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Lara Cockx
Nathalie Francken

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Lara Cockx[1] and Nathalie Francken

LICOS – Centre for Institutions and Economic Performance, University of Leuven, Belgium.

Abstract:

In the aftermath of the world food price crisis, the issue of food and nutrition security has received a high level of political attention and the international donor community has repeatedly underlined its commitment to combat hunger in the world. In order to enhance the effectiveness of the international community's efforts in addressing the widespread problem of malnutrition, we need to improve our knowledge on what activities donors are currently engaging in and which interventions have been shown to be successful. This paper offers both an overview of the aid for food and nutrition security landscape and how it has changed and an extensive review of the available evidence on the impact of a wide array of interventions aimed at addressing all four dimensions of food and nutrition security; availability, access, utilization and stability. We find that despite the renewed interest and elevated levels of funding for food and nutrition security assistance in developing countries, the empirical evidence base for the effectiveness of these interventions in improving beneficiaries' food and nutrition security – although in several cases promising – is weak. In particular, the question whether different interventions improve the quality of food consumption and consequently nutrient intake and status, remains largely unanswered. Moreover, few studies assess longer-term effects and there exists relatively little rigorous evidence that compares different interventions. It is therefore strongly recommended to undertake additional research to improve the evidence base as this would allow researchers and policy makers to establish the type of approaches that improve food and nutrition security in the most efficient and cost-effective manner. Finally, in order to facilitate this process, there is a need for a clear and uniform definition of food and nutrition security assistance on the one hand as well as agreed upon, comprehensive indicators on the other hand.

JEL Codes F35, F53, I380, O12, O13, O15.

[1] Corresponding author: lara.cockx@kuleuven.be.

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1. Introduction

In the aftermath of the world food price crisis, the issue of food security has received a high level of political and media attention and the international donor community has repeatedly underlined its commitment to combat hunger in the world. In addition, the growing evidence on the profound effects of nutritional deficiencies, has firmly entrenched food and nutrition security at the top of the development agenda.

While progress had been made, it is estimated that 795 million people in the world continue to suffer from hunger (WFP, 2015) and undernutrition is responsible for 45% of deaths of children younger than 5 years, amounting to more than 3,1 million deaths each year and additionally preventing millions of children from reaching their full intellectual and productive potential (Black et al., 2013). In order to enhance the effectiveness of the international community's efforts in addressing these widespread problems, we need to improve our knowledge on what activities donors are currently engaging in and which interventions have been shown to be successful.

This paper offers both an overview of the aid for food and nutrition security landscape and how it has changed and an extensive review of the available evidence on the impact of a wide array of interventions aimed at addressing all four dimensions of food and nutrition security; availability, access, utilization and stability.

Previous reviews have focused on intermediate outcomes including household income an food production (IOB, 2011) and more narrow concepts of aid for food and nutrition security such as interventions in agricultural production, value chains, market regulation and land security (IOB, 2011) or the in-kind or cash delivery of food assistance (Margolies and Hoddinott, 2012). Though Lentz and Barrett (2013) similarly develop a typology of food assistance policies based on the different dimensions of food security, they restrict their attention to programmes that are nutrition-sensitive.

2. Definition, classification and data

The first step in this process is to delineate the interventions which affect food and nutrition security and will be included in our measure of aid for food and nutrition security. As interventions can be aimed at different dimensions of food and nutrition security, there is no agreement on what should be seen as "food and nutrition security interventions". In line with the emerging consensus on the need for multipronged policy strategies, we adopt a broad definition of aid for food and nutrition security and consider programmes focusing on proximate causes associated with food intake as well as interventions aimed at tackling the underlying, more structural causes of food and nutrition insecurity. Put differently, as can be derived from Figure 1, we consider programmes aimed at addressing all four dimensions of food and nutrition security; availability, access, utilization and stability.

Extending the OECD (2012) definition of aid for food and nutrition security and in line with the working definition of used by the G8 L'Aquila Food Security Initiative (AFSI, 2012), we distinguish "aid for food and nutrition security" from humanitarian or emergency food assistance and consider interventions involving rural development, food aid, social protection, interventions in agriculture and fishing, nutrition-specific interventions, water, sanitation and hygiene (WASH) interventions and integrated approaches. We acknowledge however, that this approach has some limitations, as our definition could potentially include aid that is not specifically targeted to food and nutrition security and exclude some which is.

Not all interventions correspond to the sector qualification in the OECD/DAC Creditor Reporting System (CRS) database on aid activities, which we will use for the purpose of tracking aid flows. In particular, identifying social protection interventions poses a problem as donors report expenditures they consider to be for social protection across a range of CRS codes. Similarly, the reporting on expenditures on integrated approaches aimed at enhancing food and nutrition security will likely depend on donors' internal coding systems. For the purpose of tracking aid flows we consider all aid reported under *agriculture*, *agro-industries*, *fishing*, *basic nutrition*[2], *basic drinking water supply*[3] *and sanitation*[4], *rural development* and *developmental food aid/food security assistance*.

[2] "Basic nutrition" covers direct feeding programmes, determination of micro-nutrient deficiencies, provision of vitamin A, iodine, iron etc., monitoring of nutritional status, nutrition and food hygiene education, household food security.

[3] "Basic drinking water supply" covers rural water supply schemes using handpumps, spring catchments, gravity-fed systems, rainwater collection and fog harvesting, storage tanks, small distribution systems typically with shared connections/points of use and urban schemes using handpumps and local neighbourhood networks including those with shared connections.

[4] "Basic sanitation" covers latrines, on-site disposal and alternative sanitation systems, including the promotion of household and community investments in the construction of these facilities.

The second step is to identify what is the focus in terms of "impact". Finding a comprehensive measurement of food and nutrition security for evaluating these different programmes has proven to be difficult (e.g. Barrett, 2010). The scarcity of empirical impact evaluations can at least in part be attributed to the dissatisfaction with existing measurement systems. In addition, this lack of consensus significantly impedes the usefulness and especially comparability of existing analyses.

We apply strict criteria for the measurement of the food and nutrition security impact of interventions. To be included a study has to report measures directly related to individual and household food and nutrition security status, rather than its determinants. Outcomes of interest therefore include household and individual food expenditures and consumption, macro- and micronutrient intake, micronutrient status and anthropometric measures. In addition, we restrict our analysis to impact evaluations of interventions, rather than generalizing results from observational studies. The scope of the review was further restricted to studies published after the year 2000 and to interventions in low- and middle-income countries.

3. The evolution of EU aid for food and nutrition security

3.1 Evolution over time

With several Member States among the largest bilateral donors and the EU Institutions being one of the most important multilateral contributors, the EU plays a particularly important role in global funding for food and nutrition security. Since 1995, the EU as a whole accounts for more than a third of total donor commitments[5] of aid in this sector. This focus on enhancing food and nutrition security is further reflected in the establishment of a common *EU Policy Framework to Assist Developing Countries in Addressing Food Security Challenges (COM (2010)127 final).* We note however, that a clear definition of what constitutes EU aid to food and nutrition security is still lacking.

Figure 2 depicts the evolution of total and EU commitments of aid for food and nutrition security as well as this sector's relative importance in the global aid budget.

While, there appears to be somewhat of an increasing trend in total value of Official Development Assistance (ODA) aimed at enhancing food and nutrition security, these increases mostly reflect rising levels of development assistance in general. The relative importance of this sector has in fact been decreasing largely up until 2005. In particular, there was a substantial decline in development assistance channelled to agriculture following the disappointing "green revolution" in Africa, combined with low food prices and an increasing interest in the health and education sectors that offered more tangible results. Moreover, the 1990s brought another striking transition with food aid flows falling sharply as a result of declining food surpluses in donor countries (Gaus, 2012; Barrett, 2002).

The 2007-2008 world food price crisis however, caused a dramatic turnaround in public and political attention for food security issues and raised donor funding for it (Guariso et al., 2014). Several new initiatives on food security were launched. The UN established a High-Level Task Force on the Global Food Security Crisis. The G8 agreed the L'Aquila Food Security Initiative. The FAO convened the World Summit on Food Security in Rome in 2009, at which participating governments committed to reverse the trend of declining investment in agriculture and adopted the Five Rome Principles for Sustainable Global Food Security[6]. By 2009, total commitments of ODA for food and nutrition security

[5] Our analysis is based on data on commitments rather than disbursements, as these are available for a longer time period and better suited for a forward-looking analysis because they are closer to current policies.

[6] Invest in country-owned plans, aimed at channelling resources to well designed and results-based programmes and partnerships; Foster strategic coordination at national, regional and global level to improve governance, promote better allocation of resources, avoid duplication of efforts and identify response-gaps; Strive for a comprehensive twin-track approach to food security that consists of: a)

had reached an all-time high of 16.7 billion USD, representing a 34% increase compared to the previous year. After 2009 however, commitments started to decline both in absolute and relative terms up until 2012, when aid increased to 16.2 billion USD, following yet another spike in world food prices.

As can be derived from Figure 3, these global trends are even more pronounced in the evolution of EU Institutions' aid for food and nutrition security. More specifically, its share in the total development assistance budget reached an all-time low of 6 per cent in 2008. In the aftermath of the global food price crisis however, the value of EU institutions' development assistance aimed at enhancing food and nutrition security more than doubled, increasing its share in the total aid budget to 16 per cent. This however, fell back to 6 per cent by 2011, rising up to 11 per cent in 2012 and 2013, with the value of aid to reaching an all-time high of more than 2.85 billion USD, making the EU Institutions the largest multilateral donor of aid for food and nutrition security.

Compared to the EU Institutions, the Member States appear to attribute considerably less importance to aid for food and nutrition security. The level of aid for food and nutrition security from EU Member States started declining from the year 1998 onwards and became a very low priority as it made up for less than 5 per cent of the total aid budget in 2006. While the relative importance of food and nutrition security had risen to 7 per cent by 2007 already, the actual value of ODA for food and nutrition security didn't increase up until 2009.

