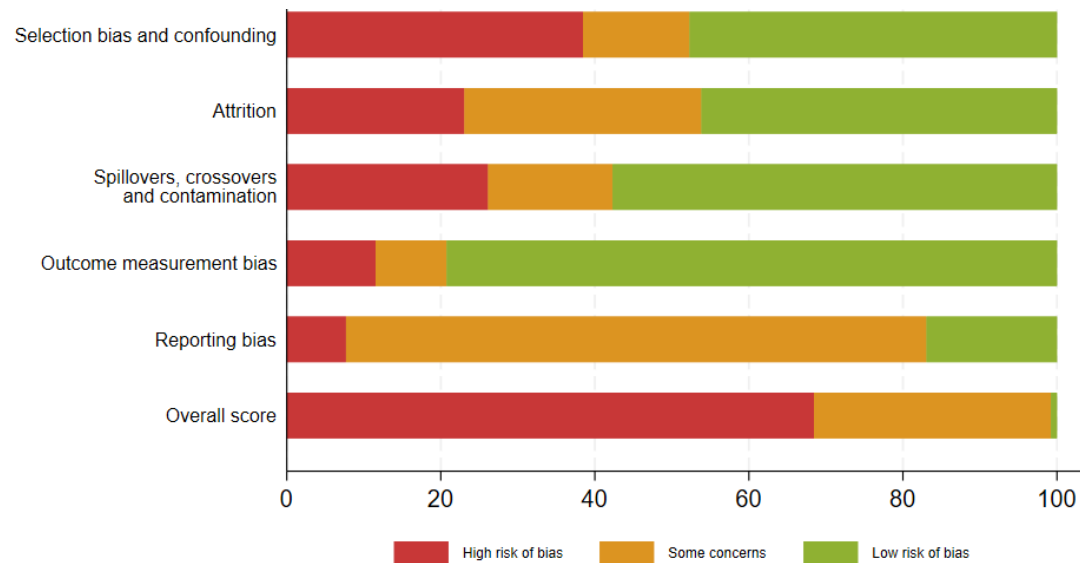


Figure is based on 130 estimates from 43 main studies and 1 linked study.

The REA protocol (Basak et al. 2024) describes the risk of bias assessment and uses the 3ie risk of bias tool (Appendix 7). We compiled a risk of bias assessment for each estimate we extracted, as estimates for different outcomes in the same study may score differently in the assessment. We assessed the risk of bias (based on the criteria in Figure 4) by answering whether the estimate is *free from* each bias, with a response set of "Yes," "Probably Yes," "Probably No," "No," and "No Information" for each domain.

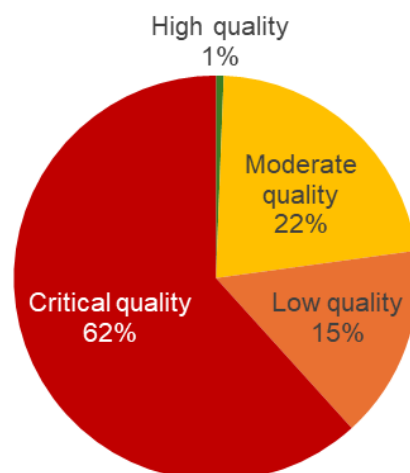
The overall rating for each estimate is as follows:

- "High risk of bias": if any of the bias domains were assessed as "No" or "Probably No"
- "Some concerns": if one or several domains were assessed as "No Information" and none were "No" or "Probably No"
- "Low risk of bias": if all bias domains were assessed as "Yes" or "Probably Yes"

### 3.3.2 Critical appraisal of included qualitative studies

We critically appraised all primary qualitative studies, process evaluations, and mixed-method studies eligible for the qualitative review to assess the trustworthiness of the evidence (n = 162).<sup>7</sup> Overall, our assessment found 62 percent of the studies (n = 100)<sup>8</sup> to have critical quality (Figure 5). We rated one study as high quality, 22 percent of studies as moderate quality (n = 36), and 15 percent as low quality (n = 25). Our synthesis included evidence from these high-, moderate-, and low-quality studies.

**Figure 5: Summary of overall critical appraisal ratings of included primary qualitative studies, process evaluations, and mixed-method studies (n = 162)**



One of the most common issues that undermined the evidence quality was credibility of the findings, due to a failure to establish findings based on data. More than a quarter of the studies (n = 23) received critical quality ratings in this domain. A similar number of studies critically lacked attention to the study context and showed limited reflectivity on how the researchers' individual perspectives influenced their interpretation.

<sup>7</sup> We used the tool's qualitative evidence assessment criteria to appraise the qualitative aspect of the mixed-method studies. The risk-of-bias tool for quantitative studies described in Appendix C was used to assess their quantitative aspect.

<sup>8</sup> This includes 76 studies directly rated as critical quality due to fatal flaws found during the configuration assessment stage.

Approximately 20% of the studies lacked a systematic and transparent research process and were rated as “critical” for rigor of research conduct. More than 60% (n = 54) of the studies lacked reflectivity and received low ratings in this domain. Two additional domains in which studies received low-quality ratings were “appropriateness of sample selection strategy” (32%; n = 28) and “defensibility of research design in relation to the aim of the study” (26%; n = 23).

## 4. Effects of food systems interventions on women’s empowerment

In this section we systematically synthesize evidence on the effect of *food systems and nutrition* interventions on *women’s empowerment* outcomes. We also describe the characteristics of the available evidence, assess studies’ risk of bias, determine the effect of these interventions on our outcomes of interest, and provide information on the barriers, facilitators, and unintended consequences, drawing from qualitative evidence (additional quantitative evidence is available in Appendix E).

### 4.1 Food supply chains

#### 4.1.1 Scope and definition

*Food supply chain* interventions include activities that affect this process—from how food is produced to consumption and disposal of waste (HLPE 2017). The FSN E&GM covers interventions focusing on improving production, storage and distribution, processing and packaging, food loss, and waste management. However, only interventions under the *production systems* interventions provided relevant evidence for our REA.

The following section will further explore the effect of *food supply chain* interventions on *women’s empowerment* outcomes through the 36 studies included in this intervention category. These studies cover 7 intervention types and 33 programs across 16 countries, with 16 studies using an experimental design and 20 studies using a quasi-experimental design (Table 3). In addition, 52 qualitative studies provided evidence on barriers, facilitators, and unintended consequences. There was sufficient evidence for a quantitative meta-analysis for all included outcomes except *gender-transformative policymaking and systems*.

**Table 3: List of food supply chain interventions**

Intervention	Definition	Number of studies <sup>9</sup>
Education/ information – Other education programs	Other education programs support the adoption of new agricultural techniques. All mediums of education are included here if the information being exchanged is related to agricultural techniques/animal husbandry. Programs related to other educational topics (e.g., literacy) would not be included.	19
Education / information - Agricultural extension programs	Trained agents visit communities to teach current practices, organize cooperatives, and engage in other secondary activities.	6

<sup>9</sup> Despite our criteria to only include FSN E&GM intervention types with more than six studies, some studies have been excluded or reallocated between interventions during the outcome mapping, leading to some categories having fewer than the inclusion threshold.

Intervention	Definition	Number of studies <sup>9</sup>
Other agricultural inputs	These include the provision of free or reduced-cost access to agricultural inputs, excluding improved seed varieties, fertilizers, pesticides/herbicides, and livestock-related inputs.	5
Land markets & management	These comprise systems to buy, sell, rent, or manage land related to agriculture.	4
Education/ information - Farmer field schools	Farmer field schools bring farmers together to learn agricultural techniques. They meet regularly during a production cycle, establishing experimentation and engagement in hands-on learning to improve skills and knowledge to help them adapt practices to their specific contexts. Demonstration farms may be used in farmer field schools or separately to show the use of certain agricultural techniques.	4
Livestock access	These entail activities supporting management of and daily work with livestock (e.g., fencing, animal housing, manual tools, protective equipment, antibiotics, farm animals).	2
Agricultural credit/ savings	These entail creating or supporting agricultural credit and savings groups.	2

*Note: The total values displayed may be larger than the number of studies identified, as a study may contain multiple interventions.*

#### **4.1.2 Quantitative analysis of the effects of the interventions**

##### **Resources**

##### *Access to economic and livelihood resources*

We included 14 studies and 15 independent estimates on the effect of *food supply chain* interventions on women's *access to economic and livelihood resources*. Studies of evaluated interventions mostly took place in Sub-Saharan Africa (k = 9), followed by South Asia (k = 4) and Latin America and the Caribbean (k = 1).

Of the 14 studies, three evaluated multi-component interventions (the Pro-Resilience Action Project [PROACT], the Deploying Vegetable Seed Kits to Tackle Malnutrition in Kenya, Uganda, Tanzania and Liberia project [DVSK], and the Women's Economic Leadership through Horticulture Planting-Material Business Project [WELHPB]) (Appendix C). The interventions focused on *education and information* through *agricultural extension programs* (k = 3), *farmer field schools* (k = 2), and *other education programs* (k = 9). There was also one study on *livestock access*, *agricultural credit*, and *savings*, and another on *other agricultural inputs*.

The estimates used different measures of *access to economic and livelihood resources*, such as whether women keep any earned income (Roy et al. 2015), whether they have their own savings (IFAD 2015), chicken income (Passarelli et al. 2020), or knowledge of contraception or nutrition best practices (Harris-Fry et al. 2016; Ahmed et al. 2022) at household (k = 11) or individual levels (k = 4).

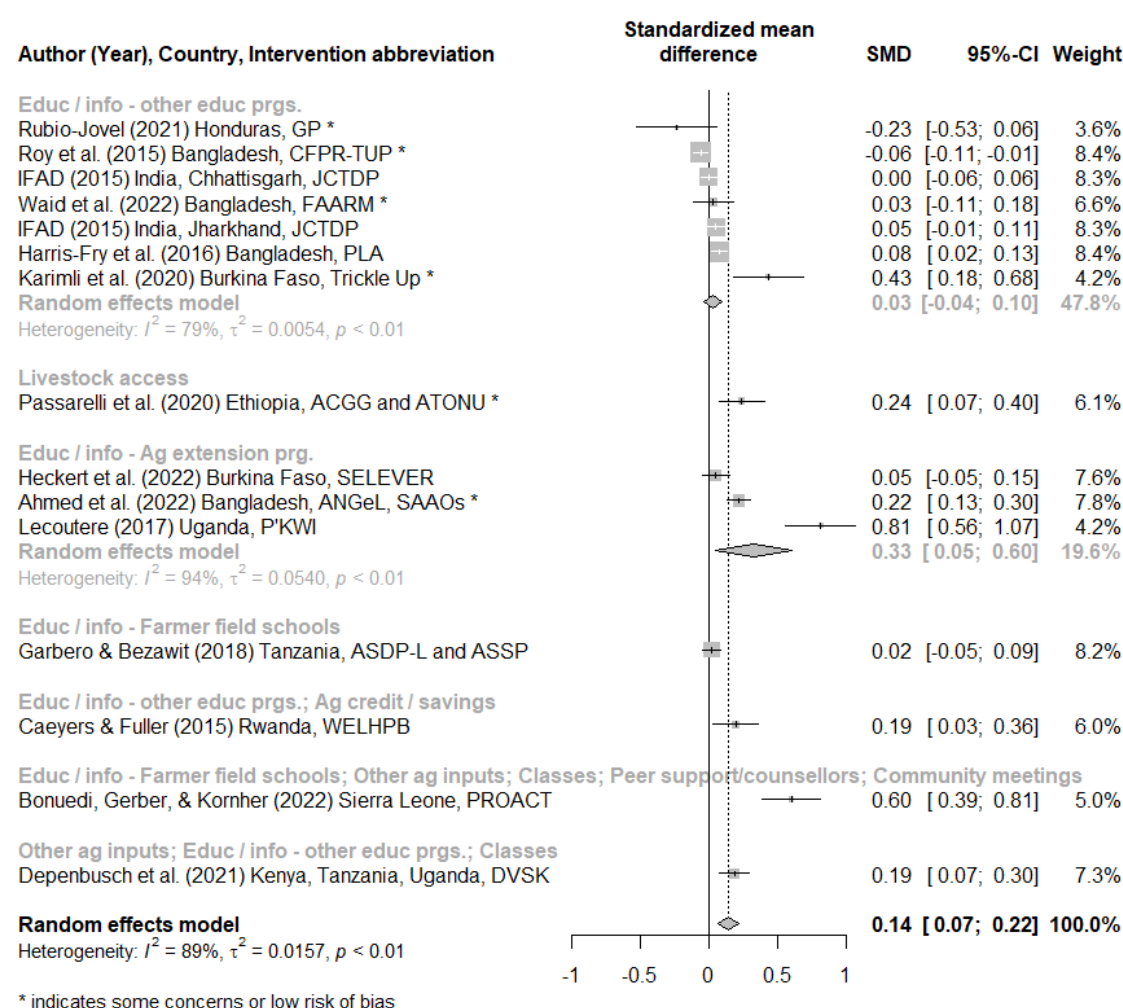
**Some interventions under the *food supply chain* category show a positive effect on women's access to economic and livelihood resources.** The overall weighted average effect was small, positive, and statistically significant (standardized mean difference [ $\widehat{SMD}$ ] = 0.14; 95% confidence interval (CI): 0.07 to 0.22; p = .001; Figure 6). The observed outcomes ranged from -0.23 to 0.81. According to the *Q*-test, there was



substantial heterogeneity across included estimates ( $Q(14) = 121.82, p < .001, \hat{\tau}^2 = 0.02, I^2 = 88.51\%$ ). *Education and information programs through agricultural extension services* ( $k = 3$ ) and through *other education programs* ( $k = 7$ ) had enough estimates to run independent meta-analyses: we observed a moderate, positive, and statistically significant effect of the former ( $\widehat{SMD} = 0.33$ ; 95% CI: 0.05 to 0.60;  $p = .02$ ), and a very small, positive, and not statistically significant effect of the latter ( $\widehat{SMD} = 0.03$ ; 95% CI:  $-0.04$  to  $0.10$ ;  $p = .38$ ; Figure 6).

In Sierra Leone, Bonuedi, Gerber, and Kornher (2022) analyzed the effect of PROACT (fostering the production of tree crops) on nutrition knowledge. They observed a large, positive, and statistically significant effect ( $\hat{g} = 0.60$ ; 95% CI: 0.39 to 0.81;  $p = .001$ ). In Bangladesh, Roy et al. (2015) observed a very small, negative, and statistically significant effect of the Challenging the Frontiers of Poverty Reduction–Targeting the Ultra Poor program (providing productive assets and training to women) on whether women kept any of the income earned ( $\hat{g} = -0.06$ ; 95% CI:  $-0.11$  to  $.01$ ;  $p = .02$ ).

**Figure 6: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of food supply chain interventions on access to economic and livelihood resources**



**Note:** Acronyms used in this figure are spelled out as follows: [ACGG and ATONU (African Chicken Genetic Gains and Agriculture to Nutrition); ANGeL (Agriculture Nutrition and Gender Linkages);

ASDP-L (Agricultural Sector Development Programme-Livestock); ASSP (Agricultural Service Support Programme); CFPR-TUP (Challenging the Frontiers of Poverty Reduction - Targeting the Ultra Poor); DVSK (Diverse Vegetables Seeds and Knowledge); FAARM (Food and Agricultural Approaches to Reducing Malnutrition); GP (Gender Partnership); JCTDP (Jharkhand Chhattisgarh Tribal Development Programme); P'KWI (Popular Knowledge Initiative Farmer to Farmer Cooperative); PLA (Participatory Learning and Action); PROACT (Promoting Opportunities for All to Rise and Capture Transformation); SAAOs (Sub-Assistant Agricultural Officers); SELEVER (Soutenir l'Exploitation Familiale pour Lancer l'Élevage des Volailles et Valoriser l'Économie Rurale); WELHPB (Women's Economic Leadership through Horticulture Planting-Material Business Project)]. See Appendix C for more information about the interventions.

None of the moderator analysis variables (i.e., year of intervention, exposure to intervention in months, follow-up period in months, gender equality index, global hunger index, gender-transformative design) significantly contributed to the variation of estimates. Both the rank correlation and the regression test indicated potential funnel plot asymmetry ( $p = .046$  and  $p < .001$ , respectively), indicating that there may be publication bias present in this body of evidence.

Of the 15 included effect sizes, six remained after excluding high risk-of-bias estimates. The effect of interventions was then positive, small, and not statistically significant ( $\widehat{SMD} = 0.11$ ; 95% CI:  $-0.05$  to  $0.26$ ;  $p = .18$ ).

#### *Ownership of land and assets*

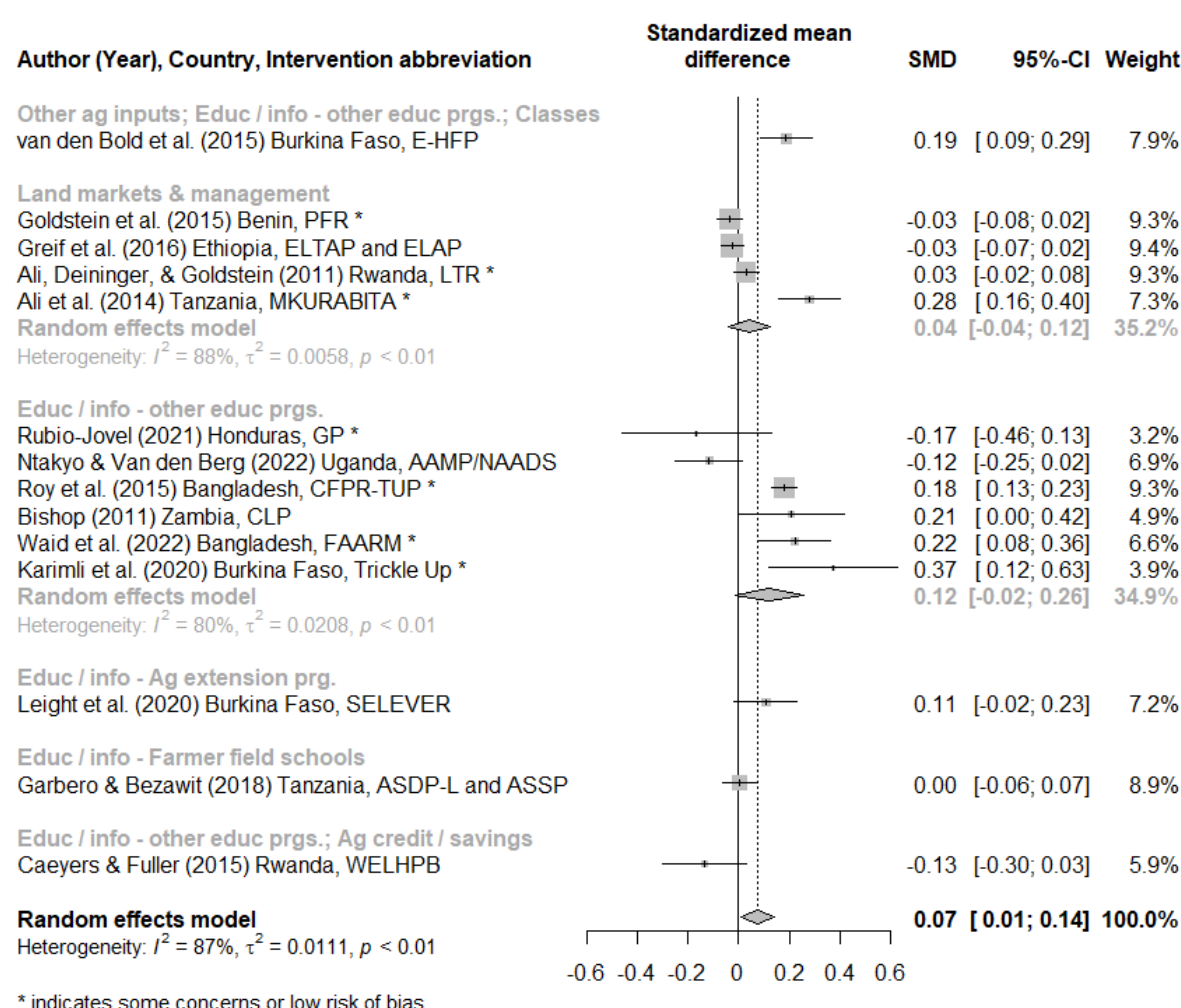
Within 14 studies, we identified 14 independent estimates of the effect of *food supply chain* interventions on women's *ownership of land and assets*. Studies of evaluated interventions mostly took place in Sub-Saharan Africa ( $k = 11$ ), followed by South Asia ( $k = 2$ ), and Latin America and the Caribbean ( $k = 1$ ). Of the 14 studies, two evaluated multi-component interventions (the Enhanced-Homestead Food Production project and WELHPB) (Appendix D). Ten interventions focused on *education and information programs* through *agricultural extension programs* ( $k = 1$ ), *farmer field schools* ( $k = 1$ ), and *other education programs* ( $k = 8$ ). Four studies focused on *land markets and management*, and one study focused on *agricultural credit and savings* and on *other agricultural inputs*.

