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The U.S. Government's Global Hunger & Food Security Initiative

FEED THE FUTURE INNOVATION LABORATORY FOR SMALL SCALE IRRIGATION (FTF-ILSSI) PROJECT NOTES

III. Exploring Small Scale Irrigation-Nutrition Linkages

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The evidence on the potential for agricultural interventions to contribute to improved nutrition has grown considerably over the past decade (Ruel et al., 2018). Numerous studies have explored both positive and negative effects of agriculture on nutrition and health (Ruel and Alderman, 2013; Herforth and Harris, 2014; Masset et al., 2012; Hoddinott, 2012). However, as an important and growing component of agriculture, small-scale irrigation has not yet been given the attention it deserves. The Innovation Laboratory for Small Scale Irrigation (ILSSI) set out, among others, to fill the evidence gap on irrigation-nutrition linkages.

Domènech (2015) describes several potential pathways through which irrigation can influence food security, nutrition, and health outcomes, including 1) a production pathway, 2) an income pathway, 3) a water supply pathway, and 4) a women's empowerment pathway. To illustrate these pathways, we adapted the agriculture-nutrition framework of Herforth and Harris (2014) to include irrigation (Figure 1), while also noting a fifth, negative pathway that links irrigation to water pollution and disease via the application of fertilizers and pesticides and via supporting vector-borne diseases, such as malaria or schistosomiasis, respectively (Passarelli et al., 2018).

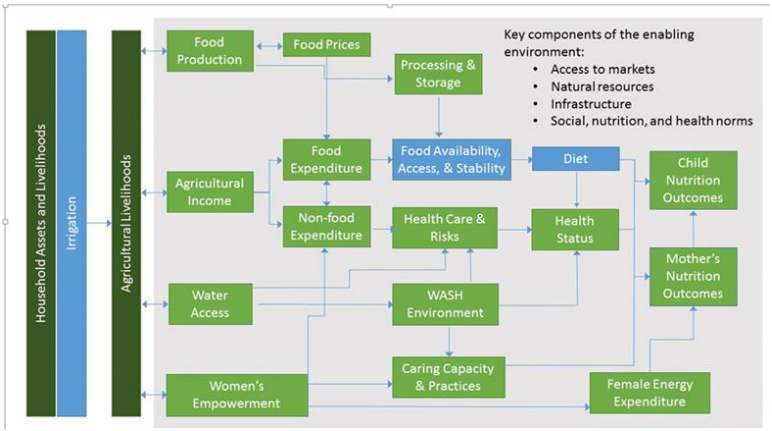

Figure 1: Irrigation-Nutrition Linkages (Source: Passarelli et al., 2018)

EXISTING EVIDENCE ON THE FOUR MAIN PATHWAYS

The ***production pathway*** describes how irrigation supports increased agricultural productivity, grows the share of more nutrient-rich crops, such as fruits and vegetables, and extends the production calendar into the lean season, all of which can contribute to improved food security, dietary diversity, and nutritional status. (Passarelli et al., 2018, Alaofè et al., 2016, Namara et al., 2011, Burney et al., 2010, Dillon et al., 2008).

The ***income pathway*** postulates that irrigation can grow income from market sales of crops grown with irrigation as well as irrigation-related employment (Alaofe et al 2016, Burney and Naylor 2012, Namara et al 2011).

Irrigation can also improve the ***water supply, sanitation, and hygiene (WASH)*** environment by providing water for multiple uses, but this requires that systems are designed to meet the needs of both agricultural production and domestic uses (Boelee et al., 2007).

Irrigation is also a potential entry point for ***women's empowerment*** through increased asset ownership, the transfer of time spent on water collection to other income-generating activities, due to reduced time use in agriculture (particularly for motorized irrigation technologies) and potentially increased control over resources from selling crops produced on women's plots (Burney et al., 2010; Iannotti et al., 2009; Olney et al., 2009).

But irrigation also needs to be designed, developed and managed to reduce potentially adverse impacts on nutrition and health. This includes more judicious fertilizer and pesticide applications and control of vector- and water-borne diseases (Kibret et al., 2014, Passarelli et al., 2018).