Though the structure of EU Member States' ODA for food and nutrition security appears to have remained relatively stable over time, with agriculture taking up on average 48 per cent of the budget between 2004 and 2013, the sectoral composition of EU Institutions' assistance has undergone some notable changes (see Figure 4).

In line with the global trend of declining availability oriented food assistance programmes focusing on the delivery of macronutrients (Lentz and Barret, 2013), the share of development food aid and food security assistance in the total EU Institutions budget ell from a staggering 70 per cent in 1997 to a 7 per cent in 2013. In addition, there has been an important shift from international shipments to local and region purchase of in-kind food

direct action to immediately tackle hunger for the most vulnerable and b) medium and long-term sustainable agricultural, food security, nutrition and rural development programmes to eliminate the root causes of hunger and poverty, including through the progressive realization of the right to adequate food; Ensure a strong role for the multilateral system by sustained improvements in efficiency, responsiveness, coordination and effectiveness of multilateral institutions; Ensure sustained and substantial commitment by all partners to investment in agriculture and food security and nutrition, with provision of necessary resources in a timely and reliable fashion, aimed at multi-year plans and programmes.

aid, which made up for 85 per cent of the total volume of EU Institutions' project food aid in 2012 (WFP, 2015). In absolute terms however, the value of development food aid and food security assistance was increasing up until 2001. Since 2007, the largest share of the budget has been allocated to the agricultural sector.

While in line with increasing understanding of the crucial importance of nutrition – especially during the critical first 1000 days from conception to 2 years – for long-term health, the *Food Security Policy Framework* was complemented with a *Framework for Enhancing Maternal and Child Nutrition in external assistance in 2013 (COM (2013) 141 final)*, funding for nutrition-specific interventions appears to have remained limited. This is however, likely to be an underestimation of overall EU support for nutrition, as the OECD/DAC CRS category only captures nutrition-specific interventions. The importance of complementary nutrition-sensitive interventions in sectors such as agriculture and education, that address the underlying determinants of nutrition, is however increasingly being recognized (Ruel and Alderman, 2013). Data from the SUN resource tracking exercise, reveal that the EU institutions allocated more than half a billion USD to nutrition sensitive interventions in 2012, with a similar pattern emerging for EU Member States. The United Kingdom for example, allocated more than tenfold of the budget for basic nutrition to nutrition-sensitive interventions.

3.2 Recipients

As can be derived from Figure 5, Sub-Saharan Africa has consistently received the largest share of EU ODA for food and nutrition security.

In 2013, approximately 37 and 46 per cent of EU institutions and Member States' budget for food and nutrition security was allocated to this region. For the latter, more than 9 per cent of total aid flows to this region has been allocated to Ethiopia, making it the largest recipient of EU Member States' aid for food and nutrition security. EU development assistance aimed at enhancing food and nutrition security for Afghanistan has also been rising rapidly since 2002.

In the aftermath of the global food price crisis, the EU Institutions appear to have attributed particular attention to developing countries on the European continent that accounted for approximately one fourth of the total budget in 2013. Turkey in particular, stands out as it was the largest recipient of EU Institutions aid for food and nutrition security

(see Figure 6). In contrast, EU Member States allocate only a negligible part of their budget to European countries and focus more on traditional recipient countries in South Asia, including Bangladesh, Afghanistan and India.

3.3 Donors

In terms of total value, the main *bilateral* EU donors of ODA for food and nutrition security are the traditionally large donors such as Germany and France (see Figure 6). In terms of the importance of food and nutrition security in donors overall development assistance budget, Ireland, clearly defining the reduction of hunger as the main goal of their development programme (Irish Aid, 2015), stands out. Finally, we note that since defining food security as one of the arrowheads of their development policy in 2011 (Dutch Ministry of Foreign Affairs, 2011), the Netherlands have also shown particularly strong commitment to improving food and nutrition security. ODA for food and nutrition security accounted for over one fifth of the Dutch total aid budget in 2013.

4. Impact of aid for food and nutrition security

As became abundantly clear throughout the first section of this paper, in the aftermath of the world food price crisis, the issue of food security has received a high level of political attention and the international donor community has repeatedly underlined its commitment to combatting hunger in the world. Moreover, overwhelming evidence has emerged on the profound effects of nutritional deficiencies, especially during the critical first 1000 days from conception to 2 years, on health throughout the human life and its inextricable link with cognitive and social development. While the call to action is therefore particularly strong, much less is known about the effectiveness of different interventions. In particular, "*there exists relatively little rigorous evidence comparing among interventions so as to establish which approaches best meet which objectives and therefore what should be given the highest priority given limited resources*" (Lentz and Barrett, 2013). Moreover, despite the growing policy focus on addressing underlying causes of chronic food and nutrition security, there are very few[7] studies that assess the long-term impact of these interventions.

4.1 In-kind food assistance

While perhaps seemingly the most straightforward way of combatting hunger in the world, the effectiveness of in-kind food aid programmes has been subject of a long-standing debate. Del Ninno et al. (2007) for example state that "*food aid is not the only, or in many cases the most efficient means of addressing food insecurity*". The supply of in-kind food aid, especially when involving intercontinental shipments, has proven to be extremely costly and often time-consuming. While depending on the context, local and regional procurement of food aid could improve cost-efficiency and timeliness (e.g. Harou et al., 2013; Lentz et al., 2013), other more general concerns have been raised. In particular, in-kind food aid has been claimed to generate dependency, give rise to disincentive effects for domestic food production and distort local food markets. Despite being exhaustively researched, so far there is limited evidence of these harmful side-effects (e.g. Abdulai et al., 2005; Barret, 2006; Margolies and Hoddinott, 2012). The main question, whether the supply of in-kind food aid successfully addresses food and nutrition insecurity, remains largely unanswered.

[7] Exceptions include studies on data from Guatemalan individuals between 2002 and 2004, who had been enrolled in a nutrition intervention study during 1969 and 1977 (Hoddinott et al., 2008) and their offspring (Behrman et al., 2009).

In the following paragraphs we review the available empirical evidence on the food and nutrition security impact of the free distribution of in-kind food and supplementary feeding for young children as well as food-for-work (see Table 1) and food-for-education schemes (see Table 2).

4.1.1 Free distribution of food

While considerable amounts of development assistance have been channelled towards the free distribution of food, surprisingly few studies evaluate the impact of in-kind food aid on its beneficiaries' food and nutrition security status. Moreover, much of the existing literature fails to account for selection into the programmes, making it difficult to attribute causation of welfare gains to food aid (Gilligan and Hoddinott, 2007).

In-kind food aid transfers have been shown to increase *food consumption*. Gilligan and Hoddinott (2007) show that free food receipts had a large and significant effect on the growth in food consumption per adult equivalent in Ethiopia up to 18 months after the programme had ended. Surprisingly however, the results show that at the same time there was a significant increase in perceived famine risk. The authors hypothesize that this could be attributed to the signalling effect of receiving food aid. Ahmed et al. (2009) similarly demonstrate that participation in a food ration programme in Bangladesh increased household per capita food consumption, be it very modestly.

Unsurprisingly, the aforementioned programme in Bangladesh failed to have any significant effect on child nutritional status, as measured by Body Mass Index (BMI). Several studies from Ethiopia however, document significant improvements in height-for-age (Quisumbing, 2003), weight-for-height (Quisumbing, 2003) and growth in height (Yamano et al., 2005). Broussard (2012) finds that food aid in Ethiopia was associated with improvements in BMI for male adults only. Moreover, the addition of micronutrient supplementation seems to provide a promising way to enhance the impact of food aid programmes. Evidence from a randomized trial in Chad suggests that the provision of targeted nutritional supplements within a general food distribution framework gave rise to significantly greater gains in height-for-age as well as higher haemoglobin levels (Huybregts et al., 2012).

4.1.2 *Supplementary feeding for young children*

The evidence base for the impact of supplementary feeding interventions on child *anthropomorphic measurements* is quite rich. Kristjansson et al. (2015) review available studies on interventions targeting children under five, comprising supplementary

food, with or without added micronutrients or other programme components such as nutrition and health education. The authors demonstrate that of the randomized controlled trials in low- and middle-income countries, meta-analyses of weight, weight-for-age, height and height-for-age gain showed increases for children who were supplemented compared to those who were unsupplemented. However, these differences were small. Supplementary food was generally more effective for children under the age of two and for those who were poorer or more undernourished at baseline. In addition, the results suggest that feeding programmes given in day-care may be more effective than that given at home, due to leakage within the family.[8]

4.1.3 Food-for-work and food-for-education

Alternative strategies for delivering in-kind food transfers include food-for-work and food-for- education programmes. These programmes explicitly aim to tackle both short term food and nutrition security problems and long-term structural causes of food insecurity, by providing food transfers as well as stimulating productivity and thus income growth through investments in public goods and human capital.

Evidence on the impact of food-for-work programmes is scarce. Moreover, while these programmes serve long-term development purposes including for example enhanced public goods provision that could contribute to the alleviation of chronic food and nutrition security problems, available evidence focuses on short-term impacts only.

Gilligan and Hoddinott (2007) find that participation in a food-for-work programme in Ethiopia increased growth in *food consumption*. Contrary to the free distribution of food however, the benefits of this programme were skewed towards households in the middle and upper tail of the consumption distribution. This result is in line with the general concern that the self-targeting mechanism implicit in food-for-work schemes may be suboptimal to reach the most vulnerable population groups (Deshingkar et al., 2005). When comparing the size of the effects and the cost of both programmes, the authors also conclude that the evidence suggests that the free food distribution programme is more cost-effective as a strategy for raising food consumption. Van der Veen and Tagel (2011) find an small but significant positive effect of food-for-work income on the probability of being food secure[9] in Ethiopia.

[8] In a country where poverty is endemic, this may not be a major concern. It however indicates fungibility of aid in that non-targeted household members received supplementary food at the expense of targeted members.

[9] Households are defined as food secure when the per capita daily consumption for adults is at least 2100 kcal.