Estimates used different measures of *ownership of land and assets* such as the value of agricultural assets (Van den Bold et al. 2015), parcel size (Goldstein et al. 2015), or the area of land in hectares owned by the wife only (Greif et al. 2016) at household ( $k = 10$ ) or individual levels ( $k = 4$ ).

**Some interventions under the *food supply chain* category show a positive effect on women's *ownership of land and assets*.** The overall weighted average effect was very small, positive, and statistically significant ( $\widehat{SMD} = 0.07$ ; 95% CI:  $0.01$  to  $0.14$ ;  $p = .02$ ; Figure 7). The observed outcomes ranged from  $-0.17$  to  $0.37$ . According to the  $Q$ -test, there is substantial heterogeneity across included estimates ( $Q(13) = 98.17$ ,  $p < .001$ ,  $\hat{\tau}^2 = 0.01$ ,  $I^2 = 86.76\%$ ). *Land market and management* ( $k = 4$ ) and *education and information on other education programs* ( $k = 6$ ) had enough estimates to run independent meta-analyses; on the former, we observed a very small, positive, and not statistically significant effect ( $\widehat{SMD} = 0.04$ ; 95% CI:  $-0.04$  to  $0.12$ ;  $p = .32$ ; Figure 7), and on the latter, we observed a small, positive and not statistically significant effect ( $\widehat{SMD} = 0.12$ ; 95% CI:  $-0.01$  to  $0.26$ ;  $p = .07$ ; Figure 7).

In Burkina Faso, Karimli, Bose, and Kagotho (2020) analyzed the effect of the Trickle Up program, which provided saving services, technical skills training, cash transfers, and ongoing support to women. They observed a large, positive, and statistically significant effect of the intervention on the durable assets owned by women 24 months after the intervention ( $\hat{g} = 0.37$ ; 95% CI: 0.12 to 0.63;  $p < .001$ ). In Tanzania, Ali et al. (2014) focused on the effect of the government property and business formalization program, MKURABITA, which invited beneficiaries to purchase agricultural land titles at a significantly reduced cost. They found a moderate, positive, and statistically significant effect of the intervention on women's land ownership ( $\hat{g} = 0.28$ ; 95% CI: 0.16 to 0.40;  $p = .001$ ).

**Figure 7: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of *food supply chain* interventions on *ownership of land and assets***



*Note: Acronyms used in this figure are spelled out as follows: [AAMP/NAADS (Agricultural Advisory and Market Production/National Agricultural Advisory Services); ASDP-L (Agricultural Sector Development Programme-Livestock); ASSP (Agricultural Service Support Programme); ATONU (Agriculture to Nutrition); CFPR-TUP (Challenging the Frontiers of Poverty Reduction - Targeting the Ultra Poor); CLP (Community Livelihoods Programme); ELAP (Ethiopia Land Administration Programme); ELTAP (Ethiopia Land Tenure and Administration Programme); FAARM (Food and Agricultural Approaches to Reducing Malnutrition); GP (Gender Partnership); LTR (Land Tenure*

*Regularization*); MKURABITA (*Mratibu wa Mpango wa Kurasimisha Rasilimali na Biashara za Wanyonge Tanzania*); PFR (*Participatory Forest Resources Management*); SELEVER (*Soutenir l'Exploitation Familiale pour Lancer l'Élevage des Volailles et Valoriser l'Économie Rurale*); WELHPB (*Women's Economic Leadership through Horticulture Planting-Material Business Project*)). See Appendix C for more information about the interventions.

The moderator analysis indicated that studies using an experimental design showed larger effects, while studies using average treatment effect showed smaller effects. Neither the rank correlation nor the regression test indicated any funnel plot asymmetry ( $p = .59$  and  $p = .49$ , respectively), indicating that there was no publication bias present.

Of the 14 effect sizes, seven remained after excluding high risk-of-bias estimates. The effect of *the food supply chain on ownership of assets and land* for women is small, positive, and statistically significant ( $\widehat{SMD} = 0.13$ ; 95% CI: 0.02 to 0.23;  $p = .02$ ).

#### *Control over resources*

In our body of evidence, 11 studies provided evidence on the effect of *food supply chain* interventions on *control over resources* outcomes through 12 estimates. The included estimates span two regions: Sub-Saharan Africa ( $k = 7$ ) and South Asia ( $k = 5$ ). Three of the 11 studies focused on multi-component programs (the Kukua Ni Kujifunza project [KnK], PROACT, and DVSK) (Appendix D).

Eleven of the estimates reported the effect of *education and information programs* through *agricultural extension programs* ( $k = 2$ ), *farmer field schools* ( $k = 3$ ), and *other education programs* ( $k = 6$ ). Greif et al. (2016) focused on *land markets and management* ( $k = 1$ ). The studies evaluating multi-component interventions provided the effect of *agricultural credit and savings* (Pamuk et al. 2021) and *other agricultural inputs* (Bonuedi, Gerber, and Kornher 2022; Depenbusch et al. 2021) combined with *education and information programs*.

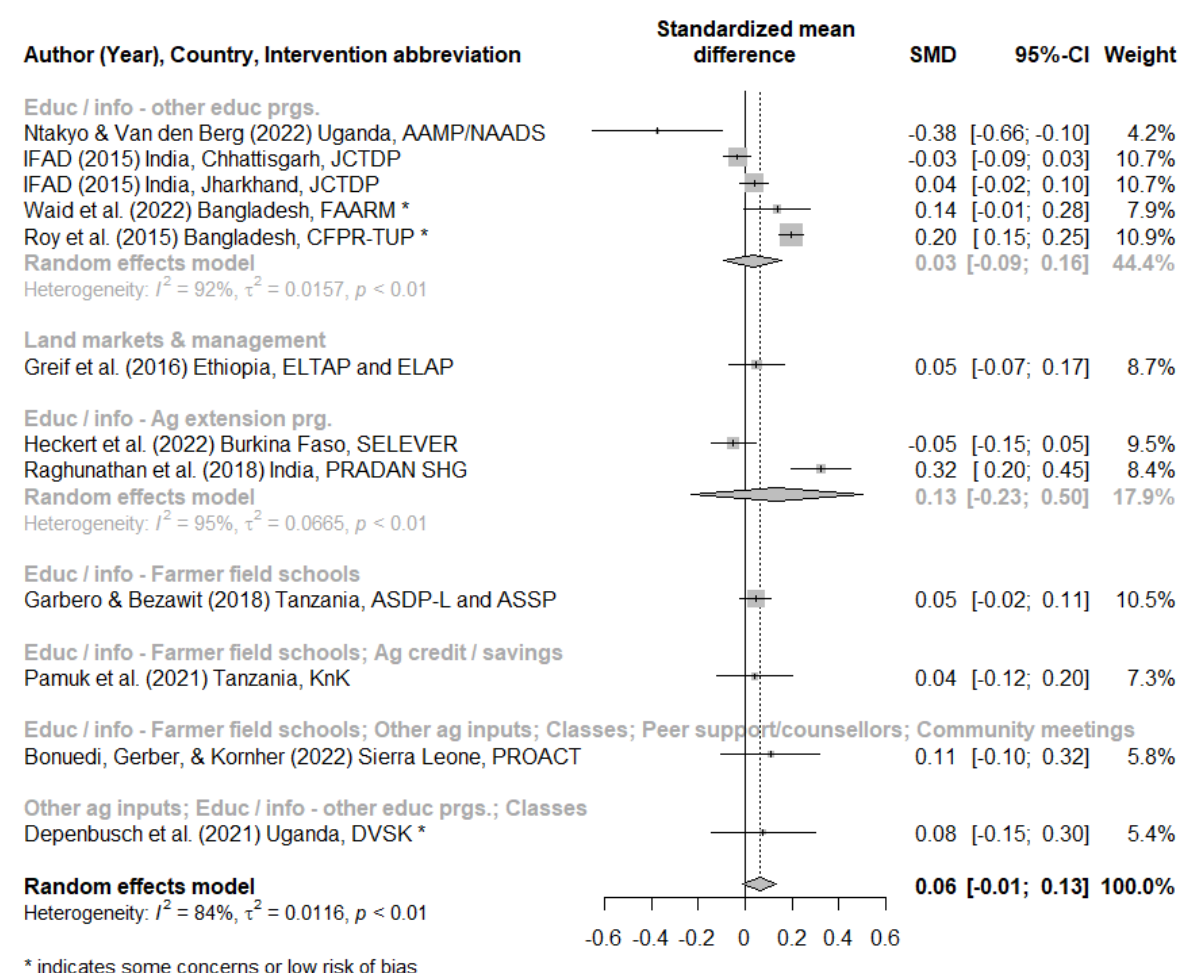
To measure *control over resources*, authors used different measures of whether women have any voice in deciding on the acquisition of assets, whether they use their savings independently, or whether they have land title certificates in their possession at the household ( $k = 10$ ) and individual level ( $k = 2$ ).

**Women's control over resources remained unchanged following food supply chain interventions.** The overall average effect was very small, positive, and not statistically significant ( $\widehat{SMD} = 0.06$ ; 95% CI: -0.01 to 0.13;  $p = .09$ ; Figure 8). The observed outcomes ranged from -0.38 to 0.32. According to the  $Q$ -test, there was substantial heterogeneity across included estimates ( $Q(11) = 69.53$ ,  $p < .001$ ,  $\hat{\tau}^2 = 0.01$ ,  $I^2 = 84.18\%$ ). *Education and information programs* through *other education programs* had enough estimates to run independent meta-analyses ( $k = 5$ ). We observed a very small, positive, and not statistically significant effect ( $\widehat{SMD} = 0.03$ ; 95% CI: -0.09 to 0.16;  $p = .59$ ; Figure 8).

In Uganda, Ntakyo and Van Den Berg (2022) observed the large, negative, and statistically significant effect of the Area-Based Agricultural Modernisation Programme /National Agriculture Advisory Services Project (which promoted the commercialization of a non-traditional cash crop in selected districts) on women's control over income ( $\hat{g} = -0.38$ ; 95% CI: -0.66 to -0.10;  $p < .001$ ). In Bangladesh, Roy et al. (2015) analyzed the effect of the Challenging the Frontiers of Poverty Reduction–Targeting the Ultra Poor

program. Its provision of productive assets and training led to a small, positive, and statistically significant effect on women's ability to have any voice in deciding to buy a cow ( $\hat{g} = 0.20$ ; 95% CI: 0.15 to 0.25;  $p < .001$ ).

**Figure 8: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of *food supply chain* interventions on *control over resources***



*Note: Acronyms used in this figure are spelled out as follows: [AAMP/NAADS (Agricultural Advisory and Market Production/National Agricultural Advisory Services); ASDP-L (Agricultural Sector Development Programme-Livestock); ASSP (Agricultural Service Support Programme); CFPR-TUP (Challenging the Frontiers of Poverty Reduction - Targeting the Ultra Poor); DVSK (Diverse Vegetables Seeds and Knowledge); ELAP (Ethiopia Land Administration Programme); ELTAP (Ethiopia Land Tenure and Administration Program); FAARM (Food and Agricultural Approaches to Reducing Malnutrition); JCTDP (Jharkhand Chhattisgarh Tribal Development Programme); KnK (Kukua Ni Kujifunza project); PROACT (Promoting Opportunities for All to Rise and Capture Transformation); PRADAN SHG (Professional Assistance for Development Action - Self Help Group); SELEVER (Soutenir l'Exploitation Familiale pour Lancer l'Élevage des Volailles et Valoriser l'Économie Rurale)]. See Appendix C for more information about the interventions.*

The moderator analysis indicated that studies analyzing effects at the individual level showed larger effects than studies analyzing effects at the household level. Neither the rank correlation nor the regression test indicated any funnel plot asymmetry ( $p = .95$  and  $p = .32$ , respectively), indicating that there was no publication bias present.

Of the 12 effect sizes, three remained after excluding high risk-of-bias estimates. The effect of *food supply chain* interventions on women's control over resources increased and was statistically significant ( $\widehat{SMD} = 0.18$ ; 95% CI: 0.14 to 0.23;  $p < .001$ ).

#### *Time use*

Our analysis included six studies and six independent estimates on the effect of *food supply chain* interventions on *women's time use*. Studies of evaluated interventions occurred in Sub-Saharan Africa ( $k = 4$ ) and South Asia ( $k = 2$ ). Of the six studies, one evaluated multi-component interventions (DVSK) (Appendix D). All six interventions focused on *education and information programs* through *agricultural extension programs* ( $k = 2$ ) and *other education programs* ( $k = 4$ ). One study focused on *other agricultural inputs*.

Authors used different measures on women's time use in household tasks and childcare,<sup>10</sup> women's farm-related workload, and hours spent on work at the household ( $k = 4$ ) and individual level ( $k = 2$ ).

**Women's time use<sup>11</sup> remained unchanged following food supply chain interventions.** The overall average effect was very small, positive, and not statistically significant ( $\widehat{SMD} = 0.01$ ; 95% CI: -0.04 to 0.05;  $p = .79$ ; Figure 9). The observed outcomes ranged from -0.14 to 0.10. According to the  $Q$ -test, the heterogeneity across included estimates may not be important ( $Q(5) = 4.73$ ,  $p = .45$ ,  $\hat{\tau}^2 = 0.001$ ,  $I^2 = 0.001\%$ ).

*Education and information programs* through *other education programs* had enough estimates to run independent meta-analyses ( $k = 3$ ), but we observed a very small, negative and not statistically significant average effect ( $\widehat{SMD} = -0.002$ ; 95% CI: -0.10 to 0.11;  $p = .98$ ; Figure 9). Indeed, none of the individual estimates included in this body of evidence were statistically significant.

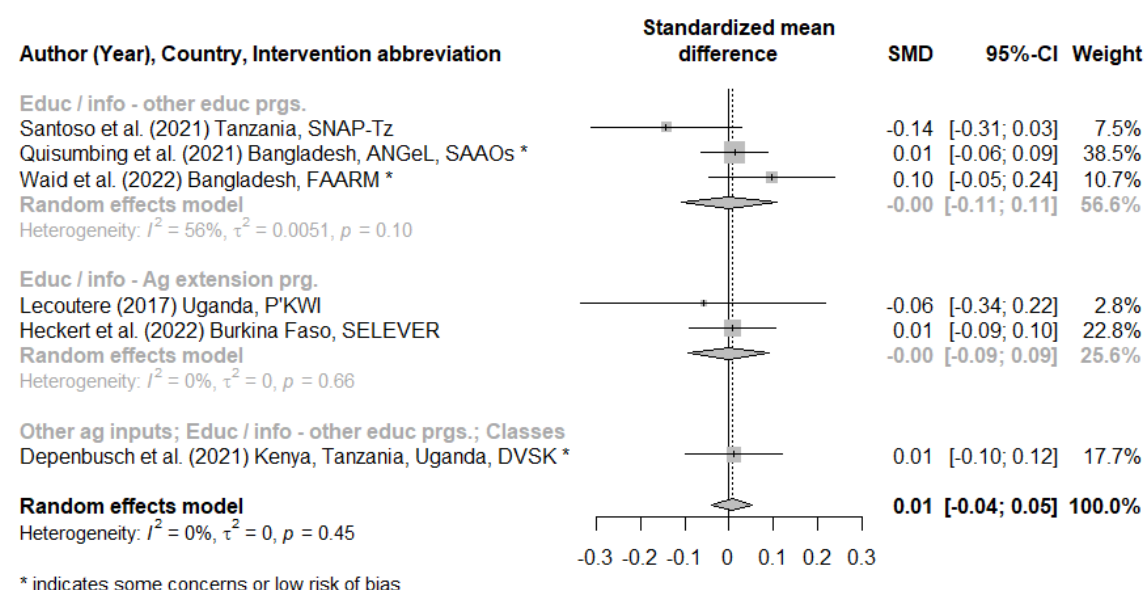
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<sup>10</sup> We analyzed such outcomes through reverse signs, meaning that a decrease in the time spent on household tasks and childcare is a positive outcome.

<sup>11</sup> We defined *time use* as the allocation of time women spend outside of gender-restricted roles; we then measured the new allocation of women's time outside of household chores towards leisure, employment, and/or community activities.



**Figure 9: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of *food supply chain* interventions on *time use***



**Note:** Acronyms used in this figure are spelled out as follows: [ANGeL (Agriculture Nutrition and Gender Linkages); DVSK (Diverse Vegetables Seeds and Knowledge); FAARM (Food and Agricultural Approaches to Reducing Malnutrition); P'KWI (Popular Knowledge Initiative Farmer to Farmer Cooperative); SAAOs (Sub-Assistant Agricultural Officers); SELEVER (Soutenir l'Exploitation Familiale pour Lancer l'Élevage des Volailles et Valoriser l'Économie Rurale); SNAP-Tz (Sustainable Nutrition Agriculture Program Tanzania)]. See Appendix C for more information about the interventions.

None of the moderator analysis variables significantly contributed to the variation in estimates. After excluding high risk-of-bias estimates, three of the six effect sizes remained. The effect of the *food supply chain* on *women's time use* was still very small, positive, and not statistically significant ( $\widehat{SMD} = 0.03$ ; 95% CI: -0.03 to 0.08;  $p = .38$ ).

## Agency

### Decision-making

Within 20 studies, we identified 20 independent estimates of the effect of *food supply chain* interventions on women's *decision-making*. Studies of evaluated interventions mostly took place in Sub-Saharan Africa ( $k = 10$ ), followed by South Asia ( $k = 7$ ), Latin America and the Caribbean ( $n = 2$ ), and East Asia and the Pacific ( $n = 1$ ). Of the 20 studies, three evaluated multi-component interventions (KnK, the Empowerment and Community Support and Learning Alliance [EACSLA], and WELHPB) (Appendix D).

Seventeen interventions focused on *education and information programs* through *agricultural extension programs* ( $k = 4$ ), *farmer field schools* ( $k = 3$ ), and *other education programs* ( $k = 10$ ). Two studies focused on *agricultural credit and savings*, two evaluated *livestock access* interventions, one focused on *land markets and management*, and one other focused on *other agricultural inputs*.