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NEW ILSSI FINDINGS

From 2014 to 2018, ILSSI conducted research on potential irrigation-nutrition linkages in Ethiopia, Tanzania and Ghana through implementing and analyzing panel intra-household datasets.

Findings from Ethiopia, Tanzania, Ghana show that irrigators had higher household dietary diversity scores (HDDS), a proxy measure of a household's food access, compared to non-irrigators (Mekonnen et al. 2019a for Ethiopia and Tanzania). Moreover, income from self-employment was associated with HDDS. As the households interviewed all depend on agriculture as their main livelihood, this finding makes sense, as we expect the additional income to increase households' ability to purchase and access more foods; and reflects both the income and production pathways discussed above. Mekonnen et al. (2021) also find that irrigators in Ethiopia had higher food and non-food expenditures than non-irrigators.

Moreover, irrigation has positive effects on the consumption of different food groups. In Ethiopia, irrigators consumed more vegetables, oils and fats, and flesh meats. In Tanzania, irrigators consumed more vitamin-A rich vegetables and fruits, fish and condiments (Mekonnen et al. 2019a). In Ghana, irrigators consumed more animal sourced foods, fruits and vegetables, and sweets. Although consumption of micronutrient-rich foods like vegetables, dairy, and eggs is positive for nutritional status, it is important to also consider the implications of the overall increased consumption of sweets. All three countries have seen a rise in the double burden of malnutrition, and consumption trends include increased intake of unhealthy processed foods.

The source of foods consumed is also important in understanding the effect of irrigation on nutrition. Food is generally obtained from three sources: own production, purchased from markets, or given by family members or friends in the form of gifts. Results from Ghana show that often several pathways are at play. In irrigated households, there was a substitution effect in the sources of consumption from market to own-production for vegetables, as well as meats and poultry, and from own-production to market for honey, compared to non-irrigators. Irrigators are also more likely to consume milk and milk products as well as fruits compared to non-irrigators. This suggests that irrigation facilitates access to a more diverse diet through a combination of increased own production and purchase from markets (Mekonnen et al., 2019b).

In a study focusing on women's nutrition in northern Ethiopia, Baye et al. (2021) find that women in irrigating households were more likely to meet the Minimum Dietary Diversity for Women (M-DDW) than women from rainfed households. No cases of malaria were found. Given these strong linkages between irrigation and food security and nutrition outcomes, irrigation interventions can be promoted as nutrition-sensitive agricultural intervention, in addition to their potential for higher income and yield. When coupled with additional nutrition interventions, such as behavior change communication or promotion of nutritious irrigated crops, the nutrition benefits of irrigation may increase even further.

THE BIGGER PICTURE

This new evidence on the irrigation-nutrition pathways is encouraging. However, it is important to note that these pathways rely on complementary infrastructure and services, and that potential environmental challenges need to be addressed for irrigation to have lasting impacts on nutrition.

For example, access to markets (income and proximity) is crucial for both the production and income pathways to have an effect. Evidence from Northern Ghana shows that proximity to markets changes the way productivity and production diversity affect dietary diversity. Production diversity has a stronger effect on dietary diversity the farther away the market is, suggesting the importance of production diversity in settings with limited access to markets (Signorelli et al., 2017).

Moreover, higher income is not necessarily spent on more diverse foods. Research shows that who controls income has implication for spending decisions. Also, if women devote additional time to work-related activities that would interfere with breastfeeding, the timely provision of complementary foods, or other childcare responsibilities, this may have negative impacts on infant and young child feeding. At the same time, to the extent that irrigation reduces women's time use in agricultural activities, additional nutrition benefits could be obtained (van den Bold et al., 2013).

Further research into irrigation-nutrition pathways should incorporate aspects of the local context, including market access and conditions, gender roles and preferences, water supply and environmental considerations, and appropriateness of technologies. Moreover, more insights are needed on factors that influence household decisions on food expenditures in different contexts to identify entry points for improving food choices of agricultural households. A recent guidance by Bryan et al. (2019) summarizes entry points to strengthen nutrition through irrigation and water resources management and also includes indicators to monitor change in nutrition outcomes over time.

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