It has been argued that while school feeding programmes are being implemented in many of the countries with the highest burden of malnutrition, evidence on this strategy's direct contribution to reducing undernutrition remains weak (Bryce et al., 2008; Lentz and Barrett, 2013). Moreover, though the literature is vast, high-quality evaluation designs that allow for causal impact estimates are relatively few (Adelman et al., 2008).

Despite concerns about household reallocation and evidence from a Kenyan randomized control trial where the benefits of receiving milk and energy snacks at school were counteracted by a decrease in the energy content of foods consumed at home, most studies point to significant increases in children's *caloric intake*, especially when baseline energy intake is low (Ahmed and Del Ninno., 2002; Ahmed, 2004; Afridi, 2010; Jacoby, 2002).

While there is some evidence of increased macro- and micronutrient intake for children participating in food-for-education programmes (Afridi, 2010; Murphy et al., 2003), improvements in *micronutrient status* appear to be limited (Siekmann et al., 2003).

Unsurprisingly, given the limited impact on micronutrient status and the fact that these programmes don't focus on the most vulnerable period for malnutrition, evidence on *growth and body composition* remains largely inconclusive (Jomaa et al., 2011). While several studies find improvements in weight gain and BMI of participants and their siblings (Ahmed, 2004; Grillenberger et al., 2003; Kazianga et al., 2009; Neumann et al., 2007; Siekmann et al., 2003;), there is limited evidence for any effects on height or other child anthropometric measures (Grillenberger et al., 2003; Neumann et al., 2007; Alderman and Bundy, 2012).

Similar to food-for-work programmes, food-for-education programmes intend to address more structural determinants of long-term food and nutrition security by fostering human capital development. While most studies demonstrate a (small) positive impact on school enrolment and attendance, especially in areas where initial indicators of school participation are low, results on academic achievement are less consistent (Jomaa et al., 2011; Alderman and Bundy, 2012). Moreover, as there exist no long-term evaluations of food-for-education programmes, we cannot ascertain whether effects on human capital accumulation are translated in improved long-term food and nutrition security. Alderman and Bundy (2012) therefore argue that despite evidence indicating favourable externalities for siblings and clear benefits in addressing short-term hunger in schoolchildren, food-for-education programmes should be viewed as social protection investments rather than food security interventions.

4.2 Social protection

It is now commonly accepted that there are powerful synergies between social protection and food and nutrition security (e.g. High Level Panel of Experts on Food Security and Nutrition, 2012). Interest in the role of cash transfers in alleviating short-term hunger and addressing long-term causes of food and nutrition insecurity is therefore increasing. We discuss available evidence on the impact of cash transfer programmes (see Table 3) as well as cash-for-work schemes (see Table 4)

4.2.1 Conditional and unconditional cash transfers

In general, the evidence on cash transfer programmes is especially rich, though most of the empirical work has focused on conditional cash transfer programmes in Latin America. Though higher income and ability to finance food expenditures constitute only two of many determinants of food and nutrition security status, and it has been argued that cash transfers should be complemented by additional education and health services (e.g. Black et al., 2008), both conditional and unconditional cash transfers have been shown to be successful. So far, there have been no rigorous analyses of the relative effectiveness of conditional versus unconditional in addressing food and nutrition security problems.

Impact evaluations consistently point to increases in *food expenditures* and *food and calorie consumption*. Outside of Latin America, cash transfers in Malawi, Kenya, South Africa and Zambia were found to have a sizeable impact on food expenditures and consumption (Coetzee, 2013; Merttens et al., 2013; Miller et al., 2011; Seidenfeld et al., 2014). Surprisingly, Pellerano et al. (2014) fail to find any significant impact of an unconditional cash transfer programme in Lesotho on food expenditures and consumption. The authors however attribute this to the unpredictability of the payments. In addition, they show that self-reported periods of extreme or severe food shortage were reduced. Evidence from conditional cash transfer programmes in Mexico, Brazil, Colombia, Nicaragua, Ecuador, Paraguay and Peru again show a positive effect on food expenditures (de Oliveira et al., 2007; Mallucio and Flores, 2005; Mallucio, 2010; Soares et al., 2008; Dasso and Fernandez, 2014) or food consumption and energy intake (Hoddinott and Skoufias, 2004; Leroy et al., 2010; Attanasio and Mesnard, 2006; Hidrobo et al., 2014). Leroy et al. (2010) however note that in the context of Mexico for example, these large increases in energy consumption are cause for concern as there is no indication of energy deficiency and a considerable prevalence of overweight. Fernald et al. (2008a) even demonstrate that a

doubling of the cumulative amount of cash transferred to households in Mexico is associated with significantly higher risk of overweight in adults. Forde et al. (2012) confirm these results for adult women in Colombia. Finally, de Bem Lignani et al. (2011) similarly conclude that a conditional cash transfer programme in Brazil was associated with increased consumption of high-density, energy rich foods such as sugar, processed foods and soft drinks, again raising the concern that cash transfers to poor families in Latin America could be associated with unhealthy food choices.

The results from several impact evaluation studies in Latin America however, also indicate some improvements in *diet quality*. Most evidence seems to suggest that beneficiaries consume more diverse diets (Hidrobo et al., 2014; Maluccio and Flores, 2005; Todd et al., 2010) and more healthy food products such as fruits and vegetables (Cunha, 2014; Hidrobo et al., 2014; Hoddinott and Skoufias, 2004; Leroy et al., 2010; Soares, 2008) and items rich in proteins (Attanassio and Mesnard, 2006). Though the aforementioned unconditional cash transfer programme in Lesotho does not appear to have a significant effect on diet diversity, evidence from Uganda indicates that cash transfers led to improvements in diet composition (Gilligan et al., 2014). Only two impact evaluations report on *micronutrient intake*. Leroy et al. (2010) report significant increases in the intake of iron, zinc and vitamin A and C. Cunha (2014) on the other hand, finds that while the programme improved vitamin C consumption, there were no significant changes for iron and zinc. Especially in the context of Latin America, improvements in the quality rather than the quantity of food consumption are however, of crucial importance and should therefore be monitored more closely.

Evidence on improvements in haemoglobin levels or rates of *anaemia* appears to be mixed. While Gertler (2004) and Rivera (2004) find significant negative effect on the probability of being anaemic, Paxson and Schady (2010) document increased haemoglobin levels only for the poorest participating families and Maluccio and Flores (2005), Fernald and Hidrobo (2011) and Cunha (2014) find no significant changes in haemoglobin concentration.

Similarly, the existing evidence on the impact of conditional cash transfer programmes in Latin America on children *anthropometric measurements* is not unequivocal. While several studies report significant increases in the weight of children (Leroy et al., 2008; Maluccio and Flores, 2005) and new-borns (Attanasio et al., 2005), these are often limited to some

beneficiary groups only[10]. Other evaluations fail to find any effect (Fernald et al., 2009; Cunha, 2014; Hoddinott, 2010) and Morris et al. (2004) even document a significantly negative effect in Brazil. The authors posit that this might have been due to the misconception that improvements in anthropometric measures would reduce the likelihood of eligibility to the programme. In line with the concerns about growing obesity in Latin America, the lack of evidence on weight gain doesn't necessarily signal programme failure. Fernald et al. (2008b) in fact demonstrate that a conditional cash transfer programme in Mexico led to a reduction of the prevalence of childhood overweight. Perhaps more importantly, though several studies (Fernald et al., 2009, Fernald and Hidrobo, 2011; Paxson and Schady, 2011; Hoddinott, 2010) fail to demonstrate a significant treatment effect, some of the available evidence for Latin America points to improvements in growth in height, height-for-age, especially for the poorest and youngest children (Attanasio et al., 2005; Rivera, 2004; Gertler, 2004; Behrman and Hoddinott, 2005).Though Merttens et al. (2013) present evidence that suggests that a Kenyan cash transfer programme didn't have any effect on child anthropometric measurements, studies conducted in Bangladesh, Malawi, South Africa and Sri Lanka demonstrate significant increases in child weight (Himaz, 2008; Ferré and Sharif, 2014) and height (Miller, 2010; Aguëro et al., 2007; Coetzee, 2013; Duflo, 2000; Himaz, 2008).

4.2.2 Cash-for-work

While food-for-work programmes provide an alternative for the free distribution of in-kind food aid, so called cash-for-work schemes are increasingly being used as social protection tool to ensure food security. Evidence on the food and nutrition security impact of these programmes is however, particularly scarce.

Several studies demonstrate significant increases in household food expenditures and consumption (Mascie-Taylor et al., 2010; Osei-Akoto et al., 2014; Ravi and Engler, 2015). Ravi and Engler (2015) also demonstrate that participation in India's large rural cash-for-work programme reduces the number of meals foregone.

The evidence impact of cash-for-work schemes in macronutrient intake appears to be somewhat mixed. Ahmed et al. (2009) find that participation increases households' per capita *calorie consumption*, though the effect is limited and much smaller compared to the

[10] In particular, Maluccio and Flores (2005) conclude that the gains appear to be concentrated among the poor. Attanasio (2005) finds that a cash transfer programme in Colombia increased the weight of new-borns only in urban areas and Leroy et al. (2008) find that only children that were younger than 6 months at the baseline experienced significant weight gain.

effect of a food ration scheme. Gilligan et al. (2009) show that receiving payments for undertaking work under the Ethiopian cash-for-work scheme had no significant impact on participants' caloric acquisition, due in part to transfer levels that fell far below programme targets. When only considering households that received at least half of the amount they should have received according to the design of the programme, the authors however find that the likelihood of having low[11] energy intake decreases. Finally, Deiniger and Liu (2013) find that a large cash-for-work scheme in India significantly increased energy and protein intake.

Given its modest impact on calorie consumption, it is not surprising that Ahmed et al. (2009) find no significant effect on child anthropometric measurements or women's nutritional status, measured by BMI. Mascie-Taylor et al. (2010) in turn report significant improvements in child height, weight and mid-upper arm circumference.