Estimates employed different measures of decision-making, such as whether women have any voice in deciding how to spend the money they earn (Roy et al. 2015), whether they make wide decisions on what crops to grow on land in their possession (Greif et al. 2016),

and whether they participate in healthcare decision-making (Harris-Fry et al. 2016) at the household ( $k = 13$ ) or individual level ( $k = 7$ ).

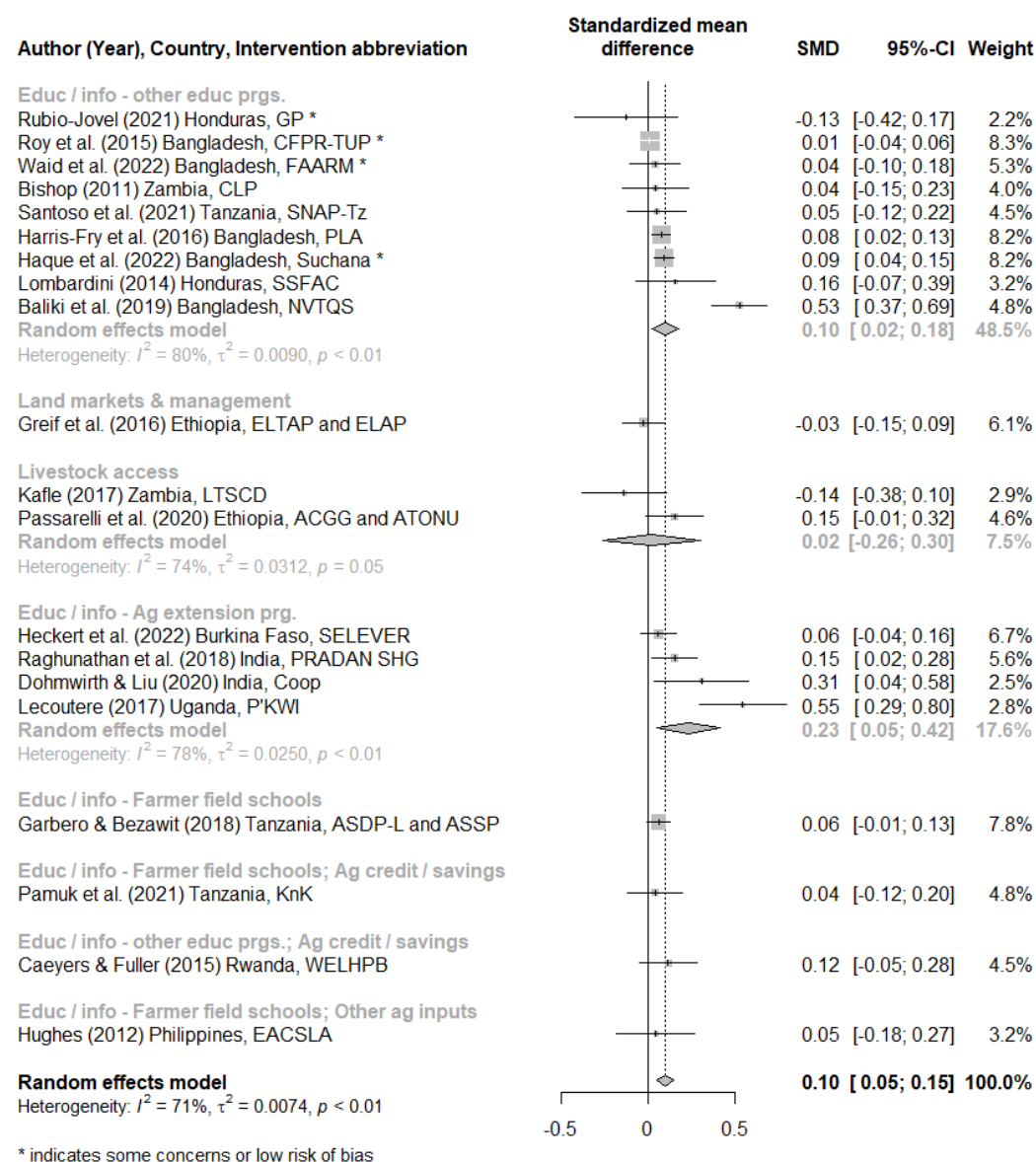
**Some interventions under the *food supply chain* category showed a positive effect on women's participation in *decision-making*.** The overall average effect was small, positive, and statistically significant ( $\widehat{SMD} = 0.10$ ; 95% CI: 0.05 to 0.15;  $p < .001$ ; Figure 10). The observed outcomes ranged from  $-0.14$  to  $0.55$ . According to the  $Q$ -test, there was substantial heterogeneity across included estimates ( $Q(19) = 65.62$ ,  $p < .001$ ,  $\hat{\tau}^2 = 0.01$ ,  $I^2 = 71.04\%$ ).

*Education and information programs* through *agricultural extension services* ( $k = 4$ ) and *other education programs* ( $k = 9$ ) had enough estimates to run independent meta-analyses. In both cases, we observed a positive and statistically significant effect: small for *other education programs* ( $\widehat{SMD} = 0.10$ ; 95% CI: 0.02 to 0.18;  $p = .01$ ; Figure 10) and moderate for *agricultural extension programs* ( $\widehat{SMD} = 0.23$ ; 95% CI: 0.05 to 0.42;  $p = .01$ ; Figure 10).

In Bangladesh, Baliki et al. (2019) analyzed the effect of the Nutrition and Vegetable Training and Quality Seed Supply Program (providing women with nutrition and cultivation training in addition to seeds), which had a large, positive, and statistically significant effect on women's decision-making about the home garden ( $\hat{g} = 0.53$ ; 95% CI: 0.37 to 0.69;  $p < .001$ ). In Uganda, Lecoutere (2017) focused on the effect of the Popular Knowledge Women's Initiative on women's decision-making power in the household. Its extension service and seeds provided on credit led to a large, positive, and statistically significant effect ( $\hat{g} = 0.55$ ; 95% CI: 0.29 to 0.80;  $p < .001$ ).



**Figure 10: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of food supply chain interventions on decision-making**



Note: Acronyms used in this figure are spelled out as follows: [ACGG and ATONU (African Chicken Genetic Gains and Agriculture to Nutrition); ASDP-L (Agricultural Sector Development Programme-Livestock); ASSP (Agricultural Service Support Programme); CFPR-TUP (Challenging the Frontiers of Poverty Reduction - Targeting the Ultra Poor); CLP (Community Livelihoods Programme); DVSK (Diverse Vegetables Seeds and Knowledge); EACSLA (Enhancing Access and Control to Sustainable Livelihood Assets of the Manobo Tribe); ELAP (Ethiopia Land Administration Programme); ELTAP (Ethiopia Land Tenure and Administration Program); FAARM (Food and Agricultural Approaches to Reducing Malnutrition); GP (Gender Partnership); KnK (Kukua Ni Kujifunza project); LTSCD (Land Tenure Security and Community Development); NVTQS (Nutrition and Vegetable Training and Quality Seed Supply); PLA (Participatory Learning and Action); P'KWI (Popular Knowledge Initiative Farmer to Farmer Cooperative); PRADAN SHG (Professional Assistance for Development Action - Self Help Group); SELEVER (Soutenir l'Exploitation Familiale pour Lancer l'Élevage des Volailles et Valoriser l'Économie Rurale); SNAP-Tz (Sustainable Nutrition Agriculture Program Tanzania); SSFAC (Small-Scale Farming and Community Action); WELHPB (Women's Economic Leadership through Horticulture Planting-Material Business Project)]. See Appendix C for more information about the interventions.

None of the moderator analysis variables significantly contributed to the variation in estimates. Neither the rank correlation nor the regression test indicated any funnel plot asymmetry ( $p = .46$  and  $p = .22$ , respectively), indicating that publication bias was not present.

After excluding estimates with a high risk of bias, four of the 20 estimates remained. The effect of the *food supply chain* on *decision-making* was then very small, positive, and no longer statistically significant ( $\widehat{SMD} = 0.04$ ; 95% CI: -0.02 to 0.10;  $p = .18$ ).

### *Women's rights*

In our body of evidence, four studies provided evidence on the effect of *food supply chain* interventions on *women's rights* outcomes through four estimates which spanned three regions: Sub-Saharan Africa ( $k = 2$ ), the Middle East and North Africa ( $k = 1$ ), and South Asia ( $k = 1$ ). One of the four studies focused on multi-component programs (WELHPB) (Appendix D). All four estimates reported the effect of *education and information programs* through *farmer field schools* ( $k = 1$ ) and *other education programs* ( $k = 3$ ). One study also focused on *agricultural credit and savings services* ( $k = 1$ ).

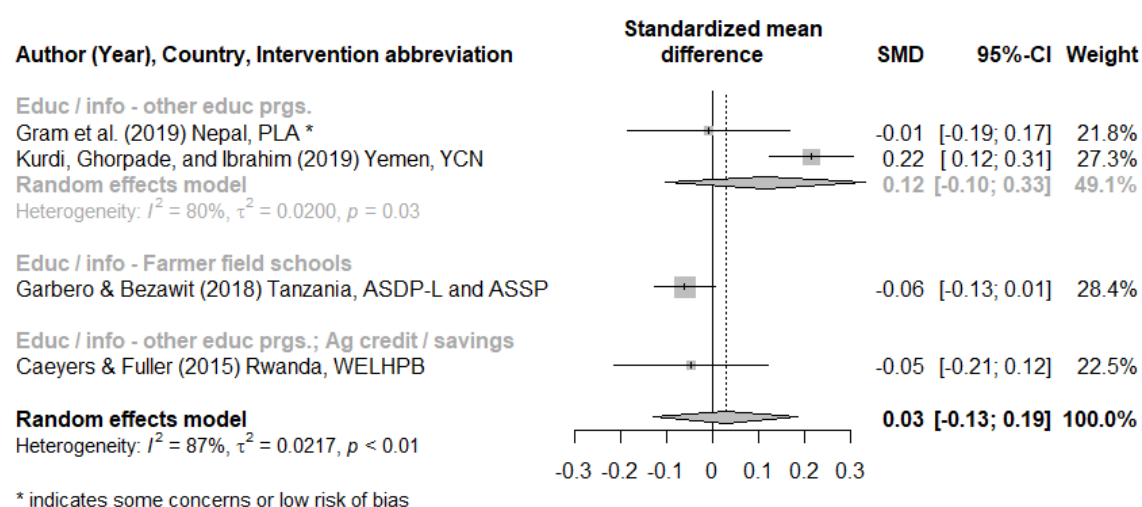
Authors used different indicators of women's rights, including women's ability to take their child alone to the health center (Kurdi, Ghorpade, and Ibrahim 2019), women's freedom of movement (Caeyers and Fuller 2015), and whether women can work outside of the home (Gram et al. 2019) at the household ( $k = 2$ ) and individual level ( $k = 2$ ). We also noted that most of the measures were related to women's freedom of movement, and less evidence was available on women's other rights.

### ***Women's rights remained unchanged following food supply chain interventions.***

The overall average effect was very small, positive, and not statistically significant ( $\widehat{SMD} = 0.03$ ; 95% CI: -0.13 to 0.19;  $p = .72$ ; Figure 11). The observed outcomes ranged from -0.06 to 0.22. According to the  $Q$ -test, there was substantial heterogeneity across included estimates ( $Q(3) = 23.77$ ,  $p < .001$ ,  $\hat{\tau}^2 = 0.02$ ,  $I^2 = 87.38\%$ ).

In Yemen, Kurdi, Ghorpade, and Ibrahim (2019) analyzed the effect of a conditional cash transfer (contingent upon participation in a nutrition program) on women's ability to take their child alone to the health center. They observed a moderate, positive, and statistically significant effect ( $\hat{g} = 0.22$ ; 95% CI: 0.12 to 0.31;  $p < .001$ ).

**Figure 11: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of *food supply chain* interventions on *women's rights***



*Note: Acronyms used in this figure are spelled out as follows: [ASDP-L (Agricultural Sector Development Programme-Livestock); ASSP (Agricultural Service Support Programme); PLA (Participatory Learning and Action); WELHPB (Women's Economic Leadership through Horticulture Planting-Material Business Project); YCN (Yemen Conditional Nutrition)]. See Appendix C for more information about the interventions.*

The moderator analysis indicated that interventions implemented in contexts with greater gender inequality (according to the gender equality index) showed larger effects than those implemented in areas with lower levels of gender inequality. Out of the four effect sizes, one remained after excluding high risk-of-bias estimates: in Nepal, Gram et al. (2019) analyzed the effect of Participatory Learning and Action, a program providing cash or food transfers alongside training sessions. They observed a very small, negative, and not statistically significant effect on women's ability to work outside the home ( $\hat{g} = -0.01$ ; 95% CI:  $-0.19$  to  $0.17$ ;  $p = .92$ ).

### *Collective action and leadership*

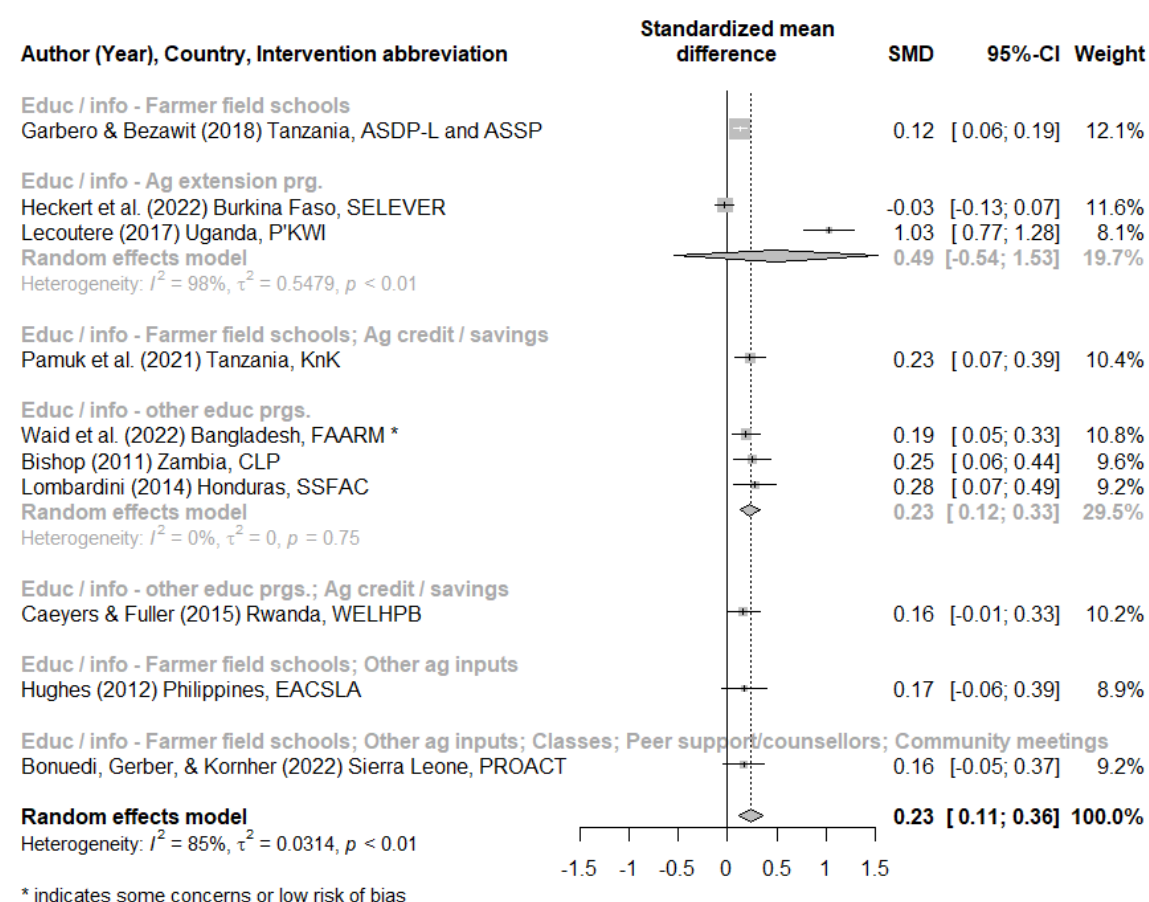
Within ten studies, we identified ten independent estimates of the effect of *food supply chain* interventions on *collective action and leadership*. Studies of evaluated interventions mostly took place in Sub-Saharan Africa ( $k = 7$ ), followed by South Asia, Latin America and the Caribbean, and East Asia and the Pacific (each  $k = 1$ ). Of the ten studies, four evaluated multi-component interventions (KnK, EACSLA, PROACT, and WELHPB) (Appendix D). All interventions focused on *education and information programs* through *agricultural extension programs* ( $k = 2$ ), *farmer field schools* ( $k = 4$ ), and *other education programs* ( $k = 4$ ). Two studies focused on the impact of *agricultural credit and savings* on *other agricultural inputs*.

Estimates used different measures of collective action and leadership, such as whether women are members of influential groups (Garbero and Bezawit 2018), their decision-making power in the community (Lecoutere 2017), or the number of groups and organizations in which they are involved (Lombardini 2014) at the household ( $k = 5$ ) or individual level ( $k = 5$ ).

**Some interventions under the *food supply chain* category showed a positive effect on women's *collective action and leadership*.** The overall average effect was moderate, positive, and statistically significant ( $\overline{SMD} = 0.23$ ; 95% CI: 0.11 to 0.36;  $p < .001$ ; Figure 12). The observed outcomes ranged from  $-0.03$  to  $1.03$ . According to the  $Q$ -test, there is substantial heterogeneity across included estimates ( $Q(9) = 61.73$ ,  $p < .001$ ,  $\hat{\tau}^2 = 0.03$ ,  $I^2 = 85.42\%$ ). *Education and information programs* through *other education* ( $k = 3$ ) had enough estimates to run independent meta-analyses, and showed moderate, positive, and statistically significant effects ( $\overline{SMD} = 0.22$ ; 95% CI: 0.13 to 0.32;  $p < .001$ ; Figure 12).

In Uganda, Lecoutere (2017) analyzed the effect of the Popular Knowledge Women's Initiative, which provided extension services and seeds to sunflower producers: the intervention had a large, positive, and statistically significant effect on women's decision-making power in the community ( $\hat{g} = 1.03$ ; 95% CI: 0.77 to 1.28;  $p < .001$ ). In Tanzania, Garbero and Bezawit (2018) focused on the Agricultural Sector Development Program (Livestock) and the Agriculture Service Support Program (a field school program for livestock keepers), which had a small, positive, and statistically significant ( $\hat{g} = 0.12$ ; 95% CI: 0.06 to 0.19;  $p < .001$ ).

**Figure 12: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of *food supply chain* interventions on *collective action and leadership***



*Note: Acronyms used in this figure are spelled out as follows: [ASDP-L (Agricultural Sector Development Programme-Livestock); ASSP (Agricultural Service Support Programme); CLP (Community Livelihoods Programme); EACSLA (Enhancing Access and Control to Sustainable*

*Livelihood Assets of the Manobo Tribe*); FAARM (Food and Agricultural Approaches to Reducing Malnutrition); KnK (Kukua Ni Kujifunza project); P'KWI (Popular Knowledge Initiative Farmer to Farmer Cooperative); PROACT (Promoting Opportunities for All to Rise and Capture Transformation); SELEVER (Soutenir l'Exploitation Familiale pour Lancer l'Élevage des Volailles et Valoriser l'Économie Rurale); SSFAC (Small-Scale Farming and Community Action); WELHPB (Women's Economic Leadership through Horticulture Planting-Material Business Project)]. See Appendix C for more information about the interventions.

