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Nutrition indicators in agriculture projects: Current measurement, priorities, and gaps

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ABSTRACT

How agriculture can improve human nutrition is a topic of debate. Recent reviews demonstrate little impact on nutritional status but do not critically examine the choice of appropriate outcome indicators. This paper reviews which nutrition impact indicators are currently used in agriculture-nutrition projects, and highlights priorities and gaps in measurement. Many project evaluations are statistically underpowered to observe impact on nutritional status, but appear to be powered to observe impacts on food consumption and dietary quality, which we conclude are an appropriate level of impact of agriculture-nutrition projects. To improve the evidence base, there is a need to develop indicators of outcomes that are not being fully measured, including dietary quality and food security, women's empowerment, health environments, and food environments.

1. Introduction

How agriculture contributes to improving nutrition of populations and vulnerable sub-groups is a topic of debate. Recent literature reviews, summarized in a review by Webb and Kennedy (2014), point to a lack of empirical evidence on nutritional status outcomes from agriculture, primarily due to methodological deficiencies in study design (Webb and Kennedy, 2014; Ruel and Alderman, 2013; Masset et al., 2011; Webb Girard et al., 2012). These reviews have focused on nutritional status indicators to measure impact, but the choice and appropriateness of outcome indicators have received less attention. Masset et al. (2011) found nutritional status outcomes to be insensitive to change: due to inadequate statistical power, none of the studies included in their review could have detected a small improvement in the prevalence of undernutrition (defined as a 2% reduction in stunting or underweight), and only half could have detected a large improvement (30% reduction).

In 2012, the Leverhulme Centre for Integrative Research on Agriculture and Health (LCIRAH) conducted a mapping study of current and planned research on agriculture for improved nutrition (hereafter called "agriculture-nutrition" projects) (Hawkes et al., 2012; Turner et al., 2013). One gap identified by the researchers was measurement of the full pathway of change from agricultural inputs and practices to nutrition outcomes in current research. Numerous conceptual frameworks have been elaborated to describe the pathways through which agriculture can improve nutrition outcomes (Hawkes et al., 2012; Turner et al., 2013; Webb, 2013; Herforth et al., 2012; Gillespie et al., 2012; Kennedy and Bouis, 1993). These frameworks share the common theme that agriculture can affect each of the underlying determinants of nutrition: access to adequate food (food security), care practices, health services and adequate health environments (UNICEF, 1990). Fig. 1 illustrates these pathways:

- **food access** through improved access to nutritious foods on-farm; increased availability and lower prices of diverse nutritious foods in markets; and income which can be spent on more diverse nutritious food *if* such food is available, affordable, and convenient.
- **care practices** through empowerment of women (particularly if they can control income, their time and labor), and through incorporating behavior change communication.
- **health environments** through management practices that protect natural resources (water in particular), and safeguard against health risks introduced by agricultural production (e.g. livestock, standing water, agrochemicals). Agricultural income can also affect health care access *if* health care is available, affordable, and convenient.

Prompted by the gap in understanding the range and appropriateness of indicators being used to measure agriculture-