4.3 Comparing in-kind versus cash

There is a long-standing debate about the relative merits of delivering social protection or food and nutrition security assistance in-kind or in cash. Several recent studies therefore compare cash versus in-kind interventions in a randomized setting[12] (see Table 5).

Several authors report that both cash and food transfers (in-kind or in vouchers) successfully increased *food consumption*, with no distinguishable difference across treatment modalities (Skoufias et al., 2013; Cunha, 2014; Hidrobo et al., 2014; Gilligan et al., 2014). In Eastern Uganda, only the cash component of the programme was associated with increased food consumption (Gilligan et al., 2014). The authors caution however, that this could be attributed to the differential timing as many food aid beneficiary households may have run out of the food transfer before the end line survey. Hoddinott et al. (2014) on the contrary reports that households receiving food baskets experience larger, positive impacts on the food consumption score[13].

The results for diet *diversity* are contradictory. While Hidrobo et al. (2014) reports evidence from Ecuador that shows that vouchers lead to significantly larger improvements

[11] Below 1800 kcal. per capita per day.
[12] For a more general overview of both experimental and quasi-experimental comparative studies on cash and in-kind transfers, we refer you to Gentilini (2014).
[13] A food consumption score is calculated by summing the number of days each food group was consumed and then multiplying those frequencies by a predetermined set of weights designed to reflect the heterogeneous dietary quality of each food group (Hoddinott et al., 2014).

in dietary diversity, results from a study in the Democratic Republic of Congo indicate that there is no discernible difference between cash and vouchers (Aker, 2013). In the experiment in Ecuador then again, there was no distinguishable difference between the cash and in-kind programme component's effect, while Hoddinott et al. (2014) reports that improvements in diet diversity in Niger were significantly greater for households receiving food baskets.

With regards to *energy intake*, in-kind food transfers appear to have a larger impact (Hidrobo et al., 2014; Leroy et al., 2010). In addition, Leroy et al. (2010) demonstrate that except for fibre, treatment effects on *micronutrient intake* were greater for households receiving food baskets. While Cunha (2014) concludes that it appears that the increases in micronutrient consumption under the in-kind transfer were larger, he finds no significant differences in treatments effects across modalities. Finally, the author demonstrates that though both programmes failed to foster any significant improvements in child *anthropometric measures*, the effect of cash transfers is significantly greater.

In general, differences in the effectiveness of cash and food transfers tend to be modest and differ across outcomes. Based on data from the previously mentioned interventions in Ecuador, Niger, Uganda and Yemen however, Margolies and Hoddinott (2015) conclude that the per transfer cost of providing cash is always less than that of providing food. On a per transfer basis, cash costs $3.17 less to deliver to a beneficiary in Uganda, $6.80 less in Yemen, $7.38 less in Niger, and $8.47 less in Ecuador. It therefore appears that cash transfers may provide a more cost-effective means of improving food and nutrition security outcomes. However, in those areas where markets are less accessible or functional, in-kind food assistance can still be more efficient.

4.4 Agricultural interventions

As was demonstrated in the analysis of aid flows in section 1, there is now a renewed interest in how agriculture could be used to improve food and nutrition security in developing countries. Agricultural interventions can arguably play an important role in improving food and nutrition security as they could potentially contribute to income growth and poverty reduction as well as increased food availability and improvements in the quality of food consumption. Yet the evidence base for the impact of agricultural interventions on food and nutrition security outcomes remains rather weak.

Several exercises[14] have been undertaken to map existing knowledge of the effects of agricultural interventions on food and nutrition security (see Table 6). All available reviews however, point to serious methodological limitations of the evidence base for the potential of agricultural strategies to improve food and nutrition security (e.g. Ruel, 2001; Berti et al., 2004; Girard et al., 2012; Massett et al., 2012; Ruel and Alderman, 2013).

Overall, evidence seems to suggest that several agricultural interventions were successful in raising food production and in some cases *food expenditures and consumption* (Arimond et al, 2011; Berti et al., 2004; Massett et al., 2012; Webb and Kennedy, 2014; World Bank, 2007). Massett et al. (2012) however argue that while several programmes successfully promoted the consumption of the particular food item targeted by the intervention, little evidence is available on improvements in the overall diet.

Several reviews further note that there is very limited evidence showing that these changes translate into substantial improvements in *nutrition* (Berti et al., 2004; World Bank, 2007; Masset et al., 2012). Webb and Kennedy (2014) for example conclude that the empirical evidence for plausible and significant impacts of agricultural interventions on nutrition outcomes remains disappointingly scarce. Arimond et al. (2011) similarly state that the results provide little support for the hypothesis that agricultural interventions help to reduce under-nutrition. All authors caution however, that absence of evidence should not be equated with evidence of no impact.

Most studies point to the importance of integrating behaviour change communication strategies aimed at promoting changes in dietary patterns with agricultural interventions (Arimond et al., 2011; Berti et al., 2004; Webb and Kennedy, 2014). In addition, it seems that nutritional effects are more likely when agriculture interventions incorporate gender considerations (Arimond et al., 2011; Berti et al., 2004; Ruel, 2001; Ruel and Alderman, 2013; World Bank, 2007). Ruel and Alderman (2013) in fact state that "*women – their social status, empowerment, control over resources and health and nutrition status – are key mediators in the pathways between agriculture inputs, intra-household resource allocation, and child nutrition*".

Increasingly, donor strategies include a focus on smallholder agriculture. Stewart et al. (2014) however, study the evidence base for the benefits of small-holder farming in Africa and conclude that food security has also not been thoroughly reviewed as an

[14] For a more elaborate overview, we refer you to Webb and Kennedy (2014).

outcome. Similarly, while Zezza and Tasciotti (2010) report encouraging results that indicate that engagement in farming in urban areas is positively associated with greater diet diversity in developing countries, Korth et al. (2014) state that the research currently available does not allow for any conclusions to be made on whether or not urban agriculture initiatives contribute to food security. Black et al. (2008) also note that interventions to diversify diets by enhancement of agriculture production have only been implemented at small scale and have not been adequately assessed.

Agricultural innovation is commonly expected to contribute to improved food and nutrition security. Most studies on the adoption of agricultural technologies however, primarily focus on impacts in terms of productivity and income (Qaim, 2014). While increasingly, empirical evidence on the link between agricultural technologies and food and nutrition security is emerging (e.g. Kabunga et al., 2014; Kassie et al., 2014; Shiferaw et al., 2014), these studies are mostly based on observational data and assess the importance of technology adoption as a determinant of food security rather than the impact of an intervention aimed at improving technology adoption. Available evidence of interventions involving the distribution of agricultural technologies is summarized in Table 7. Larsen and Lilleør (2014) report evidence from a farmer field school intervention in Tanzania and demonstrate that participating households were less likely to report suffering from hunger. There was also a consistent impact on the likelihood of children having at least three meals per day. Low et al. (2007a, 2007b) and Hotz et al. (2012) demonstrate that interventions to introduce household-level cultivation of Beta-carotene rich orange sweet potato were successful in increasing the intake of vitamin A and lowering the prevalence of vitamin A deficiency.

4.5 Nutrition-specific interventions

As part of the Lancet series on Maternal and Child Undernutrition, Bhutta et al. (2008; 2013) provide excellent reviews of evidence on interventions to tackle maternal and child undernutrition and boost survival. The authors note however that a large proportion of the evidence is still derived from efficacy trials in carefully controlled environments rather than effectiveness studies in programme settings. The most important findings are summarized here below.

Surprisingly, while there exists a large literature on the impact of interventions to promote breastfeeding on rates of breastfeeding, the few that assessed nutritional status fail to demonstrate any significant effect on child stunting. While overall complementary feeding strategies[15] for infants are associated with significant gains in child growth, education interventions alone were of benefit only in populations with sufficient means to procure appropriate food. In general, evidence for the effectiveness of complementary feeding strategies – although promising – is deemed insufficient.

Effective micronutrient interventions for pregnant women include supplementation with iron, calcium folate, and multiple micronutrients, although evidence of the latter remains scarce. While overall, iodised salt is the most cost-effective way to avert deficiency, in some regions in the world iodised oil supplementation during pregnancy can be a viable option. Bhutta et al. (2013) further conclude that vitamin A and zinc supplementation provide effective interventions in children in populations at risk of deficiency. Results from trials on vitamin A supplementation in mothers on the other hand were inconsistent and though iron supplementation in children was found to reduce the occurrence of anaemia, overall there was no benefit on growth. Moreover, iron supplementation in malaria endemic areas has even been associated with increased risk of serious illnesses (Sazawal et al., 2006).

While food fortification is generally considered as a safe and cost effective nutrition intervention and biofortification and home fortification with micronutrient powders offer interesting alternatives, evidence of benefits from developing countries is scarce. Bhutta et al. (2013) further point to the importance of identification of the right food, quality assurance and behaviour change communication in making fortification strategies a success.

4.6 Water, sanitation and hygiene (WASH) interventions

Despite methodological limitations in most studies (Clasen et al., 2010), there is compelling evidence that WASH interventions (Curtis and Cairncross, 2003; Fewtrell et al., 2005) can reduce the risk of diarrhoea. Moreover, several studies have documented the general relation between water and sanitation and child growth and the prevalence of stunting (e.g.; Fink et al., 2011; Merchant et al., 2003; Spears, 2013). There is however, little evidence on the direct impact of WASH interventions on nutrition outcomes. Zwane and Kremer (2007)

[15] Complementary feeding refers to the timely introduction of safe and nutritionally rich foods in addition to breast-feeding at about 6 months of age and typically provided from 6 to 23 months of age (Bhutta et al., 2013).

additionally note that while there is compelling evidence on the impact of the provision of piped water and sanitation, because of the higher cost, many poor countries instead focus on communal infrastructure provision, for which benefits are not yet well established.