None of the moderator variables significantly contributed to the variation in estimates. Both the rank correlation and the regression test indicated potential funnel plot asymmetry ( $p = .047$  and  $p = .005$ , respectively), suggesting that there may be publication bias in this body of evidence.

Out of the ten effect sizes, one remained after excluding high risk-of-bias estimates: in Bangladesh, Waid et al. (2022) observed the small, positive, and statistically significant effect of the Food and Agricultural Approaches to Reducing Malnutrition Program and its nutrition training on women's empowerment regarding agency ( $\hat{g} = 0.19$ ; 95% CI: 0.05 to 0.33;  $p = .01$ ).

## Achievements

### *Gender-transformative outcomes*

Our analysis included eight studies and eight independent estimates on the effect of *food supply chain* interventions on *gender-transformative* outcomes. Studies of evaluated interventions mostly took place in Sub-Saharan Africa ( $k = 4$ ), followed by South Asia ( $k = 2$ ), the Middle East and North Africa ( $k = 1$ ), and East Asia and the Pacific ( $k = 1$ ). Of the eight studies, two evaluated multi-component interventions (WELHPB and EACSLA) (Appendix D). All eight interventions focused on *education and information programs* through *agricultural extension programs* ( $k = 2$ ), *farmer field schools* ( $k = 2$ ), and *other education programs* ( $k = 4$ ). One study focused on *other agricultural inputs* and another focused on *agricultural credit and savings*.

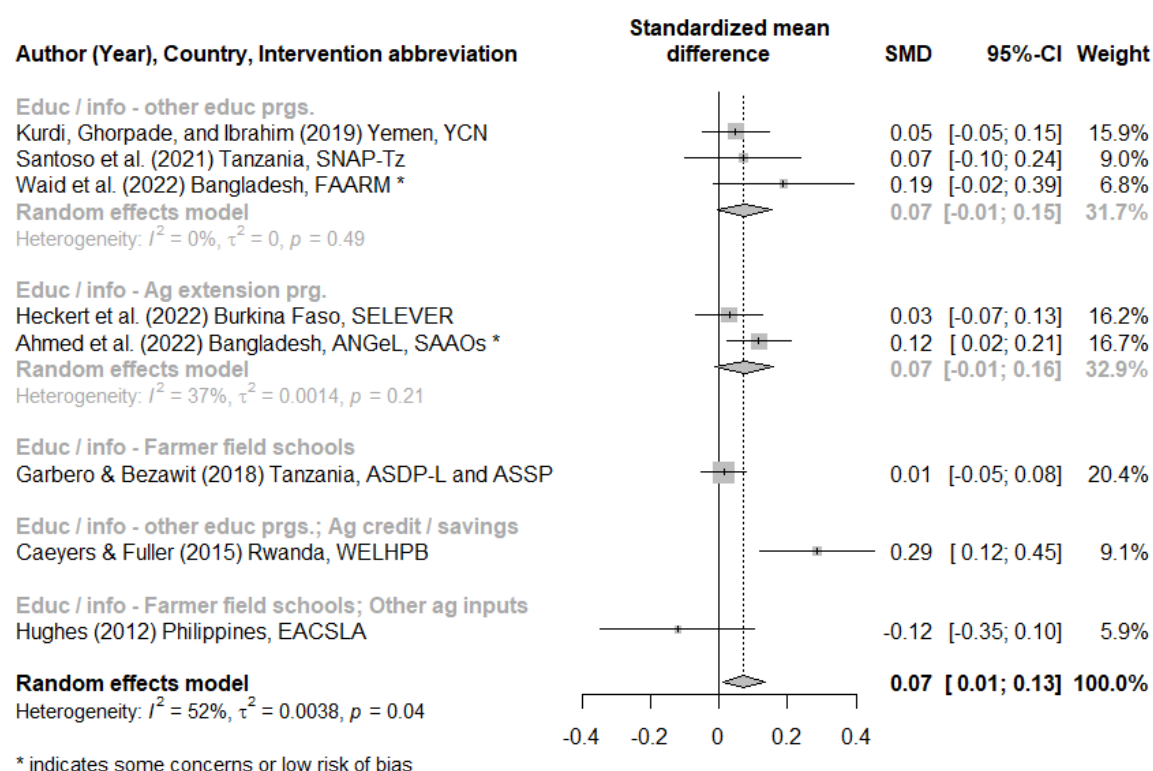
Estimates used different measures of *gender-transformative* outcomes, such as whether women expect their daughters to achieve secondary education (Kurdi, Ghorpade, and Ibrahim 2019), the number of activities in which the husband provided assistance (Santoso et al. 2021), and people's attitudes toward women's roles (Caeyers and Fuller 2015) at the household ( $k = 4$ ) or individual level ( $k = 4$ ).

**Some interventions under the *food supply chain* category show a positive effect on *gender-transformative* outcomes.** The overall average effect was very small, positive, and statistically significant ( $\widehat{SMD} = 0.07$ ; 95% CI: 0.01 to 0.13;  $p = .02$ ; Figure 13). The observed outcomes ranged from  $-0.12$  to  $0.29$ . According to the  $Q$ -test, there was substantial heterogeneity across included estimates ( $Q(7) = 14.62$ ,  $p = .04$ ,  $\hat{\tau}^2 = 0.004$ ,  $I^2 = 52.13\%$ ). *Education and information programs* through *other education* ( $k = 3$ ) had enough estimates to run an independent meta-analysis, and showed very small, positive, and not statistically significant effects ( $\widehat{SMD} = 0.07$ ; 95% CI: 0.01 to 0.13;  $p = .02$ ; Figure 13).

In Rwanda, Caeyers and Fuller (2015) analyzed the effect of the WELHPB (providing mentoring and training to women working in the pineapple value chain), which had a moderate, positive, and statistically significant effect on respondent's attitudes towards

women's roles ( $\hat{g} = 0.29$ ; 95% CI: 0.12 to 0.45;  $p = .001$ ). In Bangladesh, Ahmed et al. (2022) analyzed the effect of the Agriculture, Nutrition, and Gender Linkages Project (which provided nutrition training for women); the intervention had a small, positive, and statistically significant effect on attitudes towards women ( $\hat{g} = 0.12$ ; 95% CI: 0.02 to 0.21;  $p = .02$ ).

**Figure 13: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of *food supply chain* interventions on *gender-transformative outcomes***



*Note: Acronyms used in this figure are spelled out as follows: [ANGeL (Agriculture Nutrition and Gender Linkages); ASDP-L (Agricultural Sector Development Programme-Livestock); ASSP (Agricultural Service Support Programme); EACSLA (Enhancing Access and Control to Sustainable Livelihood Assets of the Manobo Tribe); FAARM (Food and Agricultural Approaches to Reducing Malnutrition); SAAOs (Sub-Assistant Agricultural Officers); SELEVER (Soutenir l'Exploitation Familiale pour Lancer l'Élevage des Volailles et Valoriser l'Économie Rurale); SNAP-Tz (Sustainable Nutrition Agriculture Program Tanzania); WELHPB (Women's Economic Leadership through Horticulture Planting-Material Business Project); YCN (Yemen Conditional Nutrition)]. See Appendix C for more information about the interventions.*

The exploratory moderator analysis indicated that studies analyzing effects at the individual level showed larger effects than studies analyzing effects at the household level. Of the eight effect sizes, two remained after excluding high risk-of-bias estimates. The effect of the *food supply chain* on *gender-transformative outcomes* increases slightly and is still statistically significant ( $\widehat{SMD} = 0.12$ ; 95% CI: 0.05 to 0.21;  $p = .003$ ).

### Self-esteem

Within seven studies, we identified seven independent estimates of the effect of *food supply chain* interventions on *self-esteem*. Studies of evaluated interventions mostly occurred in



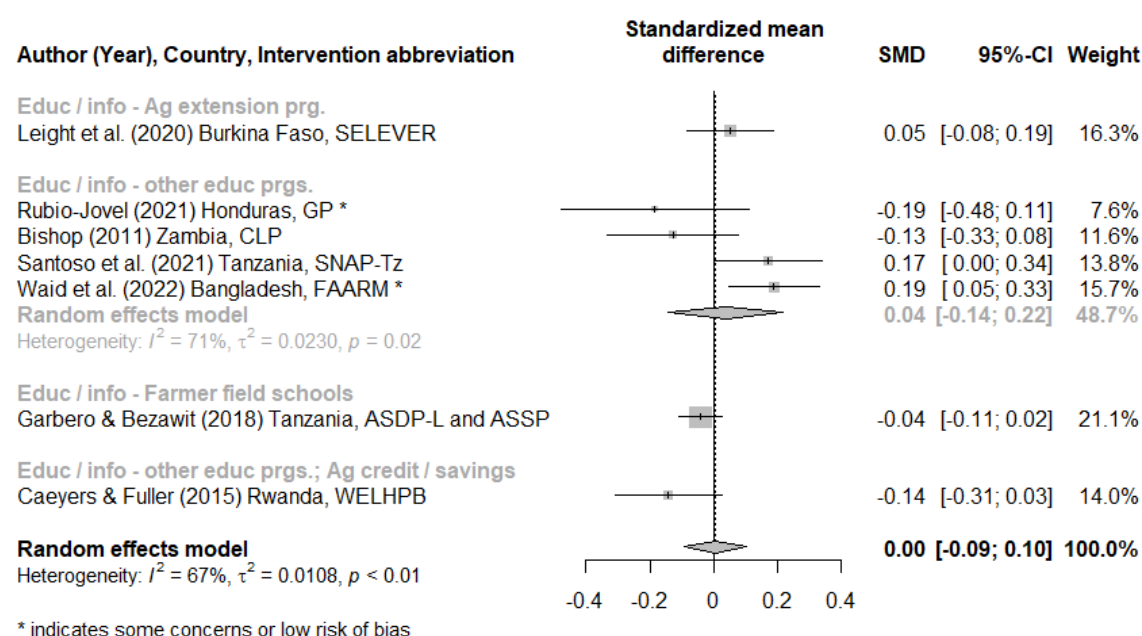
Sub-Saharan Africa (k = 5), followed by South Asia (n = 1), and Latin America and the Caribbean (k = 1). Of the seven studies, one evaluated multi-component interventions (WELHPB; Appendix D). All interventions focused on *education and information programs* through *agricultural extension programs* (k = 1), *farmer field schools* (k = 1), and *other education programs* (k = 5). One study focused on *agricultural credit and savings*.

To measure *women's self-esteem*, authors used indicators of women's self-reported self-efficacy (Leight et al. 2020), depression (Santoso et al. 2021), and confidence speaking in public (Rubio-Jovel 2021) at the household (k = 7) and individual level (k = 3).

**Interventions under the *food supply chain* category showed no effect on women's self-esteem.** The overall average effect was very small, positive, and not statistically significant ( $\widehat{SMD} = 0.004$ ; 95% CI: -0.09 to 0.10;  $p = .92$ ; Figure 14). The observed outcomes ranged from -0.19 to 0.19. According to the Q-test, there was substantial heterogeneity across included estimates ( $Q(6) = 18.42$ ,  $p = .005$ ,  $\hat{\tau}^2 = 0.01$ ,  $I^2 = 67.42\%$ ). *Education and information programs* through *other education* (k = 4) had enough estimates to run an independent meta-analysis and showed a very small, positive, and not statistically significant effect ( $\widehat{SMD} = 0.04$ ; 95% CI: -0.14 to 0.22;  $p = .66$ ; Figure 14).

In Bangladesh, Waid et al. (2022) analyzed the effect of the Food and Agricultural Approaches to Reducing Malnutrition Program, which provided nutrition training to women's groups and had a small, positive, and statistically significant effect on women's self-efficacy ( $\hat{g} = 0.19$ ; 95% CI: 0.05 to 0.33;  $p = .01$ ).

**Figure 14: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of *food supply chain* interventions on women's self-esteem**



*Note: Acronyms used in this figure are spelled out as follows: [ASDP-L (Agricultural Sector Development Programme-Livestock); ASSP (Agricultural Service Support Programme); CLP (Community Livelihoods Programme); FAARM (Food and Agricultural Approaches to Reducing Malnutrition); GP (Gender Partnership); SELEVER (Soutenir l'Exploitation Familiale pour Lancer l'Élevage des Volailles et Valoriser l'Économie Rurale); SNAP-Tz (Sustainable Nutrition Agriculture*

*Program Tanzania*); WELHPB (*Women's Economic Leadership through Horticulture Planting-Material Business Project*)). See Appendix C for more information about the interventions.

The exploratory moderator analysis indicated that studies with quasi-experimental designs showed smaller effects relative to those with experimental designs. Of the seven effect sizes, two remained after excluding high risk-of-bias estimates. The effect of *food supply chain* interventions on *gender-transformative* outcomes was still very small, positive, and not statistically significant ( $\widehat{SMD} = 0.02$ ; 95% CI:  $-0.33$  to  $0.39$ ;  $p = .89$ ).

#### *Other empowerment outcomes and indices*

Within 13 studies, we identified 13 independent estimates of the effect of *food supply chain* interventions on the *other empowerment* outcomes and indices for women. Studies of evaluated interventions mostly took place in Sub-Saharan Africa ( $k = 7$ ), followed by South Asia ( $k = 4$ ), Latin America and the Caribbean ( $n = 1$ ), and East Asia and the Pacific ( $n = 1$ ). Of the 13 studies, three evaluated multi-component interventions (KnK, EACSLA, and WELHPB) (Appendix D).

Twelve focused on *education and information programs* through *agricultural extension programs* ( $k = 3$ ), *farmer field schools* ( $k = 2$ ), and *other education programs* ( $k = 7$ ). Two studies focused on *agricultural credit and savings* (both also included *education and information programs* components), and two studies focused on *other agricultural inputs* (one study also included a *farmer field school* intervention).

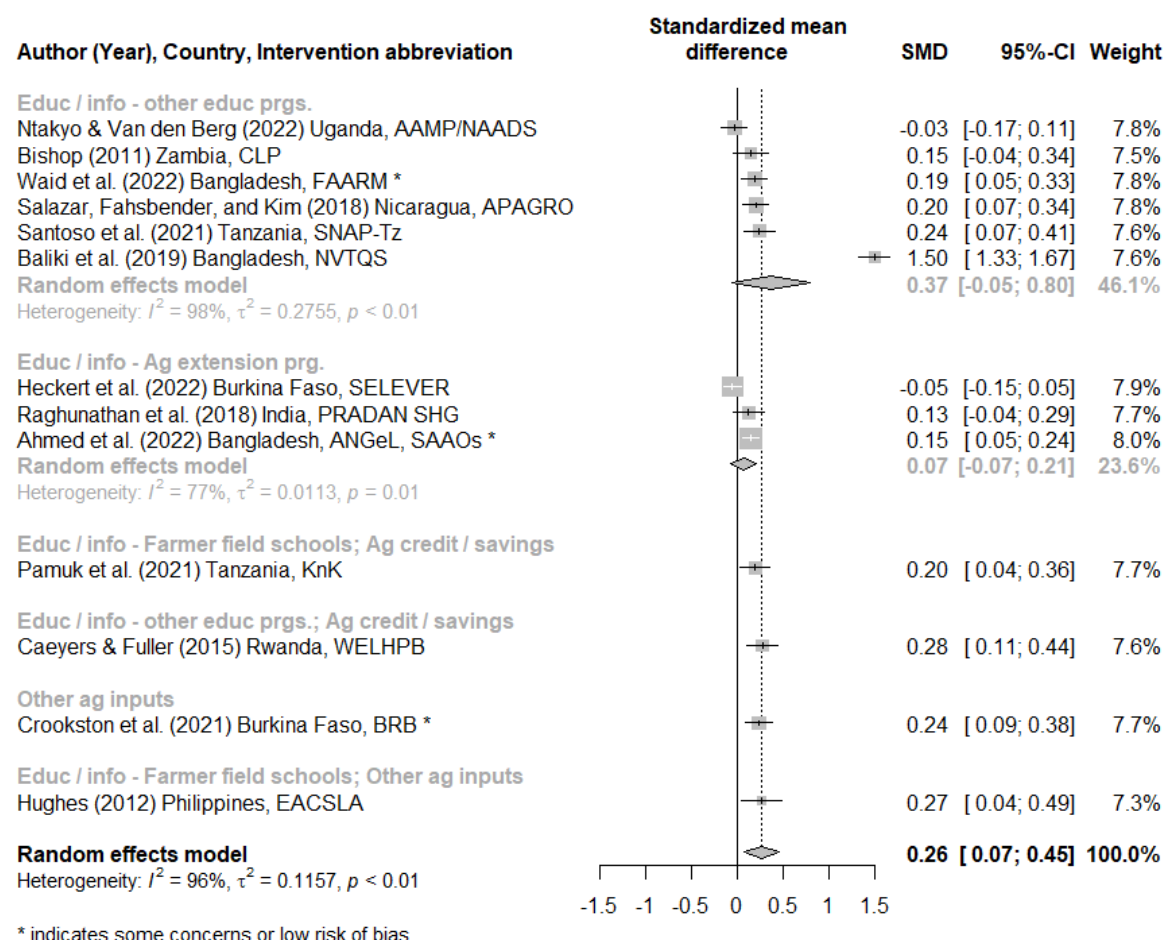
Estimates used different measures of international or author-designed indices of women's empowerment, such as the Women's Empowerment Score (Baliki et al. 2019), the Women's Empowerment in Agriculture Index (Raghunathan et al. 2018), the Abbreviated Women's Empowerment in Agriculture Index (Santoso et al. 2021), the project-level Women's Empowerment in Agriculture Index (Heckert et al. 2022; Waid et al. 2022) or the Female Disempowerment Score (Salazar, Fahsbender, and Kim 2018) at household ( $k = 8$ ) or individual levels ( $k = 5$ ).

**Some interventions under the *food supply chain* category show a positive effect on *other empowerment* outcomes and indices.** The overall average effect was moderate, positive, and statistically significant ( $\widehat{SMD} = 0.26$ ; 95% CI:  $-0.07$  to  $0.45$ ;  $p = .006$ ; Figure 15). The observed outcomes ranged from  $-0.05$  to  $1.50$ . According to the  $Q$ -test, there was substantial heterogeneity across included estimates ( $Q(12) = 267.90$ ,  $p < .001$ ,  $\hat{\tau}^2 = 0.12$ ,  $I^2 = 95.52\%$ ). *Education and information programs* through *agricultural extension* ( $k = 3$ ) or *other education* ( $k = 6$ ) had enough estimates to run independent meta-analyses. The former showed a very small, positive, and not statistically significant effect ( $\widehat{SMD} = 0.07$ ; 95% CI:  $-0.07$  to  $0.21$ ;  $p = .32$ ; Figure 15). The latter showed a large, positive, and not statistically significant effect ( $\widehat{SMD} = 0.37$ ; 95% CI:  $-0.05$  to  $0.80$ ;  $p = .08$ ; Figure 15).

In Bangladesh, Baliki et al. (2019) analyzed the effect of the Nutrition and Vegetable Training and Quality Seed Supply Program, an intervention providing nutrition and agriculture training accompanied by seed subsidies. They found a large, positive, and statistically significant effect on women's empowerment ( $\hat{g} = 1.50$ ; 95% CI:  $1.33$  to  $1.67$ ;  $p < .001$ ). In Rwanda, Caeyers and Fuller (2015) analyzed the WELHPB and observed a moderate, positive, and statistically significant effect ( $\hat{g} = 0.28$ ; 95% CI:  $0.11$  to  $0.44$ ;  $p = .001$ ).



**Figure 15: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of *food supply chain* interventions on *other empowerment* outcomes and indices**



*Note: Acronyms used in this figure are spelled out as follows: [AAMP/NAADS (Agricultural Advisory and Market Production/National Agricultural Advisory Services); ANGeL (Agriculture Nutrition and Gender Linkages); APAGRO (Agrifood Support Program); BRB (Building Resilience in Burkina Faso); CLP (Community Livelihoods Programme); EACSLA (Enhancing Access and Control to Sustainable Livelihood Assets of the Manobo Tribe); FAARM (Food and Agricultural Approaches to Reducing Malnutrition); KnK (Kukua Ni Kujifunza project); NVTQS (Nutrition and Vegetable Training and Quality Seed Supply); PRADAN SHG (Professional Assistance for Development Action - Self Help Group); SAAOs (Sub-Assistant Agricultural Officers); SELEVER (Soutenir l'Exploitation Familiale pour Lancer l'Élevage des Volailles et Valoriser l'Économie Rurale); SNAP-Tz (Sustainable Nutrition Agriculture Program Tanzania); WELHPB (Women's Economic Leadership through Horticulture Planting-Material Business Project)]. See Appendix C for more information about the interventions.*

None of the moderator variables explained the variation in estimates. The rank correlation test indicated funnel plot asymmetry ( $p = .03$ ) but the regression test did not ( $p = .31$ ); therefore, publication bias may be present.

Of the 13 effect sizes, three remained after excluding high risk-of-bias estimates. The effect of the *food supply chain* on *other empowerment* outcomes and indices was then small, positive, and statistically significant ( $\widehat{SMD} = 0.18$ ; 95% CI: 0.11 to 0.24;  $p < .001$ ).

### 4.1.3 Qualitative analysis of the unintended effects, barriers, and facilitators

In the following section, we present the main barriers and facilitators to the implementation of *food supply chain* interventions and unintended consequences identified in the body of evidence (Table 4; more information about the qualitative findings is available in Appendix E):

**Table 4: Barriers, facilitators and unintended consequences of *food supply chain* interventions**

Descriptive themes derived from the inductive coding of qualitative studies	Number of studies per theme	Analytical themes derived from the configuration of descriptive themes
<b>Barriers undermining the success of food supply chain interventions</b>		
<ul style="list-style-type: none"> <li>Restrictive gender norms and violence</li> <li>Self-perceptions, fear of retaliation, and low confidence among women</li> </ul>	<p>Total: 47</p> <p>Primary qualitative, process evaluations, &amp; mixed-method studies: 37</p> <p>Descriptive studies: 10</p>	<p><b>1.1 : Contextual factors</b></p> <p><b>Analytical theme 1.1.1: Restrictive gender norms, violence, and women's low self-esteem may impact women's roles and responsibilities and their ability to participate in and benefit from the food supply chain.</b></p> <p><b>(Contextual factors)</b></p> <p>Restrictive gender norms limit women's asset control, wages, mobility, and income-generating activities, while male dominance in household decision-making and biased inheritance laws further restrict autonomy. Gender-based violence, fear of retaliation, and low self-confidence deter participation.</p> <p><b>Analytical theme 1.1.2: Structural and systemic barriers related to economy and politics undermine women's empowerment in food supply chain initiatives</b></p> <p><b>(Contextual factors)</b></p> <p>Systemic issues, such as poor stakeholder coordination and lack of trust, hinder intervention effectiveness. Economic challenges include insufficient infrastructure investment, rising food prices, and poverty, which limit resource management.</p> <p>Political instability, administrative challenges, and security threats disrupt intervention ecosystems, with political pressure often prioritizing program success over actual needs. Addressing these barriers requires challenging deep-seated norms and improving systemic coordination, economic conditions, environmental resilience, health services, and political stability to foster a gender-equal environment.</p>
<ul style="list-style-type: none"> <li>Challenging coordination and collaboration among local stakeholders</li> <li>Structural limitations of the economy</li> <li>Unfavorable political conditions</li> </ul>		

Descriptive themes derived from the inductive coding of qualitative studies	Number of studies per theme	Analytical themes derived from the configuration of descriptive themes
<ul style="list-style-type: none"> <li>Challenging environmental factors</li> <li>Poor soil quality</li> <li>Poor human health and well-being services</li> <li>Poor health services for livestock</li> </ul>		<p><b>Analytical theme 1.1.3: Environmental factors such as climate variability and poor soil quality impact productivity.</b></p> <p><b>(Contextual factors)</b> Environmental hazards such as floods, pests, drought, aridity, or inconsistent rainfall patterns, as well as poor soil quality, may hinder the food supply chain.</p> <p><b>Analytical theme 1.1.4: Health barriers, such as poor human health services and limited livestock vaccination services, may further impede progress.</b></p> <p><b>(Contextual factors)</b> Poor health services, health risks, and the Covid-19 pandemic may have impacted implementation of some programs. For livestock, limited access to vaccination services and the risk of epidemics might hinder productivity and limit intervention effects.</p>
<ul style="list-style-type: none"> <li>Insufficient planning</li> <li>Inefficient collaboration and coordination</li> <li>Inefficient design of program components</li> <li>Unplanned and inadequate budget and incentives</li> <li>Ambiguous program design</li> <li>Lack of anticipation of challenges</li> <li>Insufficient logistics</li> <li>Lack of skills</li> </ul>	<p>Total: 24</p> <p>Primary qualitative, process evaluations, &amp; mixed-method studies: 19</p> <p>Descriptive studies: 5</p>	<p><b>1.2: Program design-related factors</b></p> <p><b>Analytical theme 1.2.1: Inefficient and unplanned distribution of roles and responsibilities may undermine programs' effects on women's empowerment outcomes.</b></p> <p><b>(Program design-related factors)</b> The absence of a pre-planned program design structure and clearly defined roles and responsibilities from the early stages of the program can limit outcomes around women's empowerment. Unplanned and inadequate budgets, ambiguous policy provisions and legal frameworks, and unclear management may lead to disjointed implementation.</p> <p><b>Analytical theme 1.2.2: Poor program design and lack of logistical provisions and skilled program staff can cause delivery challenges.</b></p> <p><b>(Program design-related factors)</b> Primary obstacles include overly ambitious program designs, underestimation of administrative challenges, funding and sustainability concerns, communication difficulties, timing mismatches for loan repayments, exclusion of lower-level members in decision-making, deviations from initial designs, and inconsistent implementation. These issues impede program delivery and efficacy and often stem from a lack of skills among the program staff responsible for designing and implementing programs.</p>

Descriptive themes derived from the inductive coding of qualitative studies	Number of studies per theme	Analytical themes derived from the configuration of descriptive themes
<ul style="list-style-type: none"> <li>• Restrictive gender norms</li> <li>• Resistance from program participants</li> <li>• Reduced trust leading to lower participation</li> <li>• Inadequate skills, quality, or incentives among project teams</li> <li>• Lack of capacity to acquire those resources</li> <li>• Management challenges</li> </ul>	<p>Total: 29</p> <p>Primary qualitative, process evaluations, &amp; mixed-method studies: 27</p> <p>Descriptive studies: 2</p>	<p><b>Analytical theme 1.3: Challenges may stem from restrictive gender norms, resistance to new practices, poor communication, inadequate program delivery, insufficient resources, and management issues.</b></p> <p><b>(Program implementation-related factors)</b>  Gender norms often limit women's participation, hindering their involvement in empowerment opportunities. Resistance to new technologies and practices highlights the need for trust and cohesion among participants. Poor communication and lack of transparency further reduce participation and trust. Ineffective program delivery, resource acquisition issues, and unmotivated staff hinder overall success.</p> <p>Management challenges, including inadequate funding and high staff turnover, disrupt implementation. Lastly, inadequate data collection hampers impact evaluation, making it difficult to measure success and make necessary adjustments.</p>
<ul style="list-style-type: none"> <li>• Vulnerability of the female population</li> <li>• Consideration for specific population groups</li> <li>• Consideration for specific population characteristics</li> <li>• Lack of education, skills and knowledge among participants</li> </ul>	<p>Total: 26</p> <p>Primary qualitative, process evaluations, &amp; mixed-method studies: 22</p> <p>Descriptive studies: 4</p>	<p><b>Analytical theme 1.4: Gender inequality, violence, and labor constraints impede women's participation in FSN programs, while vulnerable communities face barriers due to lack of targeting and resources, illiteracy, language barriers, and insufficient technical knowledge.</b></p> <p><b>(Population characteristics related factors)</b>  The additional vulnerabilities faced by women in contexts of gender inequality (such as domestic violence, differentiated access to land titles, and financial constraints) can impede their participation in and benefit gained from programs. Women's domestic and non-domestic labor responsibilities, along with a lack of consideration for specific population groups, pose barriers to effective interventions.</p> <p>Vulnerable groups such as orphaned children, young farmers, and out-of-school adolescents also face challenges due to social, political, or economic vulnerabilities. Furthermore, a lack of skills and knowledge, such as illiteracy and language barriers, can hinder participants from fully benefiting from interventions, thereby impacting health and economic empowerment outcomes.</p>

Descriptive themes derived from the inductive coding of qualitative studies	Number of studies per theme	Analytical themes derived from the configuration of descriptive themes
<b><i>Facilitators enabling food supply chain interventions</i></b>		
<ul style="list-style-type: none"> <li>• Women have control over assets and the ability to make decisions</li> <li>• Support from family</li> <li>• Support through the legal system</li> <li>• Positive perception toward women's economic participation</li> <li>• Opportunity for market participation</li> <li>• Knowledge and awareness</li> <li>• Strong and flexible political institutions</li> <li>• Representation and leadership</li> </ul>	<p>Total: 15</p> <p>Primary qualitative, process evaluations, &amp; mixed-method studies: 14</p> <p>Descriptive studies: 1</p>	<p><b>Analytical theme 2.1: Liberalized gender norms, supportive social environments, economic and political leverage, and participants' knowledge significantly enhance women's empowerment programs.</b></p> <p><b>(Contextual factors)</b></p> <p>The advancement of gender equality and the establishment of a supportive social environment served as crucial factors. Changing social norms (including men challenging traditional gender roles and couples making decisions together) facilitated women's active participation in economic activities. Legal backing, exemplified by legalized marriages, also played a significant role in advancing women's rights. Programs effectively utilizing economic and political factors maximized their impact in local communities, such as increased income from remittances and favorable market prices. Additionally, strong government ownership and political will were instrumental in ensuring successful implementation of these programs. Participant awareness and understanding of the program's significance and resource utilization further underpinned the success of the initiative, leading to improved practices, resource sharing, and, ultimately, increased income and food security.</p>
<ul style="list-style-type: none"> <li>• Integrating risk factors</li> <li>• Integrating administrative regularization and logistical pre-conditions</li> <li>• Testing and piloting components</li> <li>• Involving local leaders, role models, and authorities</li> </ul>	<p>Total: 18</p> <p>Primary qualitative, process evaluations, &amp; mixed-method studies: 15</p> <p>Descriptive studies: 3</p>	<p><b>Analytical theme 2.2: Combining risk factors, administrative organization, and logistical requirements into program design, as well as incorporating lessons learned, created a supportive environment for implementing interventions.</b></p> <p><b>(Program design-related factors)</b></p> <p>Integrating risk factors, administrative regularization, and logistical pre-conditions served as facilitators of an enabling environment for intervention implementation. These factors helped to create a positive work culture and resolve conflicts beforehand, thereby increasing willingness to participate. Simplified processes and rigorous implementation further facilitated intervention components, with improved clarity and formal procedures reported. Testing and piloting intervention components allowed for rapid integration of learnings,</p>

Descriptive themes derived from the inductive coding of qualitative studies	Number of studies per theme	Analytical themes derived from the configuration of descriptive themes
		<p>ensuring a fit-for-purpose design. Involving local leaders, role models, and authorities in program design mitigated opportunistic behaviors, ensuring compliance. Moreover, their support, such as lifting bans on certain activities, was pivotal for program success.</p>
<ul style="list-style-type: none"> <li>• Motivation of project team</li> <li>• Motivation of project participants</li> <li>• Involving local stakeholders in monitoring and evaluation</li> </ul>	<p>Total: 20</p> <p>Primary qualitative, process evaluations, &amp; mixed-method studies: 18</p> <p>Descriptive studies: 2</p>	<p><b>Analytical theme 2.3: Motivation among the team and participants facilitated the intervention's success; participants valued the knowledge gained and community recognition. Collaboration and stakeholder involvement ensured the program's success.</b></p> <p><b>(Program implementation-related factors)</b></p> <p>Ensuring motivation among the project team and participants was identified as a significant facilitator for intervention success. Participants felt motivated by the knowledge gained and the community's recognition of the project's value. Village farm leaders expressed enthusiasm for their roles and found satisfaction in contributing to their community's welfare. They provided informal follow-up training and felt a sense of duty in supporting beneficiary mothers.</p> <p>Master trainers supporting village farm leaders were motivated by the recognition of their efforts and the potential impact on child nutrition. Close collaboration among the project team, research partners, and government facilitated timely implementation and allowed for mid-course corrections, enhancing intervention effectiveness. Involving local stakeholders in feedback loops and monitoring processes addressed implementation challenges. Stakeholders contributed ideas for cost reduction in projects and were engaged in policy preparation, implementation planning, and specific program activities, ensuring contextual relevance and effectiveness while minimizing unintended consequences.</p>
<ul style="list-style-type: none"> <li>• Poor populations benefited from group discussions</li> <li>• Reconciliation of livestock grazers and farmers</li> <li>• Homogenous population</li> </ul>	<p>Total: 9</p> <p>Primary qualitative, process evaluations, &amp; mixed-method</p>	<p><b>Analytical theme 2.4. Farmer group discussions, local committees, and women's groups played crucial roles in identifying and addressing obstacles, resolving disputes, and providing essential support networks. Additionally, the homogenous nature of certain populations streamlined program implementation, saving time and resources.</b></p>



Descriptive themes derived from the inductive coding of qualitative studies	Number of studies per theme	Analytical themes derived from the configuration of descriptive themes
	studies: 7  Descriptive studies: 2	<b>(Population characteristics-related factors)</b> Several key facilitators were identified across various programs to improve agricultural productivity and socioeconomic conditions in different regions. Farmer group discussions played a crucial role in identifying and addressing obstacles, allowing participants to leverage available resources effectively. Local committees proved instrumental in resolving disputes and facilitating compensation for damages caused by livestock grazing. Women's groups provided essential support networks, enabling access to credit and promoting financial security. Additionally, the homogenous nature of the population in certain regions streamlined program implementation, saving both time and resources.
<b><i>Unintended consequences of food supply chain interventions</i></b>		
<ul style="list-style-type: none"> <li>• Emphasis on gender equity in household tasks rather than decision-making</li> <li>• Children replacing adults in labor</li> <li>• Irregularities in payments and leakages</li> <li>• Increased workload and conflicts</li> <li>• Increased school attendance</li> <li>• Access to financial services</li> </ul>	Total: 23  Primary qualitative, process evaluations, & mixed-method studies: 22  Descriptive studies: 1	<b>Analytical theme 3: Unintended practices create burdens for women and dependence on programs, resulting in undesired outcomes. However, interventions lead to positive effects like increased school attendance and improved access to land mortgages.</b> Despite efforts to integrate agricultural practices and women's empowerment, the focus on agricultural aspects didn't consistently improve gender equity outcomes. For example, mentor farmers emphasized gender equity in household tasks rather than decision-making, with men primarily interested in agricultural aspects, leading to minimal gender equity improvements. Households sometimes replaced adults with children in labor, which affected schooling, and sedentarization among pastoralist farmers decreased mobility and access to resources. Late payments and corruption issues were also reported, adding burdens and tensions, particularly for women, who faced increased workload and conflicts within communities. Dependence on programs was noted, with some households reverting to food insecurity post-graduation, especially female-headed households. However, some interventions also led to unexpected positive outcomes, such as increased school attendance and greater access to financial services.

#### **4.1.4 Discussion and implications**

The studies under the *food supply chain* interventions category analyzed the effect of seven intervention types on women's empowerment outcomes. Overall, we observed a relatively large body of evidence from 36 studies, allowing meta-analyses for all included outcomes except for *gender-transformative policymaking and systems*. Effect estimates are generally subject to a high risk of bias, and are primarily located in Sub-Saharan Africa and South Asia.

The meta-analyses of this body of evidence showed mostly positive, small, and statistically significant effects of the interventions on women's empowerment outcomes. We observed the interventions' positive, moderate, and statistically significant effect on *collective actions and leadership* and *other empowerment* outcomes and indices. We also observed the interventions' small or very small, positive, and statistically significant effects on *access to economic and livelihood resources*, *decision-making*, *ownership of land and assets*, and *gender-transformative* outcomes.

None of the meta-analyses show statistically significant negative effects of interventions. The analysis of heterogeneity does not show clear patterns of effects of moderators. We only observe a larger effect on *gender-transformative* outcomes for studies analyzing effects at the individual level and on *ownership of assets* for studies using average treatment effect estimates.

Studies on *food supply chain* interventions comprise the largest body of qualitative evidence in our review, and our analysis draws from 52 qualitative impact and process evaluations. Similar to the quantitative evidence, these studies are mostly assessed as low-to-moderate quality. Restrictive gender norms are the primary barriers to women's participation in and benefits from *food supply chain* interventions.

Systemic challenges—including poor coordination among stakeholders, lack of trust, and insufficient economic resources—impede the effectiveness of food security and nutrition interventions. Environmental conditions, poor health services, political instability, and administrative issues exacerbate these challenges, necessitating holistic and context-specific strategies to address these barriers and promote women's empowerment.

Other barriers include a lack of clear structure and role allocation from the early stages of the program, low engagement levels from participants, and vulnerability impeding some population groups' participation. On the other hand, liberalization of gender norms, a supportive social environment, and increased knowledge and awareness of interventions' benefits facilitate their implementation and effectiveness.

Regarding unintended consequences of interventions, implementing FSN interventions may lead to illegal or unintended practices that cause negative outcomes for affected populations. Examples include a focus on agricultural aspects over gender equality components, use of child labor, corruption, or hindered school attendance. FSN interventions can also place additional social, economic, or administrative burdens on women or generate dependencies.

Despite these challenges, interventions may also lead to positive externalities according to their context; examples from studies include increased school attendance and enrolment and improved access to land mortgages.



## 4.2 Consumer behavior

### 4.2.1 Scope and definition

The *consumer behavior* intervention category includes activities that shape individual preferences related to consumption, allocation of food within the household, food prices, and income available for food (HLPE 2017). The FSN E&GM includes interventions focusing on behavior change concerning the food system; some of these did not provide evidence on women's empowerment and were therefore not included in our REA.

The following section further explores the effect of *consumer behavior* interventions on *women's empowerment* outcomes through the eight studies included in this intervention category. The limited body of evidence covers three intervention types, eight programs, and nine countries, with seven studies using an experimental design and one study using a quasi-experimental design (Table 5; Bonuedi, Gerber, and Kornher 2022). In addition, three qualitative studies provided evidence on barriers, facilitators, and unintended consequences. Reported evidence allowed us to run meta-analyses on a limited number of outcomes, including *access to economic and livelihood resources*, *control over resources*, *decision-making*, and *other empowerment* outcomes and indices.