Dangour et al. (2013) conduct a systematic review of the effects of WASH interventions on child nutritional status and conclude that the duration was relatively short and none of the included studies is of high methodological quality. The review also indicates that the literature might be suffering from a strong publication bias, as several published studies don't actually report the lack of impact on child nutrition status. Based on the results from five randomized control trials, the authors conduct a meta-analysis and find no evidence of an effect on weight-for-age or weight-for-height. The study further reveals a borderline statistically significant effect on height-for-age. Clasen et al. (2014) also find no effect on mean weight-for-age or height-for-age. The per-protocol analysis, only including the participants who actually completed suggest evidence for an increase in weight-for-age.

4.7 Integrated approaches

Development strategies aimed at improving food and nutrition security often include integrated multi-sectoral interventions. These evaluations however, only provide information on the combined effectiveness of different interventions and we therefore prefer to discuss these findings separately (see Table 8).

An integrated food security programme in Ethiopia for example included activities in irrigation and agricultural production as well as cash-for-work and food-for-work schemes. Using survey data from 2007, Abebaw et al. (2010) demonstrate that the programme has a positive and statistically significant effect on food calorie intake. The results indicate that land-rich households benefited comparatively more. The gain from the programme is also significantly larger for female-headed and smaller households.

Smith et al. (2013) report evidence from the *SHOUHARDO* project in Bangladesh that combines a myriad of food and nutrition security interventions including direct maternal and child health and nutrition interventions, interventions aimed at empowering women and the poor, improvements in water and sanitation, agricultural programmes, cash-for-work and food-for-work schemes and capacity and infrastructure building activities to prepare for and respond to disasters. The authors note that while there was no decreasing trend in stunting in rural Bangladesh as a whole over the evaluation period between 2006 and 2009, project

households saw a rapid and considerable reduction in the prevalence of stunting. The data further suggest that the average number of months per year in which households report having sufficient access to food and the share of respondents reporting to have had three meals a day most of the time in the last year saw a substantial increase, as did the average dietary diversity.

Banerjee et al. (2015) report evidence from six randomized control trials of an integrated approach to improve livelihoods among the very poor that included the transfer of a productive asset, consumption support, training and coaching, savings encouragement and health education and/or services. This multisite study was conducted between 2007 and 2014 in Ethiopia, Ghana, Honduras, India, Pakistan and Peru and therefore spans three continents and different cultures, market access and structures, religions, subsistence activities and overlap with government safety net programmes. The results from the pooled sample indicate a significant improvement on a self-reported food security index at the end of the two-year programme and even one year later. When looking at the distribution of outcomes, the authors further note that the impacts on food security occur only toward the bottom. Though the results are not driven by any one country, there is however, significant site-by-site variation. In particular, the effect on the food security index was not statistically significant in Ghana and Peru and didn't persist after the programme had ended in Honduras[16] and Pakistan.

[16] The authors note that the lack of any persistent effects in Honduras, could be explained by the fact that most households were given chickens and a large fraction of the chicken died due to illness (Banerjee et al., 2015).

5. Conclusion

After a decade of declining interest in interventions aimed at enhancing food security following the disappointing "green revolution" in Africa, combined with low food prices, declining food surpluses in donor countries and increasing focus on the health and education sector that offered more tangible results, the global food price crisis of 2007 and 2008 caused a dramatic turnaround. Today, food and nutrition security is at the top of the development agenda with commitments in this sector reaching 16.2 billion USD in 2013, most of which has been channelled to Sub-Saharan Africa.

To address concerns over food and nutrition security, donors concentrate to a large extent on investments in the agricultural sector, taking up more than half of the budget. This emphasis on agriculture is driven by the assumption that agricultural interventions can contribute to income growth and poverty reduction as well as increased food availability and improvements in the quality of food consumption. Though several studies document positive impacts on intermediary outcomes such as food production and income and there is promising evidence on the interaction with women empowerment, evidence on the direct impact of agriculture programmes on household or individual food and nutrition security is inconclusive.

In line with the increasing recognition that enhancing food and nutrition security requires multipronged policy strategies that combine immediate hunger relief with long-term sustainable actions addressing the underlying determinants, the role of availability oriented programmes covering the supply of in-kind food has shrunk. In addition, the cost-efficiency of in-kind food aid programmes is often questioned and the available empirical evidence points to modest short-term effects only. Well-targeted supplementary feeding interventions for young children however, appear to successfully improve child nutritional status. Evidence on increasingly popular food-for-work programmes is still scarce. Moreover, while food-for-education programmes are being implemented in many of the countries with the highest burden of malnutrition, evidence on this strategy's direct contribution to reducing undernutrition remains weak.

Interestingly, several randomized control trials comparing the in-kind and cash delivery of food and nutrition security assistance show that in general cash transfers may provide a more cost-effective means of improving food and nutrition security outcomes. However, in

those areas where markets are less accessible or functional, in-kind food assistance can still be more efficient.

In general, the evidence on the food and nutrition security impact of conditional and unconditional cash transfers remains somewhat mixed. While impact evaluations consistently point to increases in food expenditures and food and calorie consumption, few studies document improvements in diet quality and micronutrient status.

Aid for basic nutrition is gaining importance. Moreover, it is increasingly complemented by nutrition-sensitive interventions in other areas. It has to be noted however, that most of the (compelling) evidence on nutrition supplementation is derived from efficacy trials, rather than effectiveness studies in programme settings. Moreover, while food fortification is generally considered as a safe and cost effective nutrition intervention and biofortification and home fortification with micronutrient powders offer interesting alternatives, evidence of benefits from developing countries is scarce.

While donors have consistently invested a substantial part of their budget in WASH interventions and there is compelling evidence that these can reduce the risk of diarrhoea, evidence on the direct impact on food and nutrition security remains weak.

Finally, we note that development strategies aimed at improving food and nutrition security often include integrated multi-sectoral interventions. Though still scarce, evidence on the food and nutrition security impact of these integrated approaches appears to be promising.

In sum, our analysis reveals that the empirical evidence for the effectiveness of these interventions in improving beneficiaries' food and nutrition security – although in several cases promising – is surprisingly weak. In particular, the question whether different interventions improve the quality of food consumption and consequently nutrient intake and status, remains largely unanswered. Moreover, few studies assess longer-term effects and there exists relatively little rigorous evidence that compares different interventions.

This paper therefore strongly recommends to undertake additional research to improve the evidence base as this would allow researchers and policy makers to establish the type of approaches that improve food and nutrition security in the most efficient and cost-effective manner. Finally, in order to facilitate this process, there is a need for a clear and uniform definition of food and nutrition security assistance on the one hand as well as agreed upon, comprehensive indicators on the other hand.

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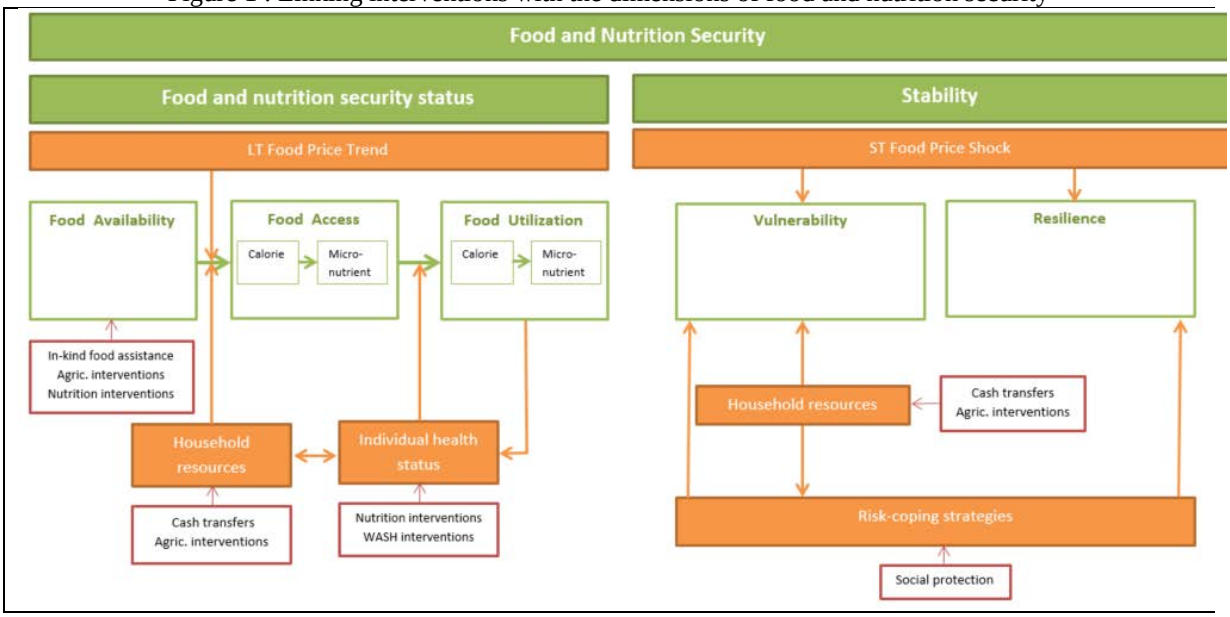
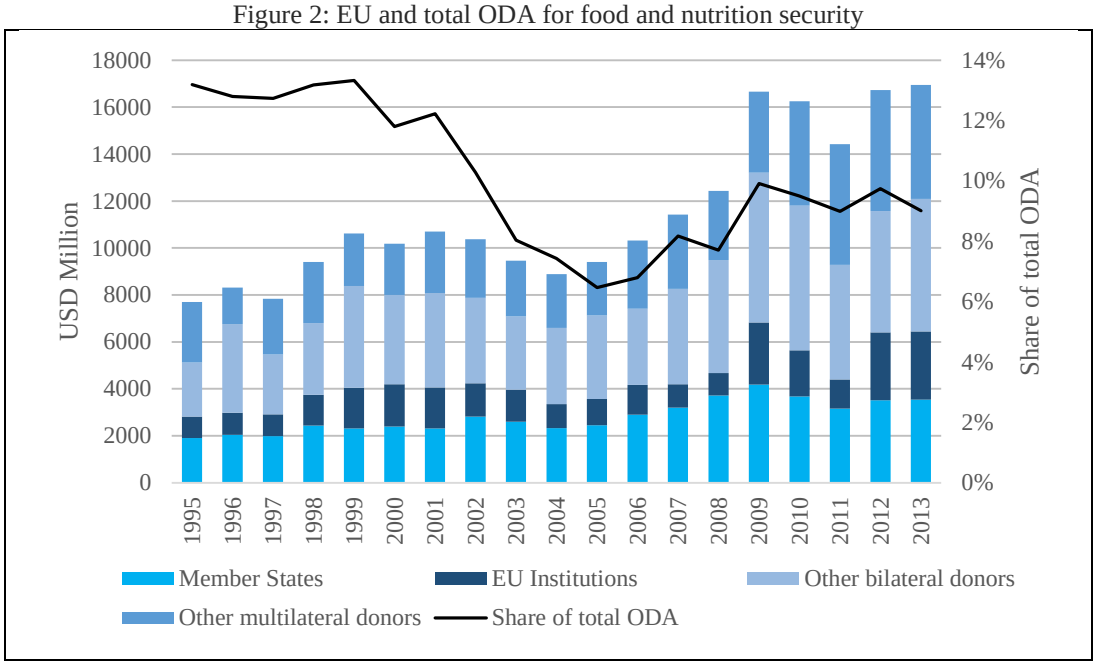
Figures