**Table 5: List of consumer behavior interventions**

Intervention	Definition	Number of studies
Classes	The use of a classroom structure to provide messages regarding healthy eating. This includes classrooms outside of school, online, and ambiguous references to "nutrition education" or "education sessions."	7
Peer support/counselors	The use of peer support or counselors to increase healthy eating. Includes home visits and other work by community health workers.	2
Community meetings	The use of community meetings to provide messages regarding healthy eating. Community meetings are public engagement to promote discussion and mobilization, not simply education. Education within established groups (such as women's self-help groups or microfinance groups) is not included, as these groups are not open to the public.	2

*Note: The total values displayed may be larger than the number of studies identified, as a study may contain multiple interventions.*

### 4.2.2 Quantitative analysis of the effects of the interventions

#### Resources

##### *Access to economic and livelihood resources*

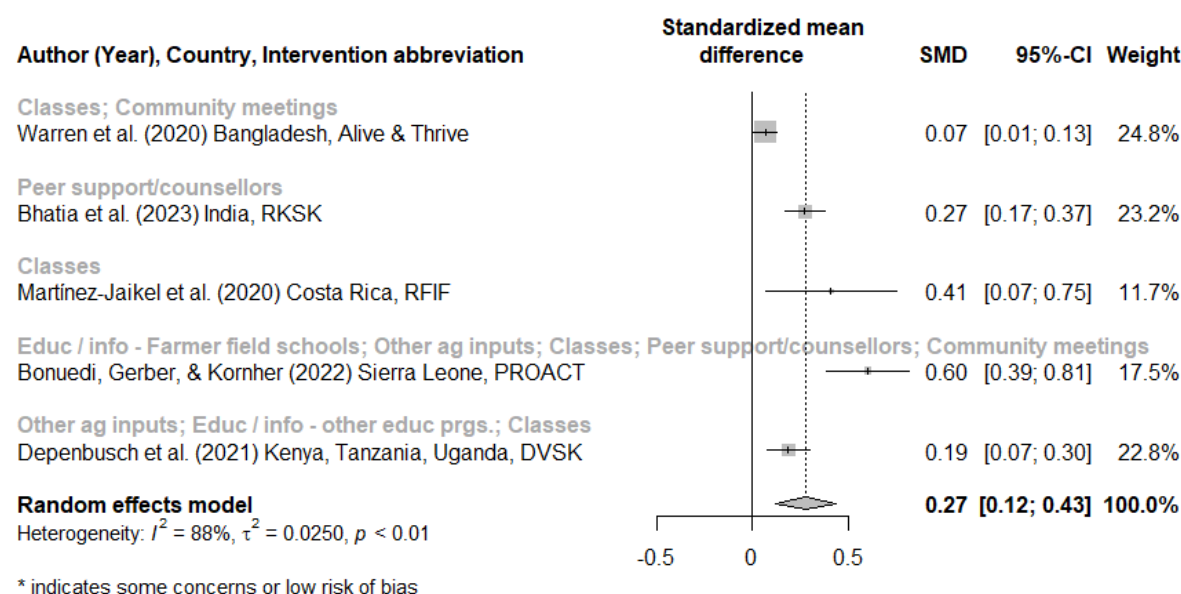
Our analysis included five studies and five independent estimates on the effect of *consumer behavior* interventions on *access to economic and livelihood resources*. Studies of evaluated interventions mostly took place in Sub-Saharan Africa ( $k = 2$ ) and South Asia ( $k = 2$ ), followed by Latin America and the Caribbean ( $k = 1$ ). Of these five studies, three evaluated multi-component interventions (Alive & Thrive [A&T], PROACT, and DVSK) (Appendix D). Four studies focused on *classes* interventions, two on *peer support and counsellors*, and two on *community meetings*.

Estimates used different measures of access to employment (Warren et al. 2020), nutrition knowledge (Depenbusch et al. 2021), and access to education (Warren et al. 2020) at the household ( $k = 3$ ) or individual level ( $k = 2$ ).

**Some interventions under the *consumer behavior* category showed a positive effect on access to economic and livelihood resources.** The overall average effect was moderate, positive, and statistically significant ( $\widehat{SMD} = 0.27$ ; 95% CI: 0.12 to 0.43;  $p < .001$ ; Figure 16). The observed outcomes ranged from 0.07 to 0.60. According to the  $Q$ -test, there was substantial heterogeneity across included estimates ( $Q(4) = 32.10$ ,  $p < .001$ ,  $\hat{\tau}^2 = 0.03$ ,  $I^2 = 87.54\%$ ).

In Bangladesh, Warren et al. (2020) analyzed the effect of the A&T intervention, which implemented interpersonal counseling, community mobilization, and a mass media campaign to promote breastfeeding and complementary feeding for infants and young children. The authors observed its very small, positive, and statistically significant effect on mothers' employment ( $\hat{g} = 0.07$ ; 95% CI: 0.01 to 0.13;  $p = .03$ ). In India, Bhatia et al. (2023) focused on the effect of the Rashtriya Kishor Swasthya Karyakram Program on girls accessing at least one school-related entitlement. The intervention provided peer education on health and had a moderate, positive, and statistically significant effect ( $\hat{g} = 0.27$ ; 95% CI: 0.17 to 0.37;  $p < .001$ ).

**Figure 16: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of *consumer behavior* interventions on access to economic resources and livelihood**



*Note: Acronyms used in this figure are spelled out as follows: [DVSK (Diverse Vegetables Seeds and Knowledge); PROACT (Promoting Opportunities for All to Rise and Capture Transformation); RFIF (Rural Family Income Initiative); RKSK (Rashtriya Kishor Swasthya Karyakram)]. See Appendix C for more information about the interventions.*

The exploratory moderator analyses revealed that more recent interventions, and those with a shorter exposure period, had a greater effect than older interventions and those with longer exposure periods. All five effect sizes had a high risk of bias.

### *Ownership of land and assets*

The body of evidence on the effect of *consumer behavior* on *ownership of land and assets* included two studies through two estimates. Evidence was not sufficient to run a meta-analysis and only allowed for the reporting of independent effects:

- In Burkina Faso, Van den Bold et al. (2015) analyzed the effect of the Enhanced-Homestead Food Production project. This nutrition-sensitive agricultural program by Helen Keller International aimed to improve maternal and child health and nutrition through asset transfers, training in agriculture and health practices, and a behavior change communication strategy. The authors observed a small, positive, and statistically significant effect on the value of agricultural assets owned by women ( $\hat{g} = 0.19$ ; 95% CI: 0.08 to 0.29;  $p < .001$ ).
- In Bangladesh, Warren et al. (2020) analyzed the effect of the A&T program, and observed a very small, negative, and statistically significant effect of the intervention on the ownership of gold jewelry by women ( $\hat{g} = 0.08$ ; 95% CI:  $-0.15$  to  $-0.03$ ;  $p = .005$ ).

Both estimates had a high risk of bias, primarily due to concerns related to spillovers, crossovers, and contamination in Van den Bold et al. (2015) and reporting bias in Warren et al. (2020).

### *Control over resources*

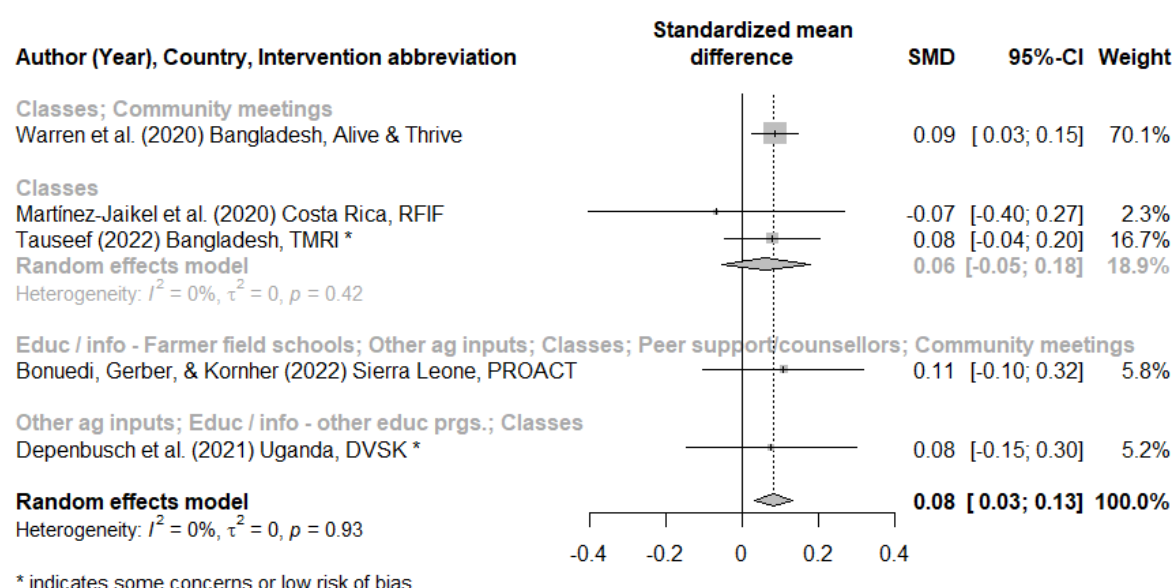
Within five studies, we identified five independent estimates of the effect of *consumer behavior* interventions on women's *control over resources*. Studies of evaluated interventions mostly took place in Sub-Saharan Africa ( $k = 2$ ) and South Asia ( $k = 2$ ), followed by Latin America and the Caribbean ( $n = 1$ ). Of the five studies, three evaluated multi-component interventions (DVSK, PROACT, and A&T) (Appendix D). All focused on *classes*; however, PROACT interventions also focused on *peer support/counselors* and *community meetings* and A&T interventions also consisted of *community meetings*.

Estimates used different measures of whether mothers use their own money (Warren et al. 2020), whether they control their resources (Tauseef 2022), or whether caregivers have adequate control over income (Bonuedi, Gerber, and Kornher 2022) at the household ( $k = 4$ ) or individual level ( $k = 1$ ).

**Some interventions under the *consumer behavior* category showed a positive effect on women's control over resources.** The overall average effect was very small, positive, and statistically significant ( $\widehat{SMD} = 0.08$ ; 95% CI: 0.03 to 0.13;  $p = .001$ ; Figure 17). The observed outcome ranged from  $-0.07$  to  $0.11$ . According to the  $Q$ -test, there was no significant heterogeneity across included estimates ( $Q(4) = 0.85$ ,  $p = .93$ ,  $\hat{\tau}^2 = 0.0001$ ,  $I^2 = 0.0001\%$ ).

In Bangladesh, Warren et al. (2020) examined the A&T program, observing its very small, positive, and statistically significant effect on whether mothers have their own money to use ( $\hat{g} = 0.09$ ; 95% CI: 0.03 to 0.15;  $p = .005$ ).

**Figure 17: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of *consumer behavior* interventions on *control over resources***



Note: Acronyms used in this figure are spelled out as follows: [DVSK (Diverse Vegetables Seeds and Knowledge); PROACT (Promoting Opportunities for All to Rise and Capture Transformation); RFIF (Rural Family Income Initiative); TMRI (Transfer modality research initiative)]. See Appendix C for more information about the interventions.

None of the exploratory moderator analysis variables explained the variation of estimates. Of the five effect sizes, two remained after excluding high risk-of-bias estimates. The effect was still very small and positive but was statistically significant ( $\widehat{SMD} = 0.07$ ; 95% CI:  $-0.03$  to  $0.19$ ;  $p = .16$ ).

### Time use

The body of evidence on the effect of *consumer behavior* on *time use* included one study through one estimate. Depenbusch et al. (2021) analyzed the effect of DVSK, which deployed vegetable seed kits and classes to tackle malnutrition in Kenya, Tanzania, and Uganda. The intervention had a very small, positive, but not statistically significant effect on the time women spend on vegetable production ( $\hat{g} = 0.01$ ; 95% CI:  $-0.10$  to  $0.12$ ;  $p = .86$ ). There were some concerns for risk of bias for this estimate due to possible spillovers, crossovers, and contamination.

### Agency

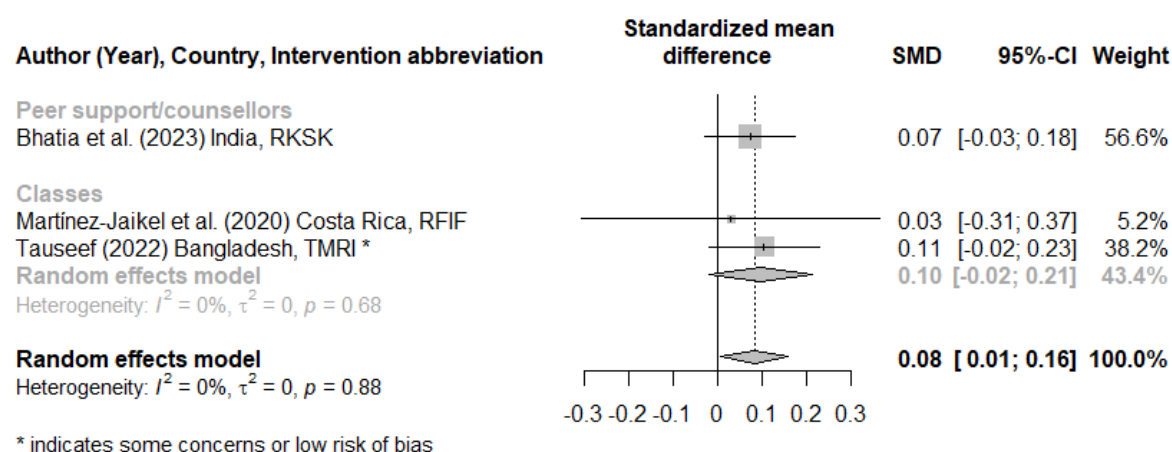
#### Decision-making

Within three studies, we identified three independent estimates of the effect of *consumer behavior* interventions on women's *decision-making*. Studies of evaluated interventions occurred in South Asia ( $k = 2$ ) and Latin America and the Caribbean ( $n = 1$ ). None of the three studies evaluated multi-component interventions (Appendix D). Two focused on *classes*, and one focused on *peer support and counselors*.

Estimates used different measures of girls making independent decisions (Bhatia et al. 2023), girls' participation in purchase decisions (Martínez-Jaikel et al. 2020), and girls' decision-making (Tauseef 2022) at the household ( $k = 1$ ) or individual level ( $k = 2$ ).

Some interventions under the *consumer behavior* category showed a positive effect on women's participation in *decision-making*. The overall average effect was very small, positive, and statistically significant ( $\overline{SMD} = 0.08$ ; 95% CI: 0.01 to 0.16;  $p = .03$ ; Figure 18). The observed outcomes ranged from 0.03 to 0.11. According to the  $Q$ -test, there was no significant heterogeneity in the true outcomes ( $Q(2) = 0.25$ ,  $p = .88$ ,  $\hat{\tau}^2 = 0.001$ ,  $I^2 = 0.001\%$ ).

**Figure 18: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of *consumer behavior* interventions on *decision-making***



Note: Acronyms used in this figure are spelled out as follows: [RFIF (Rural Family Income Initiative); RKSK (Rashtriya Kishor Swasthya Karyakram); TMRI (Transfer modality research initiative)]. See Appendix C for more information about the interventions.

We did not have enough data to run exploratory moderator analyses. Of the three effect sizes, one remained after excluding high risk-of-bias estimates. The study from Tauseef (2022) analyzed the effect of the Transfer Modality Research Initiative (TMRI) in Bangladesh, which provided social protection transfers and behavior change communication focusing on food security and nutrition. The author observed a small, positive, but not statistically significant effect ( $\hat{g} = 0.11$ ; 95% CI:  $-0.02$  to  $0.23$ ;  $p = .10$ ).

#### Collective action and leadership

The body of evidence on the effect of *consumer behavior* on *collective action and leadership* included one study through one estimate. In Sierra Leone, Bonuedi, Gerber, and Kornher (2022) analyzed the effect of PROACT, which focused on building capacity for production and processing through farmer field schools, providing productive inputs, and supporting market linkages. It also aimed to improve nutrition through education; behavior change communication; water, sanitation, and hygiene practices; and sustainable agriculture. The authors observed a small, positive, and not statistically significant effect of the intervention on women caregiver's confidence in voicing their opinions in a meeting with males and females ( $\hat{g} = 0.16$ ; 95% CI:  $-0.05$  to  $0.37$ ;  $p = .13$ ). This estimate had a high risk of bias, primarily due to concerns about confounding effects and selection bias.

#### Achievements

##### Gender-transformative outcomes

The body of evidence on the effect of *consumer behavior* on *gender-transformative* outcomes included one study through one estimate. In India, Bhatia et al. (2023) analyzed

the effect of the Rashtriya Kishor Swasthya Karyakram Program, which provided peer educators to increase adolescents' health knowledge and build their skills and capacities to resolve their health concerns. The authors observed a moderate, positive, and statistically significant effect on gender role attitudes ( $\hat{g} = 0.21$ ; 95% CI: 0.11 to 0.32;  $p < .0001$ ). This estimate had a high risk of bias, primarily due to non-random attrition and significant missing data.

### *Self-esteem*

The body of evidence on the effect of *consumer behavior* on *self-esteem* included one study through one estimate. In Brazil, Dunker and Claudino (2018) analyzed the effect of the Nutrition Maintenance Program, which provided group education sessions and individual counseling on nutrition. The authors observed a very small, positive, and not statistically significant effect on women's self-worth and feelings about themselves, as measured by the Rosenberg Self-Esteem Scale ( $\hat{g} = 0.06$ ; 95% CI: -0.17 to 0.30;  $p = .61$ ). There were some concerns of risk of bias for this estimate due to non-random attrition and significant missing data.

### *Other empowerment outcomes and indices*

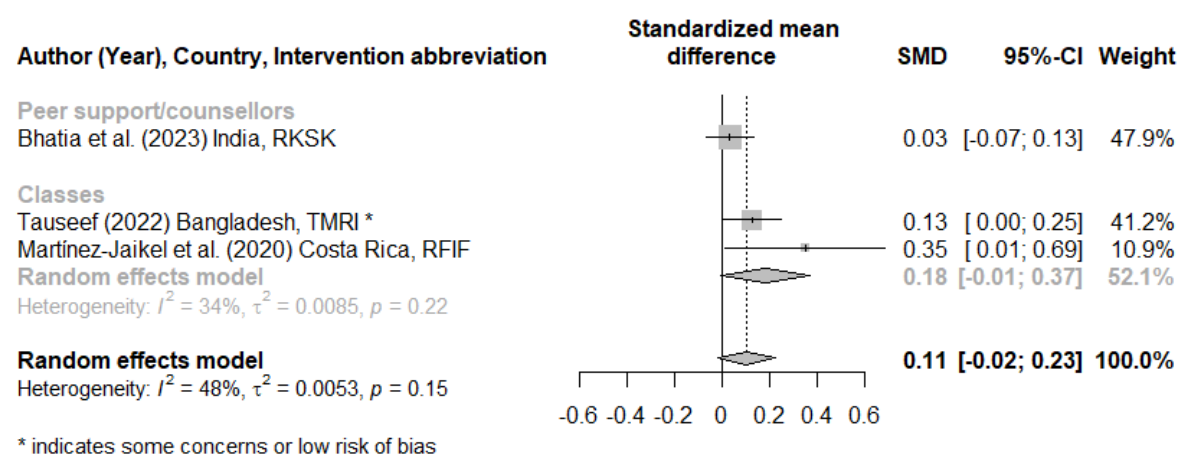
Our analysis included three studies and three independent estimates on the effect of *consumer behavior* interventions on *other empowerment* outcomes and indices. Studies of evaluated interventions occurred in South Asia ( $k = 2$ ) and Latin America and the Caribbean ( $k = 1$ ). None of the three studies evaluated multi-component interventions (Appendix D). Two studies focused on *classes* interventions, and one on *peer support and counselors*.

Estimates used different measures of self-efficacy (Bhatia et al. 2023), psychological empowerment (Martínez-Jaikel et al. 2020), and mobility (Tauseef 2022) at household ( $k = 1$ ) or individual levels ( $k = 2$ ).

***Other empowerment outcomes and indices remained unchanged following consumer behavior interventions.*** The overall average was small, positive, and not statistically significant ( $\widehat{SMD} = 0.11$ ; 95% CI: -0.02 to 0.23;  $p = .09$ ; Figure 19). The observed outcomes ranged from 0.03 to 0.35. According to the  $Q$ -test, there was moderate heterogeneity across included estimates ( $Q(2) = 3.84$ ,  $p = .15$ ,  $\hat{\tau}^2 = 0.005$ ,  $I^2 = 47.84\%$ ).

In Costa Rica, Martínez-Jaikel and colleagues (2020) analyzed the effect of the Rural Family Income Initiative, which provided classes and emotional support to women—with a moderate, positive, and statistically significant effect on women's psychological empowerment ( $\hat{g} = 0.35$ ; 95% CI: 0.01 to 0.69;  $p = .04$ ).

**Figure 19: Forest plot showing observed outcomes and estimates of the random-effects model for the effect of *consumer behavior* interventions on *other empowerment* outcomes and indices**



Note: Acronyms used in this figure are spelled out as follows: [RFIF (Rural Family Income Initiative); RKSK (Rashtriya Kishor Swasthya Karyakram); TMRI (Transfer modality research initiative)]. See Appendix C for more information about the interventions.

We did not have enough data to run exploratory moderator analyses. Of the three effect sizes, one remained after excluding high risk-of-bias estimates. In Bangladesh, Tauseef (2022) observed a small, positive, and statistically significant effect of the TMRI on women's mobility ( $\hat{g} = 0.13$ ; 95% CI: 0.002 to 0.25;  $p = .045$ ).

#### 4.2.3 Qualitative analysis of unintended effects, barriers, and facilitators

In the following section, we present the main barriers and facilitators to the implementation of *consumer behavior* interventions, as well as unintended consequences, as identified in the body of evidence (Table 6; Appendix E):

**Table 6: Barriers, facilitators, and unintended consequences of *consumer behavior* interventions**

Descriptive themes derived from the inductive coding of qualitative studies	Number of studies per theme	Analytical themes derived from the configuration of descriptive themes
<b>Barriers undermining the success of consumer behavior interventions</b>		
<ul style="list-style-type: none"> <li>Challenges faced by adolescents</li> <li>Perceptions on access and control to land, productive assets, and revenue</li> <li>Difficult languages used during discussions</li> <li>Time constraints</li> <li>Fear of being embarrassed</li> </ul>	<p>Total: 5</p> <p>Primary qualitative, process evaluations, &amp; mixed-method studies: 1</p> <p>Descriptive studies: 4</p>	<p><b>Analytical theme 1: Vulnerable groups such as adolescents, girls/boys, women, and the poor lacked power. Limited access to land and productive assets, difficulties with complex languages during discussions, time constraints, fear of embarrassment, poverty, and distance from intervention sites also created challenges.</b></p> <p>Adolescent girls, particularly those from financially poor and rural households, faced difficulties negotiating intra-household food allocation. Older adolescents, boys, and out-of-school adolescents participated less frequently in interventions due to their involvement in household</p>



Descriptive themes derived from the inductive coding of qualitative studies	Number of studies per theme	Analytical themes derived from the configuration of descriptive themes
<ul style="list-style-type: none"> <li>Poverty</li> <li>Distance from intervention sites</li> </ul>		<p>economic activities or studying for exams.</p> <p>Communication barriers were evident, particularly among younger adolescents, who struggled to grasp information from group activities. Additionally, certain populations, such as women living far from intervention areas or with limited mobility, were underrepresented in the intervention aimed at ensuring equitable and sustainable land management.</p>
<b>Facilitators enabling consumer behavior interventions</b>		
<ul style="list-style-type: none"> <li>Frequent visits of implementers to intervention areas</li> <li>Clear communication channels among implementers on troubleshooting</li> <li>Multi-channel communication strategy</li> </ul>	<p>Total: 4</p> <p>Primary qualitative, process evaluations &amp; mixed-method studies: 1</p> <p>Descriptive studies: 3</p>	<p><b>Analytical theme 2: Program staff's frequent visits to the program sites may have helped to enforce behavior change messages, and a combination of face-to-face communication and mass media can be more effective in reaching out to the masses.</b></p> <p>Frequent visits by program staff to program sites were identified as crucial for reinforcing program messages and enhancing program effectiveness across various initiatives, such as those aimed at improving infant and young child feeding practices, literacy, health, and dietary habits. These visits fostered trust and adherence to recommended behaviors among beneficiaries, despite prevailing community practices.</p> <p>Combining face-to-face communication with mass media proved more effective in promoting desired behaviors, especially in encouraging women to adopt recommended practices. Furthermore, the effectiveness of behavior change communication strategies varied depending on implementers' knowledge-transfer abilities and their engagement with beneficiaries, with health committee members demonstrating greater effectiveness in promoting positive outcomes (particularly in improving children's nutritional status).</p>
<b>Unintended consequences of consumer behavior interventions</b>		
<ul style="list-style-type: none"> <li>Enhanced reputation</li> <li>Female participants felt valued in their communities</li> <li>Increase in family disputes over land</li> </ul>	<p>Total: 3</p> <p>Primary qualitative, process evaluations, &amp; mixed-method studies: 1</p> <p>Descriptive studies: 2</p>	<p><b>Analytical theme 3: Programs may strengthen women's standing in family and society, but access to resources such as land may escalate family disputes.</b></p> <p>Positive unintended consequences included enhancement in the reputation and influence of female participants within their communities. However, land access for legally married women may give rise to family disputes, particularly over land inheritance, due to flaws in adjudication and titling processes.</p>



#### **4.2.4 Discussion and implications**

Studies under the *consumer behavior* interventions category analyzed the effect of three intervention types on women's empowerment outcomes. Overall, we observed a relatively small body of evidence, with eight studies allowing meta-analyses for a limited number of outcomes—with a limited number of studies available to provide strong and generalizable conclusions (*decision-making*, *access to economic and livelihood resources*, *control over resources*, and *other empowerment* outcomes and indices). Effect estimates are generally subject to a high risk of bias, and the evidence is primarily from Sub-Saharan Africa and South Asia.

The meta-analyses of this body of evidence showed mostly small, positive, and statistically significant effects of the interventions on women's empowerment outcomes. We observed interventions' moderate, positive, and statistically significant effects on *access to economic and livelihood resources*. We also observed a very small, positive, and statistically significant effect of the interventions on *control over resources* and *decision-making*. None of the meta-analyses show negative and statistically significant effects of interventions. There were no clear patterns that could explain the heterogeneity across estimates. The exploratory moderator analyses revealed that more recent interventions and shorter intervention exposures had a larger effect on *access to economic and livelihood resources*.

The analysis of qualitative evidence draws from a very limited number of studies. The only relevant barriers analysis is Bhatia et al.'s (2023) study of the Jharkhand Initiative for Adolescent Health in India. The study identified two main barriers to future intervention design: first, the program faced difficulties due to the vulnerability of its target population (adolescent girls from financially poor, rural households), who struggled with negotiating intra-household food allocation.

Additionally, older adolescents, boys, and out-of-school adolescents participated less frequently due to their roles in supporting household economic activities or studying for exams. Second, communication barriers were noted particularly among younger adolescents, who struggled to understand information from group activities.

Authors highlighted that regular field visits and consideration for knowledge transfer are facilitators of intervention effectiveness (Mukta et al. 2014; Olney et al. 2016; Safarha 2018). In terms of unintended consequences, Mukta et al.'s (2014) study on the A&T Initiative in Bangladesh (which aimed to improve maternal, infant, and young child nutrition) observed a positive externality: female participants reported feeling more valued, respected, and influential within their communities as a result of their participation in the intervention.

### **4.3 Food environment**

#### **4.3.1 Scope and definition**

The food environment includes the ways in which consumers engage with the food system that provides and shapes dietary preferences, choices, and nutritional status, based on physical, economic, political, and sociocultural contexts (HLPE 2017). The FSN E&GM comprises interventions focusing on food availability and affordability, promotion and labeling, and quality and safety. However, only one intervention had enough evidence on women's empowerment to be included in our REA.

The following section will further explore the effect of *food environment* interventions on *women's empowerment* outcomes through the five studies included in this intervention category. The limited body of evidence covers one intervention type, five programs, and four countries, with three studies using an experimental design and two studies using a quasi-experimental design (Table 7). In addition, three qualitative studies provided evidence on barriers, facilitators, and unintended consequences. Reported evidence did not allow us to run meta-analyses as it was drawn from independent studies on a limited number of outcomes: *control of resources*, *decision-making*, *gender-transformative* outcomes, *self-esteem*, and *other empowerment* outcomes and indices.

**Table 7: List of food environment interventions**

Intervention Definition		Number of studies
Direct provision of food	State outlets that distribute food for free or at reduced cost/Meals provided for free or reduced cost at school//Provision of food outside of state outlets and school meals. Often relates to the charitable distribution of food by religious or civil society groups	5

### 4.3.2 Quantitative analysis of the effects of the interventions

#### Resources

##### *Control over resources*

The body of evidence on the effect of *food environment* interventions on *control over resources* included one study through one estimate. In Bangladesh, Tauseef (2022) analyzed the effect of the TMRI, which provided food rations, including 30 kilograms of rice, 2 kilograms of masoor pulse (a type of lentil), and 2 liters of micronutrient-fortified cooking oil. The author observed a small, positive, and not statistically significant effect of the intervention on women's control over resources ( $\hat{g} = 0.05$ ; 95% CI:  $-0.07$  to  $0.17$ ;  $p = .46$ ). There were some concerns for risk of bias for this estimate due to non-random attrition and significant missing data.

##### *Time use*

The body of evidence on the effect of *food environment* interventions on *time use* included one study through one estimate. In Ecuador, Hidrobo, Peterman, and Heise (2016) analyzed the effect of a World Food Programme intervention that provided six monthly cash transfers, vouchers, or food to Colombian refugees and poor Ecuadorian households. The authors observed a very small, negative, and not statistically significant effect on hours worked in domestic labor in a typical day ( $\hat{g} = -0.06$ ; 95% CI:  $-0.17$  to  $0.05$ ;  $p = .27$ ). There were some concerns for risk of bias for this estimate due to potential spillovers, crossovers, and contamination.

#### Agency

##### *Decision-making*

The body of evidence on the effect of *food environment* interventions on *decision-making* included two studies through two estimates.

In Bangladesh, Tauseef (2022) analyzed the effect of the TMRI. The intervention provided food rations, including rice, lentils, and fortified cooking oil, maintained throughout the intervention to assess impacts on food security and nutrition levels among participating households. The author observed a small, positive, and not statistically significant effect of the intervention on women's decision-making ( $\hat{g} = 0.11$ ; 95% CI:  $-0.02$  to  $0.23$ ;  $p = .09$ ).

In Ethiopia, Bahru and Zelier (2022) analyzed the effect of the Productive Safety Net Program, which provided cash or in-kind (food) payments to households with non-disabled members in exchange for labor on community asset-building projects. The authors observed a very small, positive, and not statistically significant effect of the intervention on whether female members made decisions about crop and livestock production ( $\hat{g} = 0.01$ ; 95% CI:  $-0.04$  to  $0.05$ ;  $p = .79$ ).

Of the two estimates, one was assessed as having a high risk of bias (Bahru and Zelier 2022), and the other as having some concerns about the risk of bias (Tauseef 2022).

## Achievements

### *Self-esteem*

The body of evidence on the effect of *food environment* interventions on *self-esteem* included one study through one estimate. In Brazil, Dunker and Claudino (2018) analyzed the effect of the Nutrition Maintenance Program, which provided group education sessions and individual counseling on nutrition while providing lunch and food to all participants. The authors observed a very small, positive, and not statistically significant effect on women's self-worth and feelings about the self as measured by the Rosenberg Self-Esteem Scale ( $\hat{g} = 0.06$ ; 95% CI:  $-0.17$  to  $0.30$ ;  $p = .61$ ). There were some concerns for risk of bias for this estimate due to non-random attrition and significant missing data.

### *Other empowerment outcomes and indices*

The body of evidence on the effect of *food environment* interventions on *other empowerment* outcomes and indices included one study through one estimate. In Bangladesh, Tauseef (2022) analyzed the effect of the TMRI, which had a very small, positive, and not statistically significant effect on women's mobility ( $\hat{g} = 0.02$ ; 95% CI:  $-0.10$  to  $0.15$ ;  $p = .75$ ). There were some concerns about the risk of bias for this estimate, primarily due to potential spillovers, crossovers, and contamination.

### 4.3.3 Qualitative analysis of the unintended effects, barriers, and facilitators

In the following section, we present the main barriers and facilitators to the implementation of *food environment* interventions, as well as unintended consequences, as identified in the body of evidence (Table 8; Appendix E):

**Table 8: Barriers, facilitators, and unintended consequences of *food environment* interventions**

Descriptive themes derived from the inductive coding of qualitative studies	Number of studies per theme	Analytical themes derived from the configuration of descriptive themes
<b><i>Barriers undermining the success of food environment interventions</i></b>		
<ul style="list-style-type: none"> <li>Unfavorable legal system</li> <li>Legal fees</li> <li>Retraumatization from disclosing abuse</li> </ul>	Total: 2 Primary qualitative, process evaluations, & mixed-method	<b>Analytical theme 1.1: Restrictive gender norms and unfavorable legal systems restrain women from reaping program benefits.</b> <b>(Contextual factors)</b> Key issues included barriers within the legal system, such as lengthy case processing, legal fees, and the risk of

Descriptive themes derived from the inductive coding of qualitative studies	Number of studies per theme	Analytical themes derived from the configuration of descriptive themes
<ul style="list-style-type: none"> <li>Restrictive gender norms</li> </ul>	studies: 1  Descriptive studies: 1	retraumatization from disclosing abuse. Additionally, societal norms that excluded women from household decision-making and placed men as the sole decision-makers limited women's autonomy and participation in programs aimed at addressing intimate partner violence. Partners' disapproval also emerged as a barrier, preventing some women from participating in the program.
<ul style="list-style-type: none"> <li>Elderly women</li> <li>Women with less education</li> <li>Living far</li> <li>High transport cost</li> <li>Other responsibilities create a schedule conflict</li> </ul>	Total: 2  Primary qualitative, process evaluations, & mixed-method studies: 1  Descriptive studies: 1	<p><b>Analytical theme 1.2: Women, particularly those who are old, have less education, need to travel far, and have schedule conflicts due to other responsibilities may face higher restrictions in participation.</b></p> <p><b>(Population characteristics related factors)</b></p> <p>Older women and women with lower education levels experienced more interpersonal barriers to accessing the intervention. Participants who couldn't afford transportation costs, had scheduling conflicts with their jobs or childcare duties, or lived too far away were unable to take part in the program.</p>
<b>Facilitators enabling food environment interventions</b>		
<ul style="list-style-type: none"> <li>Tradition of women making financial and dietary decisions</li> <li>Men spending money on self-interest</li> </ul>	Total: 2  Primary qualitative, process evaluations, & mixed-method studies: 1  Descriptive studies: 1	<p><b>Analytical theme 2.1: Liberal gender norms such as women being traditionally known for being more responsible with money, more aware of budgeting for food, and prioritizing the best interests of the household may have led to program success.</b></p> <p><b>(Contextual factors)</b></p> <p>It has been suggested that women should continue to be responsible for managing household finances as this is their traditional role. Some argue that women are more responsible, more aware of food budgeting, and prioritize the best interests of the household— whereas men might spend money on only a few necessary items and keep the rest for themselves.</p>
<ul style="list-style-type: none"> <li>Large transfer size</li> <li>Other women from the same area travel together</li> </ul>	Total: 2  Primary qualitative, process evaluations, & mixed-method studies: 1  Descriptive studies: 1	<p><b>Analytical theme 2.2: Large transfers facilitated saving behavior. Women's mobility improved when women from the same area traveled together.</b></p> <p><b>(Program design-related factors)</b></p> <p>Programs can facilitate a savings culture by design. When transfers were large enough, they allowed households to save the money left over after purchasing food. Women's mobility improved when women in the same area went to pick up food transfers or vouchers together.</p>

Descriptive themes derived from the inductive coding of qualitative studies	Number of studies per theme	Analytical themes derived from the configuration of descriptive themes
<b><i>Unintended consequences of food environment interventions</i></b>		
<ul style="list-style-type: none"> <li>Reckless spending and irresponsibility of partners</li> </ul>	Total: 2 Primary qualitative, process evaluations, & mixed-method studies: 0 Descriptive studies: 2	<b>Analytical theme 3: Women's increased access to food and resources made their husbands or partners spend recklessly and feel less responsible for feeding the family.</b>

#### **4.3.4 Discussion and implications**

The *food environment* interventions category analyzed the effect of one intervention type on women's empowerment outcomes. Overall, we observed a relatively small body of evidence from five studies, which did not provide enough evidence to run quantitative meta-analyses. Effect estimates are generally subject to a high risk of bias and are mostly located in Sub-Saharan Africa and South Asia. They mostly show very-small-to-small, positive, and not statistically significant effects of interventions in their respective contexts.

The body of qualitative evidence on food environments is scarce, with the only relevant study in our review being Buller et al.'s (2016) analysis of a World Food Programme initiative in Ecuador. This intervention targeted women and provided monthly transfers of USD40 in cash, food vouchers, or food. A main barrier was the exclusion of women from household decision-making, as men, considered the heads of households, made important decisions. This limited women's autonomy in using the monthly transfers. On the other hand, giving women a role in managing transfers was a way to valorize them within their household. The body of qualitative studies did not provide additional evidence related to the unintended effects of the interventions.

## **5. Conclusion**

### **5.1 Summary of findings**

The body of evidence of studies that rigorously and quantitatively examine the effects of FSN interventions on women's empowerment is limited and unevenly distributed: our scope includes 44 unique quantitative studies completed by 9 linked quantitative papers, 64 qualitative evaluations, and 323 descriptive qualitative papers. The IEs cover 42 programs, including eight multi-component interventions, and 19 countries through 22 experimental and 22 quasi-experimental evaluations. The most studied intervention category was *food supply chain* interventions (n = 36), followed by *consumer behavior* (n = 8) and *food environment* (n = 5).

For interventions with enough evidence to run quantitative meta-analyses, we mostly found small, positive, and statistically significant effects of FSN interventions on women's empowerment (Figure 9). Most of the evidence is reporting the effects of *food supply chain* interventions, and more evidence from the other intervention categories will be needed to reliably assess their effect on women's empowerment outcomes. We observed moderate and statistically significant effects of *food supply chain* interventions on *collective action and leadership* ( $\widehat{SMD} = 0.23$ ; 95% CI: 0.11 to 0.36;  $p < .001$ ), *empowerment indices* ( $\widehat{SMD} = 0.26$ ; 95% CI: -0.07 to 0.45;  $p = .006$ ) and *consumer behavior* interventions on *access to economic and livelihood resources* ( $\widehat{SMD} = 0.27$ ; 95% CI: 0.12 to 0.43;  $p < .0001$ ).