Figure 1 : Linking interventions with the dimensions of food and nutrition security



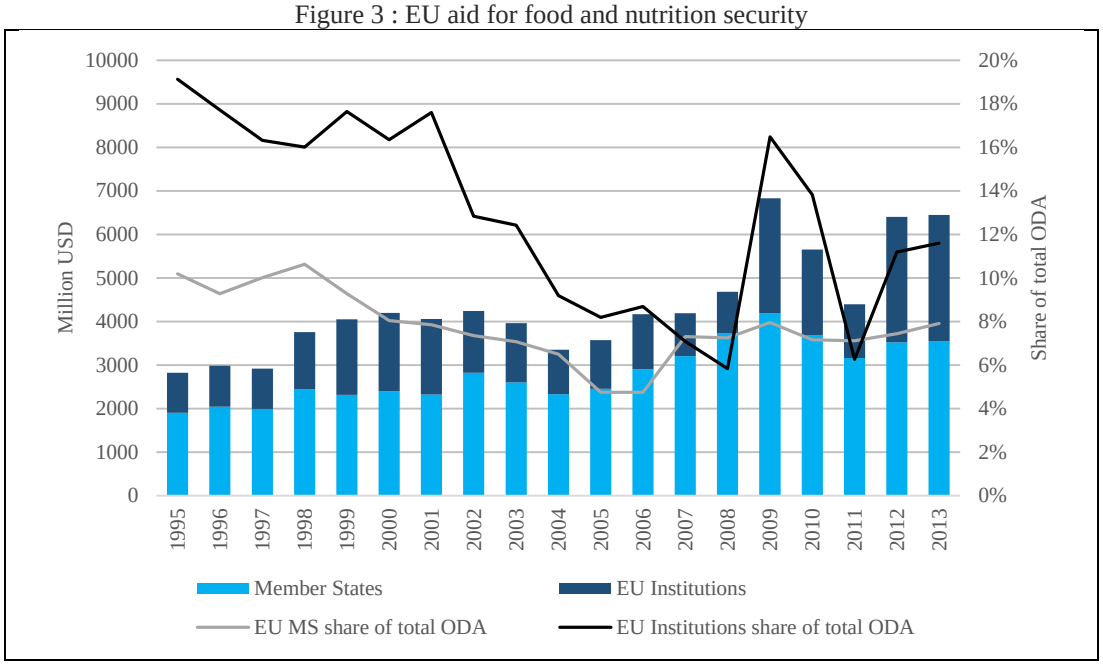
Adapted from Pieters et al. (2013)

Figure 2: EU and total ODA for food and nutrition security



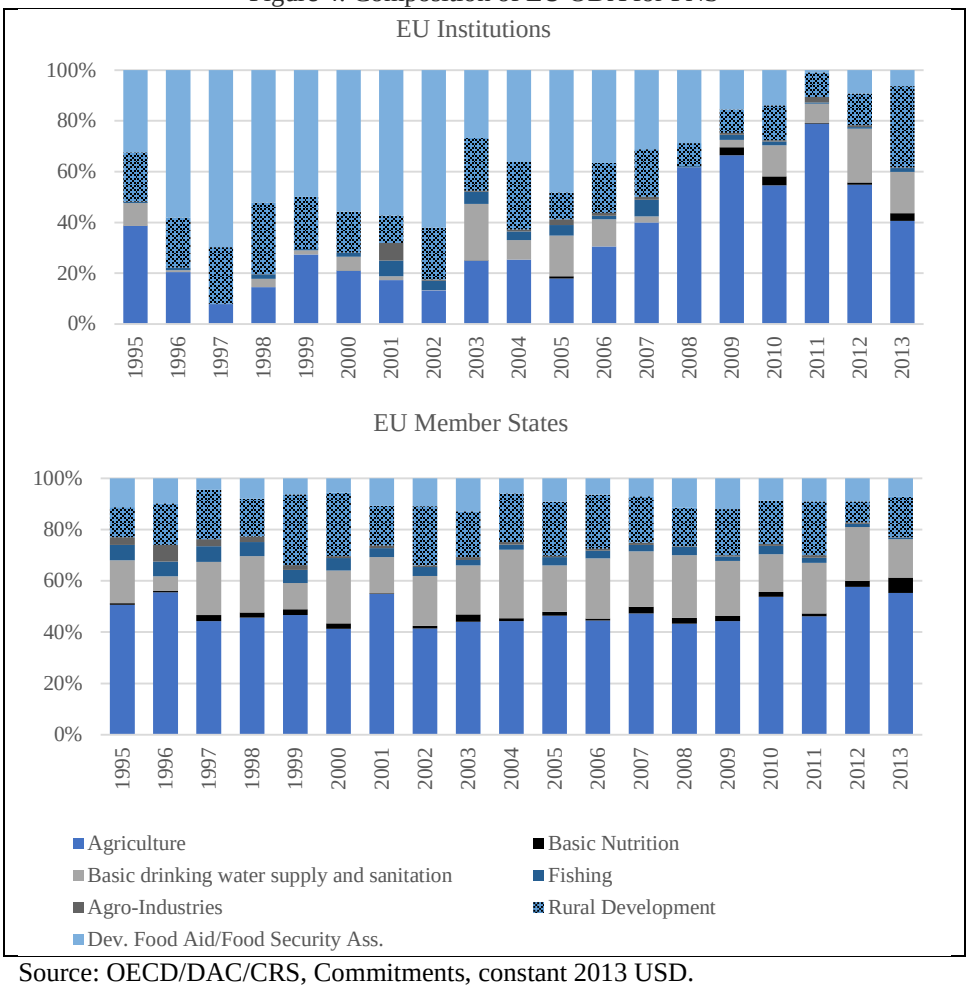
Source: OECD/DAC/CRS, Commitments, constant 2013 USD.

Figure 3 : EU aid for food and nutrition security



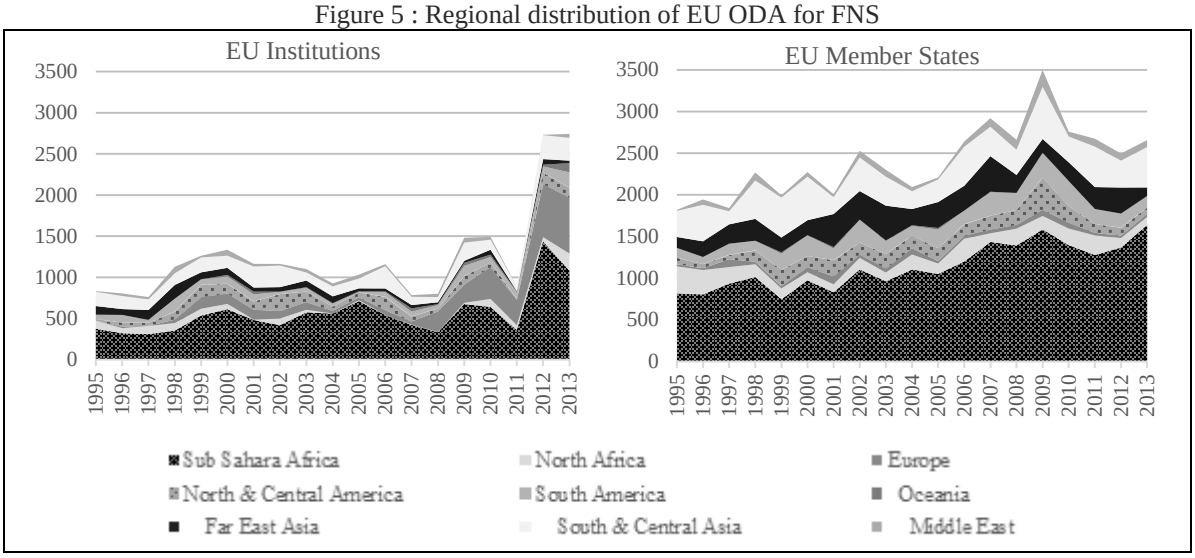
Source: OECD/DAC/CRS, Commitments, constant 2013 USD.