Other meta-analyses mostly show very small to small and statistically significant effects of *food supply chain* interventions on *access to economic and livelihood resources* ( $\widehat{SMD} = 0.14$ ; 95% CI: 0.07 to 0.22;  $p = .001$ ), *ownership of land and assets* ( $\widehat{SMD} = 0.08$ ; 95% CI: 0.01 to 0.14;  $p = .02$ ), *decision-making* ( $\widehat{SMD} = 0.10$ ; 95% CI: 0.05 to 0.15;  $p < .001$ ), *gender-transformative* outcomes ( $\widehat{SMD} = 0.01$ ; 95% CI: -0.09 to 0.11;  $p = .92$ ). We observed similar sizes and directions of effects among *consumer behavior* interventions on *control over resources* ( $\widehat{SMD} = 0.08$ ; 95% CI: 0.03 to 0.13;  $p = .001$ ), and *decision-making* ( $\widehat{SMD} = 0.08$ ; 95% CI: 0.01 to 0.16;  $p = .03$ ).

None of the meta-analyses show significant negative effects of the interventions. However, several outcomes lack sufficient data to robustly measure intervention effects, particularly under *consumer behavior* and *food environment interventions* (Table 9).

When we examined potential sources of heterogeneity, we found very little effect of moderators (e.g., intervention year, unit of analysis, evaluation method, length of follow-up or exposure, multi-component interventions, including gender-specific design, gender inequality context, or hunger and nutrition contexts). This absence of heterogeneity patterns can be partly explained by the lack of evidence from intervention categories with a limited number of studies or missing data.

Our review of *consumer behavior*, *food environment*, and *food supply chain* interventions highlights significant barriers and facilitators. In *food supply chain* interventions restrictive gender norms are primary barriers to women's participation in food supply chain interventions. Systemic challenges include poor stakeholder coordination, lack of trust, and insufficient resources, exacerbated by environmental conditions, poor health services, political instability, and administrative issues. Facilitators include liberalization of gender norms, a supportive social environment, and increased awareness of intervention benefits.

In *consumer behavior*, Buller et al.'s (2016) study in Ecuador revealed that women's exclusion from household decision-making limited their autonomy over USD40 monthly transfers, though involving them in managing transfers increased their household valorization.

For *food environment* interventions, Bhatia et al.'s (2023) analysis of the Jharkhand Initiative for Adolescent Health in India identified barriers such as the vulnerability of target adolescent girls. Mukta et al.'s (2014) study on the A&T Initiative in Bangladesh noted that female participants felt more valued and influential within their communities.

Some of the main unintended consequences included the additional economic, social and political burden on women participating in interventions but also the potential dependencies caused by the interventions. Unintended consequences of FSN interventions also included negative outcomes like child labor, corruption, and hindered school attendance but, depending on the context, also positive externalities such as increased school enrolment and improved access to land mortgages, depending on the context (Appendix D provides narrative summaries of qualitative findings).

**Table 9: Summary of the meta-analyses results**

Intervention Category	Outcome	SMD	95% CI	k	p-value	Moderator analysis
Food supply chain	Access to economic and livelihood resources	0.14	0.07,0.22	15	.001	
	Ownership of land and assets	0.07	0.01,0.14	14	.02	Effects based on average treatment effect were smaller relative to those based on intention to treat ( $\hat{\beta} = -0.24, p = .02$ ). Effects from experimental design studies were larger relative to those from quasi-experimental design studies ( $\hat{\beta} = 0.16, p = .01$ ). Effects from the individual-level analysis were larger relative to those from household-level analysis ( $\hat{\beta} = 0.2, p = .02$ ).
	Control over resources	0.06	-0.01,0.13	12	.09	
	Time use	0.01	-0.04,0.05	6	.79	
	Decision-making	0.10	0.05,0.15	20	< .001	Effects were larger in studies focusing on countries with higher gender equality index scores ( $\hat{\beta} = 0.72, p = .04$ ).
	Women's rights	0.03	-0.13,0.19	4	.72	
	Collective action and leadership	0.23	0.11,0.36	10	< .001	
	Gender-transformative outcomes	0.07	0.01,0.13	8	.02	Effects from individual-level analysis were larger relative to those from household-level analysis. ( $\hat{\beta} = 0.10, p = .01$ )
	Self-esteem	0.004	-0.09,0.10	7	.92	Effects from quasi-experimental design studies were smaller relative to those from experimental design studies ( $\hat{\beta} = -0.18, p = .006$ ).
	Other empowerment outcomes and indices	0.26	0.07,0.45	13	.006	
Consumer behavior	Access to economic and livelihood resources	0.27	0.12,0.43	5	< .001	Effects were larger in more recent studies ( $\hat{\beta} = 0.05, p = .04$ ). Effects were smaller with intervention exposure ( $\hat{\beta} = -0.01, p = .003$ ).

Intervention Category	Outcome	SMD	95% CI	k	p-value	Moderator analysis
	Ownership of land and assets					Insufficient information
	<b>Control over resources</b>	0.08	0.03,0.13	5	< .001	
	Time use					Insufficient information
	<b>Decision-making</b>	0.08	0.01,0.16	3	.03	
	Collective action and leadership					Insufficient information
	Gender-transformative outcomes					Insufficient information
	Self-esteem	0.11	-0.02,0.23	3	.09	Insufficient information
	Other empowerment outcomes and indices					
<b>Food environment</b>	<b>Control over resources</b>					Insufficient information
	Time use					Insufficient information
	<b>Decision-making</b>					Insufficient information
	Self-esteem					Insufficient information
	Other empowerment outcomes and indices					Insufficient information

*Note: Outcomes in bold have a statistically significant SMD at a 5 percent significance level. k is the number of estimates. Insufficient information indicates that we did not conduct a meta-analysis for these outcome types. In these cases, k = 1 or k = 2 and we chose not to conduct a meta-analysis due to various differences (e.g., intervention types, regions).*

## 5.2 Limitations of available studies

The overall evidence base on the effect of FSN interventions on women's empowerment is limited: we selected 59 of 101 studies (44 of which remained after the outcome mapping) measuring the effect of FSN interventions on women's empowerment, which were a subset of the 2,338 IEs included in the FSN E&GM. Our sample represents a small portion of the overall body of evidence on FSN—namely, 2 percent of the broader literature on FSN interventions in L&MICs. The body of evidence is unevenly distributed, with a dearth of evidence in the Middle East and North Africa, Europe, and Central Asia. This limited our ability to reach generalizable conclusions about the likely effects of some interventions, particularly on *consumer behavior* and *food environment* interventions.

Moreover, not all studies measuring the effect of interventions on women's empowerment outcomes necessarily analyze the effect of a gender-specific intervention. In our sample, 68 percent of interventions had a gender-specific or gender-transformative design.

The quality of the available studies should be considered when analyzing the conclusions from this body of evidence, as most estimates were assessed as having some concerns or a high risk of bias. Almost 40 percent of estimates were assessed as having potential risks



of bias related to both selection and confounding. In these cases, studies lacked sensitivity analyses for hidden bias in statistical matching, did not establish pre-treatment parallel trends for difference-in-difference methods, or did not conduct adjustments needed when the estimation assumptions were not met. In addition, most studies did not provide a pre-analysis plan when baseline data was collected, resulting in some concerns about the potential for reporting bias or p-hacking.

Similarly, although qualitative evidence allows us to complement our quantitative findings, the available evidence was limited in quality; we therefore could not include most studies (62%) in our qualitative synthesis. Key reasons as to why they did not meet minimal inclusion criteria included: a lack of credibility in findings due to their inability to establish arguments based on collected primary data, inadequate attention to the study context, and limited reflectivity of authors' perspectives.

A lack of a systematic and transparent approach to the research process also caused critical flaws in some studies. About 40 percent of the 62 studies we included in the qualitative analysis were rated as low-quality. Most of these scored a low rating in the assessment domain of reflectivity of the authors' perspectives in the data collection, analysis, and interpretation processes. Other key areas in which the studies received low ratings included inappropriate samples, indefensible study designs, and lack of rigor in research conduct.

### **5.3 Strengths, limitations, and future directions**

Findings of REAs must be interpreted with greater caution than those of SRs. Apart from the abbreviated approach to search-and-screening, our approach followed the Campbell Collaboration guidelines for SRs (Campbell Collaboration 2021). One reviewer performed an outcome mapping, which was quality-approved by a second reviewer. Two reviewers performed data extraction and risk-of-bias assessments independently. We undertook the analysis according to our proposed methodology (Basak et al. 2024).

Our body of evidence is based on a subset of the FSN E&GM as of November 2023. We have only undertaken an additional search for qualitative evidence based on the included programs from quantitative IEs. Since November 2023, a new update of the FSN E&GM provided additional resources and evidence that might be relevant for the scope of our review. A future update of this work could aim to include this additional evidence.

In addition, our qualitative search was not based on all qualitative evidence on the link between FSN interventions and women's empowerment; rather, it only included programs identified in the included quantitative IEs. Thus, despite the rigor of our analysis, some relevant studies might not be included. Additionally, due to resource constraints, we selected 59 of the 101 studies analyzing the effect of FSN interventions on women's empowerment outcomes. The excluded studies either focused on interventions and outcomes with available synthesis evidence, or lacked enough evidence to bring insightful findings.

Evidence is not available for all aspects of the included intervention categories: under *food supply chain* interventions, the available evidence focuses on production systems interventions; however, the gap of evidence regarding other aspects (e.g., storage and distribution, processing and packaging, food loss and waste management) limits the generalizability of findings. This is particularly visible in the *food environment* category, as it is exclusively covered by the direct provision of food interventions.

The high variability of studies meant that only a subset could be analyzed through meta-analysis. This limits our ability to draw generalized conclusions about the effectiveness of some of the included interventions. Building on the living FSN E&GM, future studies should aim to regularly update the findings of this REA and bringing in additional evidence to update our understanding of the effect of relevant interventions.

## 5.4 Implications for policymakers and researchers

### 5.4.1 Implications for policymakers and implementers

**Implementers and policymakers can rely on FSN interventions' small yet positive effects to contribute to women's empowerment.** The analysis of a selection of FSN interventions shows an overall small, positive, and statistically significant effect on several women's empowerment outcomes across the resources, agency, and achievements framework. The evidence shows particularly promising effects from some *food supply chain* interventions on resources, agency, and achievement-related outcomes such as *collection action and leadership*, *access to economic and livelihood resources*, *decision-making*, and *ownership of land and assets*.

Evidence does not show a pattern of statistically significant differences in effects between gender-specific and non-gender-specific interventions and between gender inequality contexts.<sup>12</sup> However, the evidence is limited, and future studies can contribute to our ability to assess potential differences. Through interventions in food systems and nutrition, implementers and policymakers can contribute to women's empowerment and gender equality. Nonetheless, implementers and policymakers should consider the scant evidence available on *consumer behavior* and *food environment* and the subsequent limitations in analyzing the effectiveness of those interventions.

**Implementers and policymakers should further explore the iteratively positive relationship between FSN and women's empowerment.** Berretta et al. (2023) observed positive and statistically significant effects of women's empowerment interventions on FSN outcomes, namely: food security, food availability and affordability, diet quality and adequacy, anthropometrics (though there is a lack of evidence in this area), micronutrient status (lack of evidence), and mental well-being (lack of evidence).

These positive outcomes can all be leveraged through FSN interventions, and may contribute to women's empowerment. Although most of the observed effects in both cases are small to moderate, by building on this mutually beneficial process between FSN and women's empowerment, policymakers and implementers may contribute to improving food security and nutrition while supporting women's empowerment and gender equality.

**Intervention design should consider the barrier of gender-restrictive norms and take a holistic approach to maximize the effect.** As reported in the qualitative evidence, gender-restrictive norms—which limit women's autonomy, contribution to decision-making, participation in community activities, or security from gender-based violence—are common patterns that may hinder intervention effectiveness. Addressing these norms from early project stages may increase women's participation in, and benefit received from, the interventions. Through this approach, implementers and policymakers should consider not

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<sup>12</sup> The only exception was for the effect of *food supply chain* interventions on *women's rights*, and was based on a small body of evidence ( $k = 5$ ).

only a gender-sensitive approach, but a gender-transformative approach, by addressing restrictive gender norms in the design of their FSN interventions.

**Interventions should be mindful of the additional vulnerabilities that might affect women.** Being a woman might not be the only source of vulnerability faced by female participants: it may intersect with other factors that increase vulnerability in some contexts, such as being adolescent or elderly, belonging to a poor and/or rural household, having disabilities, or having lower levels of education or literacy.

This overlap of vulnerabilities requires a thorough diagnosis and a targeting of beneficiary populations based on a deeper understanding of the intersectionality of vulnerability. This ensures that processes and incentives are in place to allow for the inclusive, safe, and sustainable participation of vulnerable populations in the intervention. In the absence of this targeting process, implementers and policymakers might increase the risk of exclusion of some population groups (particularly women facing multiple sources of vulnerability) as well as intervention dropout, or lead to unintended consequences such as increasing risks and further marginalizing vulnerable groups.

**Tackling logistical and economic barriers could be helpful for the full participation of women in interventions.** Qualitative evidence across FSN interventions identified logistical barriers as a common obstacle to women's participation, such as transportation costs, travel safety issues, and geographical distance. Securing adequate supply chains, infrastructure, and logistics for program implementation may be an important success factor. Similarly, ensuring that economic prerequisites are in place may catalyze implementation of program components.

**To ensure the effectiveness of FSN interventions, it may be beneficial to secure strong government buy-in and support where possible.** The qualitative evidence shows that various strategies can be employed to ensure such government buy-in and involvement in support of the project's objectives. However, it is important to ensure that the intervention timeline is not rushed by political interests aiming to showcase positive effects prematurely, as some authors reported that this could ultimately become a barrier to a program's success. Additionally, in countries wherein governments severely limit women's rights and do not prioritize their empowerment, different diplomatic approaches will be needed to contribute to change in women's empowerment through FSN interventions.

**Implementers and policymakers should also consider the potential burdens and dependencies that interventions may create among women beneficiaries.** Due to their multiple roles and responsibilities at the household and community level, women's participation in FSN interventions may impose additional administrative, social, or economic burdens upon them (e.g., increased labor demand, administrative process for marriage registration, childcare). In addition, interventions should consider the sustainability of their design to avoid creating dependency, especially regarding income-generating activities. For empowerment to occur, intervention should consider both the feasibility and sustainability of the intervention from the perspective of its participants.

**Finally, implementers and policymakers can contribute to filling some of the evidence gaps on the effect of FSN interventions on women's empowerment outcomes.** Included studies represent about two percent of the overall body of evidence

on FSN interventions, showing that a minority of studies have a gender equality lens or, at least, provide measures for gender equality outcomes. Policymakers and implementers can contribute to filling this gap by incorporating a gender framework into their FSN intervention design and their monitoring, evaluation and learning plans. By contributing to the body of evidence, they will be better able to inform the design of future interventions across contexts and intervention categories.

#### **5.4.2 Implications for researchers**

**The FSN sector requires further evidence on the effectiveness of interventions on women's empowerment outcomes, particularly regarding *consumer behavior* and *food environment* interventions.** The body of evidence is scarce and unevenly distributed across interventions, outcomes, methodologies, and geographies. From an intervention perspective, more evidence is needed on *consumer behavior* and *food environment* interventions or on other aspects of the *food supply chain*, such as storage and distribution, processing and packaging, food loss, and waste management.

From an outcome perspective, more evidence is needed on the effect of FSN interventions on the *adoption of gender-transformative policymaking*, as none of the included studies covered this outcome. Researchers might also want to focus on *time-use*, different types of *women's rights*, or *self-esteem*-related outcomes, as they are less covered by the current body of evidence. Geographically, little evidence is available in Latin America and the Caribbean, the Middle East and North Africa, and East Asia and the Pacific—as well as central Africa, as most studies from this region focus on West, East, and southern Africa.

With regard to methodologies, despite the even split between experimental and quasi-experimental quantitative designs, future research might want to explore longer follow-up periods, as the average follow-up period in the body of evidence is two months. Understanding the sustained impact over longer periods will provide valuable insights for more effective interventions. A longer follow-up period might also contribute to better measurement of changes in gender norms over time, as this outcome might require a longer timeframe.

**To enhance analysis accuracy, both quantitative and qualitative evidence must improve methodological rigor and transparency.** Many of the sources of bias in included quantitative studies could be readily addressed through additional statistical analyses, which would not necessitate completely changing the evaluation approach. Studies regularly lack sufficient reporting of common statistical and placebo tests and necessary statistical adjustments that might add confidence about the specific application of a study design.

To enhance qualitative evidence, researchers should focus on the appropriateness of the research design, transparency of the process, and reflectivity of the analysis. Researchers could improve these areas by presenting well-supported and plausible arguments based on the collected evidence and clearly describing the study's context and specifics. They should reflect on how various contextual factors, including their own subjectivity, may have influenced their approach and analysis. It's also crucial to provide a systematic and transparent account of the research process. Furthermore, the research design must be clearly defined and suitable for the study's aims and objectives, and participants should be carefully selected to ensure the research's validity and reliability.

**Considering the constant growth of the FSN body of evidence, the analysis of intervention effectiveness should be regularly updated with new evidence.** From the 101 potentially relevant studies based on the November 2023 update of the FSN E&GM, the total number of potentially relevant studies as of May 2024 is 161. This rapidly growing body of evidence, combined with the availability of a live E&GM, is an opportunity for regular updates of evidence synthesis, as new studies might contribute to filling some of the gaps identified in our review.

**Considering the size of the FSN body of evidence, researchers should explore other synthesis gaps to better understand the effect of FSN interventions on development outcomes.** As of May 2024, the FSN E&GM currently includes 3,087 studies, and women's empowerment is one of the many outcome domains it covers. As per the E&GM's recent update, several of its intervention and outcome domains E&GM are characterized by synthesis gaps that future research may want to fill, namely: outcomes related to other diet quality and adequacy measures, education interventions within the food supply chain, agricultural insurance interventions, and the provision of free or reduced-cost farm inputs to crop production.

## **Online appendixes**

### **Online appendix A: List of interventions and outcomes included in REA**

<https://3ieimpact.org/sites/default/files/2024-07/FSNWE-REA-WP-Online-appendix-A.pdf>

### **Online appendix B: Study designs**

<https://3ieimpact.org/sites/default/files/2024-07/FSNWE-REA-WP-Online-appendix-B.pdf>

### **Online appendix C: Quantitative and Qualitative assessment tool**

<https://3ieimpact.org/sites/default/files/2024-07/FSNWE-REA-WP-Online-appendix-C.pdf>

### **Online appendix D: Characteristics tables and overview of evidence**

<https://3ieimpact.org/sites/default/files/2024-07/FSNWE-REA-WP-Online-appendix-D.pdf>

### **Online appendix E: Technical appendices**

<https://3ieimpact.org/sites/default/files/2024-07/FSNWE-REA-WP-Online-appendix-E.pdf>

### **Online appendix F: Additional qualitative documents**

<https://3ieimpact.org/sites/default/files/2024-07/FSNWE-REA-WP-Online-appendix-F.pdf>

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