Figure 4: Composition of EU ODA for FNS



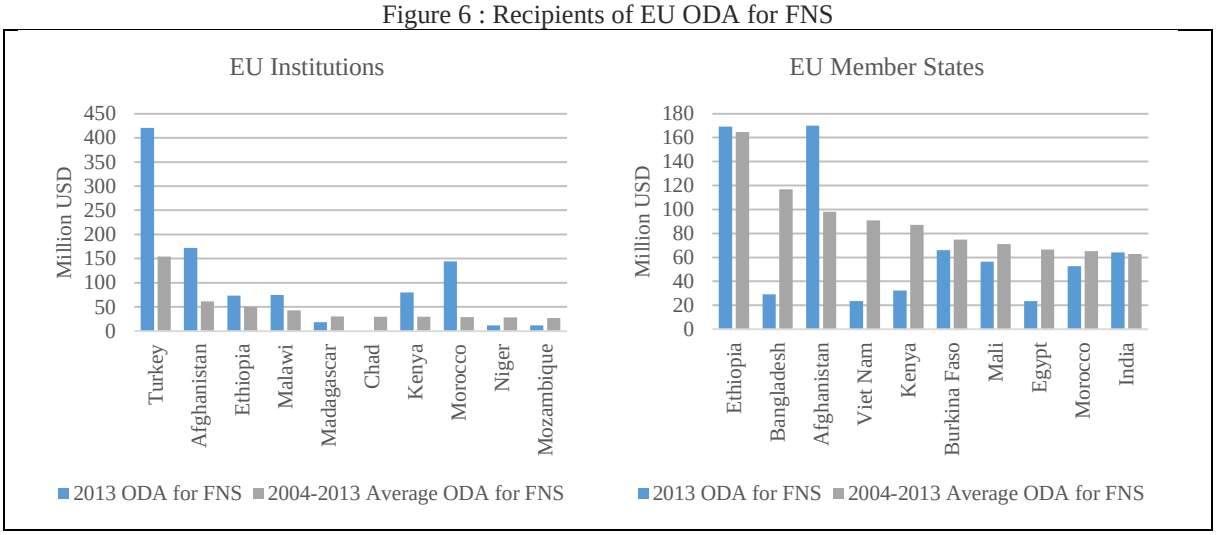
Source: OECD/DAC/CRS, Commitments, constant 2013 USD.

Figure 5 : Regional distribution of EU ODA for FNS



Source: OECD/DAC/CRS, Commitments, constant 2013 USD.

Figure 6 : Recipients of EU ODA for FNS



Source: OECD/DAC/CRS, Commitments, constant 2013 USD.

Tables

Table 1: Free distribution of food and Food-for-work

Study		Intervention(s)	Country	Time	Sample[a]	FNS outcome
Quisumbing (2003)		Food FFW	Ethiopia	1994-1997	±1500 households	Weight-for-height, height-for-age (children 0-9y)
Yamano et al. (2005)		Food	Ethiopia	1995-1996	2089 children (6-60m)	Growth in height
Gilligan, D. O., & Hoddinott, J. (2007)		Food FFW	Ethiopia	1999-2004	1327 households	Growth in food consumption per adult equivalent
Stifel, D., & Alderman, H. (2006)		Milk supplementation	Peru	1994-2000	(19053 obs.) children (<5y)	Height for age, weight-for-height, height-for-age
Ahmed et al. (2009)		Food Food + UCT FFW + CFW CFW	Bangladesh	2006	2000 households	Daily per capita food consumption
Broussard (2012)		Food	Ethiopia	1994-1995	292 households	BMI
Huybregts et al. (2012)	✓	Food Food + supplement	Chad	2010	1038 children (6-36 m)	Height-for-age
van der Veen and Tagel (2011)		Food-for-work	Ethiopia		90 households	Daily per capita food consumption

Notes: Randomized evaluation designs are marked with ✓.
FFW, UCT, CFW, m and y stand for food-for-work, unconditional cash transfers, cash-for-work, months and years respectively.
[a] Included in the data analysis.

Table 2: Food-for-education

Study		Intervention(s)	Country	Time	Sample[a]	FNS outcome
Jacoby (2002)		School meals	Philippines	1994-1995	3384 children (6-12y)[b]	Daily calorie consumption
Ahmed and Del Ninno (2002)		THR	Bangladesh	2000	600 households	Household food expenditure Calorie intake, height-for-age, weight-for-height
Ahmed (2004)		School snack	Bangladesh	2003	408 households	Daily energy intake, BMI
Afridi (2010)		School meals	India	2004	1096 primary school children[b]	Individual nutrient intake (calories, carbohydrates, proteins, calcium, iron)
Murphy et al. (2003)	✓	School snack	Kenya	1998-2000	492 primary school children	Energy, protein, fat, iron, zinc, vitamin B12 and riboflavin intake
Siekmann et al. (2003)	✓	School snack	Kenya	1998-2000	555 children (5-14y)	Height-for-age, weight-for-height, micronutrient status (haemoglobin, plasma ferritin, serum iron, serum zinc, serum copper, plasma vitamin B-12, plasma folate, plasma retinol, RBC riboflavin)
Grillenberger et al. (2003)	✓	School snack	Kenya	1998-2000	554 primary school children	Weight, mid-upper-arm circumference, triceps skinfold thickness, subscapular skinfold thickness, height
Neumann et al. (2007)		School snack	Kenya		900 children (6-14y)	Weight, mid-upper arm circumference, height
Kazianga et al. (2009)		School meals THR	Burkina Faso	2006-2007	4140 children (6-15y)	Weight-for-age, weight-for-height, BMI (<5y) Haemoglobin levels

Notes: Randomized evaluation designs are marked with ✓.
THR, m and y stand for take-home rations, months and years respectively.
[a] Included in the data analysis.
[b] At baseline.

Table 3: Cash transfers

Study		Intervention	Country	Time	Sample[a]	FNS outcome
Hoddinott and Skoufias (2004)	✓	CCT + supplement	Mexico	1998-1999	±24000 households	Daily per capita caloric availability
Rivera et al. (2004)	✓	CCT + supplement	Mexico	1998-1999	650 children (<=12m)[b]	Height-for-age, weight-for-age, weight-for-height, haemoglobin levels
Gertler, P. (2004)	✓	CCT + supplement	Mexico	1998-2000	1552 children (12-36 m) 2010 children (12-48 m)	Height for age Haemoglobin
Behrman and Hoddinott (2005)	✓	CCT + supplement	Mexico	1998-1999	601 children (4-48m)[b]	Height, height-for-age
Fernald et al. (2008a)	✓	CCT + supplement	Mexico	1997-2003	2449 children (24–68m)[c]	Height-for-age, BMI, prevalence of stunting and being overweight
Fernald et al. (2008b)	✓	CCT + supplement	Mexico	1997-2003	3688 adults (18-65y)	BMI
Leroy et al. (2008)	✓	CCT + supplement	Mexico	2002-2004	432 children (<24 m)[b]	Length, height-for-age, weight gain, weight-for-height
Fernald et al. (2009)	✓	CCT + supplement	Mexico	1998-2007	1793 children (8-10y)[c]	Height-for-age, BMI
Todd et al. (2010)		CCT + supplement	Mexico	1997-1999	9936 households	Food consumption from own production, diet diversity
Attanasio et al. (2005)		CCT	Colombia	2001-2002		Height-for-age, weight of new-borns
Attanasio and Mesnard (2006)		CCT	Colombia	2001-2002	±11500 households	Food consumption
Forde et al. (2012)		CCT	Colombia	2002-2006	2073 mothers (>18 y)[c]	BMI
Morris et al. (2004)		CCT	Brazil	2001-2002	1889 children (<7y)	Weight-for-age, weight gain, height-for-age
de Oliveira et al. (2007)		CCT	Brazil	2005	15240 households	Food expenditures
de Bem Lignani et al. (2010)	✓	CCT	Brazil	2007	5000 households	Food consumption
Maluccio & Flores (2005)	✓	CCT	Nicaragua	2000-2002	1359 households[b]	Food expenditures Height, weight, haemoglobin (for children < 5)
Maluccio (2010)	✓	CCT	Nicaragua	2000-2004	1581 households[b]	Food expenditure
Paxson & Schady (2010)	✓	UCT	Ecuador	2003-2006	5547 children (0-6y)[b]	Height-for-age, haemoglobin
Fernald & Hidrobo (2011)	✓	UCT	Ecuador	2003-2006	1196 children (12-35m)[c]	Height-for-age, haemoglobin, food index[*]
Soares (2008)	✓	CCT	Paraguay	2007	1401 households	Food expenditures
Hoddinott (2010)	✓	CCT + supplement	Mexico	1998-1999	24077 households[b]	Height for-age, weight-for-age, weight
	✓	CCT	Nicaragua	2000-2002	1581 households[b]	Height for-age, underweight
	✓	CCT	Honduras	2000-2002	5408 households[b]	Height for-age, weight-for-age
		CCT	Brazil	2003	1666 households[b]	weight
Dasso and Fernandez (2014)		CCT	Peru	2009-2010	3772 households [b]	Food expenditure
Duflo (2000)		UCT	South Africa	1993	3482 children (6-60m)	Height-for-age
Agüero et al. (2007)		UCT	South Africa	1993-2004		Height-for-age
Coetzee (2013)		UCT	South Africa	2008	7305 households and 9336 children(<14y)	Monthly food expenditure, height-for-age
Miller et al. (2010)	✓	UCT	Malawi	2007-2008	766 households	Height-for-age, weight-for-age, weight-for-height
Miller et al. (2011)	✓	UCT	Malawi	2007-2008	819 households[b]	Food expenditure, food consumption, dietary diversity
Himaz, (2008)		Vouchers	Sri Lanka	1999-2000	821 children (6-60m)	Weight-for-age, height-for-age
Merttens et al. (2013)	✓	UCT	Kenya	2009-2012	5108 households[b]	Food expenditures, dietary diversity, whether any household members went entire days without eating solid foods, height-for-age, weight-for-age weight-for-height
Pellerano et al. (2014)	✓	UCT	Lesotho	2011-2013	2150 households	Food expenditures, dietary diversity, food consumption score, self-reported food shortages
Seidenfeld et al. (2014)	✓	UCT	Zambia	2010-2013	2298 households	Food consumption
Ferré and Sharif (2014)	✓	CCT	Bangladesh	2012-2013	2718 households	Food consumption, height-for-age, weight-for-height and weight-for-age, dietary diversity

Notes: Randomized evaluation designs are marked with ✓.
CCT, UCT and m and y stand for conditional cash transfers, unconditional cash transfers and months and years respectively.
[*] The index is based on Principal Components Analysis including indicators for whether a child ate any of a list of 11 food items in the last week.
[a] Included in the data analysis.
[b] At baseline.
[c] At follow-up.

Table 4: Cash-for-work

Study	RCT	Intervention(s)	Country	Time	Sample[a]	FNS outcome
Gilligan et al. (2009)		Cash-for-work (+Agricultural support)	Ethiopia	2006	3700 households	Daily per capita caloric acquisition, change in months of self-reported food security, number of children's meals per day
Ahmed et al. (2009)		Cash-for-work	Bangladesh	2006	2000 households	Daily per capita food consumption
Mascie-Taylor et al. (2010)		Cash-for-work	Bangladesh	2007	1816 households	Height, weight, BMI, midupper arm circumference (for women and children <5y)
Deiniger and Liu		Cash-for-work	India	2004-2008	±4000 households	Energy intake, protein intake
Osei-Akoto et al. (2014)	✓	Cash-for-work	Ghana	2012-2013	2596 households	Food expenditures
Ravi and Engler (2015)		Cash-for-work	India	2007-2009	1064 households[b]	Monthly food expenditures, number of meals foregone

Notes: Randomized evaluation designs are marked with ✓.
m and y stand for months and years respectively.
[a] Included in the data analysis.
[b] At baseline.

Table 5: In-kind vs. Cash

Study	RCT	Intervention(s)	Country	Time	Sample[a]	FNS outcome
Leroy et al. (2010)	✓	Cash transfer Food	Mexico	2003-2005	5823 households[b]	Energy and nutrient (carbohydrates, proteins, fat, fibre, iron, zinc, vitamin A, vitamin C)consumption per day per adult equivalent
Skoufias (2013)	✓	Cash transfer Food aid	Mexico	2003-2005	5851 households	Per capita food consumption
Cunha (2014)	✓	Cash transfer Food	Mexico	2003-2005	6706 households[b]	Household food expenditure, Individual caloric and micronutrient intake height, weight, haemoglobin (women and children)
Hidrobo et al. (2014)	✓	Cash transfer Food Food voucher	Ecuador	2011	2357 households[b]	Household food consumption, caloric intake, diet diversity
Gilligan et al. (2014)	✓	Cash transfer Food voucher	Ecuador	2011	2357 households[b]	Household food consumption (starches and tubers; fruits and vegetables; meat, seafood, eggs; pulses, legumes, nuts; dairy; oils and fats; and other)
	✓	Cash transfer Food	Uganda	2011-2012	2568 households[b]	
	✓	Cash transfer Food	Yemen	2011-2012	1581 households[b]	
Aker (2013)	✓	Cash transfer Vouchers	DRC	2011-2012	252 households	Household food expenditure, diet diversity
Hoddinott et al. (2014)	✓	Cash transfer Food	Niger	2011	2209 households	Dietary Diversity Index[*], Food Consumption score[**]

Notes: Randomized evaluation designs are marked with ✓.
m and y stand for months and years respectively.
[*] The DDI is calculated by summing the number of distinct food categories consumed by the household in the previous seven days.
[**] The FCS is calculated by summing the number of days each food group was consumed and multiplying those frequencies by a predetermined set of weights designed to reflect the heterogeneous dietary quality.
[a] Included in the data analysis.
[b] At baseline.

Table 6: Reviews of agricultural interventions

Review	Interventions	Outcome	Period	#	Evidence base	Impact
Ruel (2001)	Home gardening	Vitamin A and iron intake and status	1995-1999	14	Poor evaluation designs prevent conclusions	Evidence of impact on micronutrient status is scant
Berti et al. (2004)	Home gardening, livestock, mixed garden and livestock, cash cropping, and irrigation	Nutritional status	1985-2001	30	Unsuitable study designs Potential Hawthorne effect	Mixed results Nutrition education is of central importance
World Bank (2007)	Programmes involving staples (agricultural commercialization)	Household-level food consumption, individual food and nutrient intake, nutrient status	1985-2007	8		Fairly consistent positive impacts on food expenditures, but no substantial impacts on child nutritional status
	Programmes involving fruits and vegetables (homestead gardening)	Household-level food consumption, individual food and nutrient intake, nutrient status	1985-2007	26		homestead gardening projects were successful if they incorporated human capital–related components
	Programmes involving animal source foods.	Household-level food consumption, individual food and nutrient intake, nutrient status	1985-2007	19		Impacts on dietary intake and nutritional status showed mixed results
Arimond et al. (2011)	Agr. commercialization, women in agriculture, horticultural interventions, livestock and aquaculture interventions.	Food expenditures, dietary energy intakes, child nutritional status	1987-2003	39	Many of the studies were weakly designed	Behaviour change communication strategies must be included to ensure that increased income and access to translate into nutrition improvements.
Girard et al. (2012)	Interventions to increase household food production	nutrition and health outcomes of women and young children	1990-2011	17	Limited number of highly heterogeneous, quasi-experimental studies, most of which have significant methodological limitations.	Significantly improved diet patterns and vitamin A intakes. Mixed results for effects on stunting and wasting. Findings for an effect on vitamin A status, anaemia and morbidity were inconsistent.
Masset et al. (2012)	Bio-fortification, home gardens, small scale fisheries and aquaculture, dairy development, and animal husbandry and poultry development	Dietary diversity, micronutrient intake and prevalence of under-nutrition	1990-2011	23	Methodological weaknesses of the studies cast serious doubts on the validity of these results.	Improved consumption of food rich in protein and micronutrients Effect on the overall diet remains unclear Little evidence of a positive effect on the prevalence of stunting, wasting, and underweight among children
Webb and Kennedy (2014)	*Metareview*			10	Weaknesses in study design and survey methods are all too common, leading to weak results and limited generalizability	Empirical evidence for plausible and significant impacts of agricultural interventions on nutrition outcomes remains disappointingly scarce. Absence of evidence should not be equated with evidence of no impact.
Stewart et al. 2014	Smallholder agriculture (Africa)	Food security and nutrition		55	There is a need for future systematic reviews which assess the impacts of interventions on food security	
Korth et al. (2014)	Urban agriculture	Calorie and micronutrient intake, income, food expenditures	-2013		No studies met the review's inclusion criteria	

Table 7: Technology adoption

Study		Intervention(s)	Country	Time	Sample[a]	FNS outcome
Low et al. (2007a)		integrated package of agriculture, nutrition, and market interventions focused on introduction and promotion of OFSP	Mozambique	2003-2004	741 children (<3y)	Vitamin A intake, diet diversity
Low et al.(2007b)		integrated package of agriculture, nutrition, and market interventions focused on introduction and promotion of OFSP	Mozambique	2003-2004	741 children (<3y)	Serum retinol concentration
Hotz et al. (2012)	✓	integrated package of agriculture, nutrition, and market interventions focused on introduction and promotion of OFSP	Uganda	2006-2009	264 children (6-35 m) 544 children (3–5 y) 539 women	Height-for-age, weight-for-age, energy and nutrient intakes Height-for-age, weight-for-age, serum retinol, energy and nutrient intakes Serum retinol, energy and nutrient intakes
Larsen and Lilleør (2014)		Farmer Field School	Tanzania	2006-2012	1706 households	Self-reported hunger, number of meals per day, consumption of eggs, dairy products or meat over the last week

Notes: Randomized evaluation designs are marked with ✓.
m and y stand for months and years respectively.
[a] Included in the data analysis.

Table 8: Integrated approaches

Study		Interventions	Country	Time	Sample[a]	FNS outcome
Abebaw et al. (2010)	✓	CFW + FFW + Agricultural interventions	Ethiopia	2007	184 households	Calorie intake
Smith et al. (2013)		Health and nutrition interventions + Women empowerment + WASH interventions + Agricultural interventions + CFW + FFW + Disaster preparedness	Bangladesh	2006-2009	3200 households (with children 6-24m)[b]	Prevalence of stunting, self-reported food security, number of meals, diet diversity
Banerjee et al. (2015)	✓	Asset transfer + training and coaching + savings encouragement + UCT + health education and/or services	Ethiopia	2010-2011	925 households	Self-reported food security index
			Ghana	2011-2012	2606 households	
			Honduras	2009-2010	2403 households	
			India	2007-2008	978 households	
			Pakistan	2008-2010	1299 households	
			Peru	2011-2012	2284 households	

Notes: Randomized evaluation designs are marked with ✓.
m and y stand for months and years respectively.
[a] Included in the data analysis.
[b] At baseline.

FOODSECURE
FOR POLICIES THAT MATTER

The FOODSECURE project in a nutshell

Title	FOODSECURE – Exploring the future of global food and nutrition security
Funding scheme	7th framework program, theme Socioeconomic sciences and the humanities
Type of project	Large-scale collaborative research project
Project Coordinator	Hans van Meijl (LEI Wageningen UR)
Scientific Coordinator	Joachim von Braun (ZEF, Center for Development Research, University of Bonn)
Duration	2012 - 2017 (60 months)

Short description

In the future, excessively high food prices may frequently reoccur, with severe impact on the poor and vulnerable. Given the long lead time of the social and technological solutions for a more stable food system, a long-term policy framework on global food and nutrition security is urgently needed.

The general objective of the FOODSECURE project is to design effective and sustainable strategies for assessing and addressing the challenges of food and nutrition security.

FOODSECURE provides a set of analytical instruments to experiment, analyse, and coordinate the effects of short and long term policies related to achieving food security.

FOODSECURE impact lies in the knowledge base to support EU policy makers and other stakeholders in the design of consistent, coherent, long-term policy strategies for improving food and nutrition security.

EU Contribution	€ 8 million
Research team	19 partners from 13 countries

FOODSECURE project office
LEI Wageningen UR (University & Research centre)
Alexanderveld 5
The Hague, Netherlands

T +31 (0) 70 3358370
F +31 (0) 70 3358196
E foodsecure@wur.nl
I www.foodsecure.eu

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