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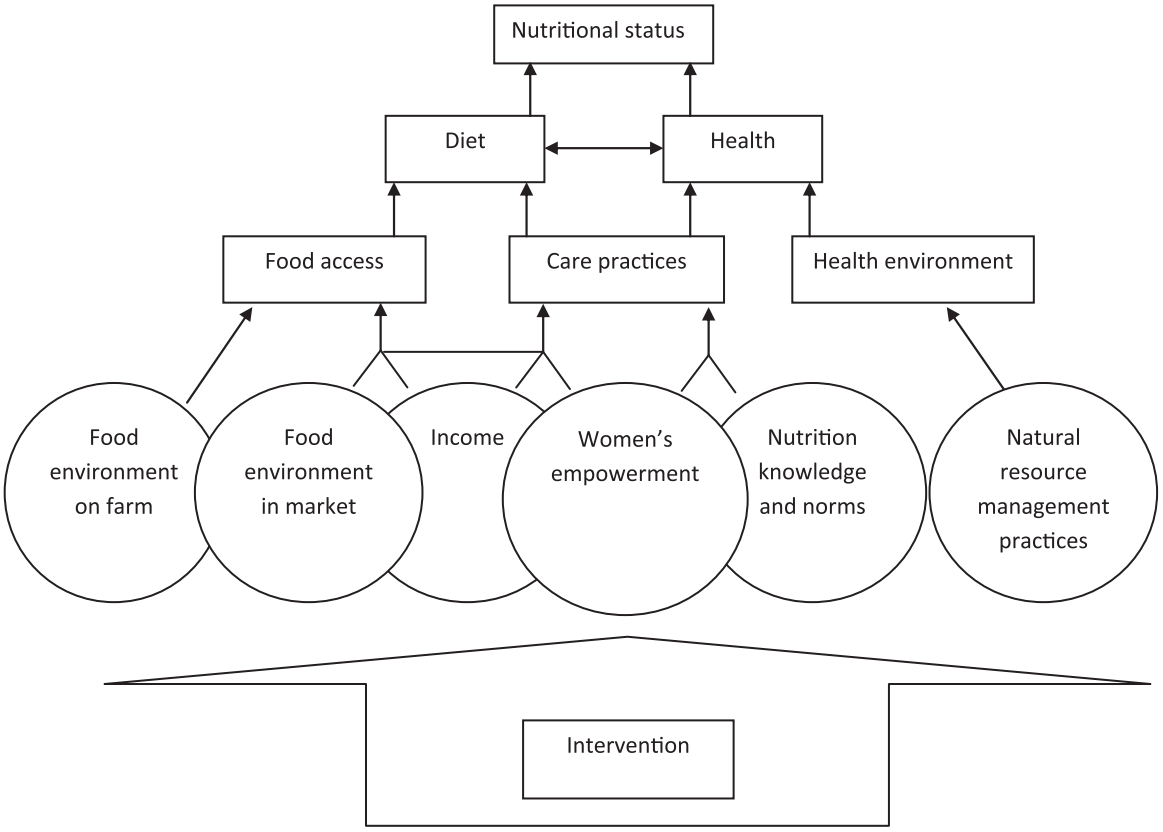

Fig. 1. Conceptual framework for nutrition interventions in agriculture. Source: Authors.

nutrition intervention outcomes, our aim is to review which indicators are currently being selected, in order to understand better how to strengthen the evidence base and to recommend what indicators should be used or need to be developed. We discuss how current measurement has advanced compared to previous literature, and what we can expect to learn from current agriculture-nutrition research based on indicators selected and power calculations. We use this information on current research as the basis for a broader discussion and recommendations around how nutrition measurement in agriculture projects can be strengthened.

2. Methods

In order to review the status of nutrition measurement in agriculture-nutrition research, we conducted a survey of investigators currently researching the links between agriculture projects and nutrition outcomes. Because a mapping study had recently been done of current research projects exploring the links between agriculture and nutrition, we drew our sample from the 151 studies that had been identified in that study (Hawkes et al., 2012; Turner et al., 2013). We included only those that explicitly listed nutrition improvement as an objective and that engaged in field research, and excluded secondary data analyses, formative research, unspecified research activities, and unfunded projects. Seventy-three intervention-based studies met the criteria. Principal investigators of the 73 eligible projects were surveyed on use of indicators relevant to nutrition outcomes via an online questionnaire using SurveyMonkey® (Supplementary materials 1). The survey questions were designed to reflect the pathways of how agriculture can affect nutrition. Respondents were asked to describe their project's nutrition-relevant goals and how project activities would be expected to affect nutrition. They were asked to identify the indicators used in their projects in the categories of: nutritional status, diet and food consumption, food security or food access, economic outcomes, women's labor or empowerment, nutrition knowledge or behaviors, natural resource management or environmental safeguards, and "other." Respondents were also asked if their projects linked with health, water and sanitation, or social protection activities. Information was gathered on study design, including target population of projects and survey sample sizes, use of a comparison group, timing of surveys (baseline, midline, endline, other), if they were employed at the same time of year and if any related qualitative data were collected.

The survey was personally sent by e-mail to project principal investigators. Non-responders were followed up twice. Data were downloaded, cleaned, and coded, and frequencies were calculated using IBM SPSS software (IBM Corp, 2011).

To investigate the statistical power needed for detecting improvements in two distinct nutrition outcomes (reducing stunting and improved dietary quality), we estimated sample sizes that would be needed to have 80% probability of observing improvements in stunting and dietary diversity of young children at a significance level of 0.05, using an on-line sample size calculator (Rollin Brant's Sample Size Calculators, 2016). Sufficient sample size to statistically detect changes in impact indicators in an intervention population over time is an essential component of a rigorous evaluation design. In order to attribute observed changes to the intervention itself, the same outcomes need to be measured in a comparison population, that is comparable but that does not participate in the intervention. Our power calculations estimate sample sizes needed for each group (i.e. the intervention and the comparison group). Because most intervention studies cannot randomize participation in the intervention, alternative sampling designs to select a survey sample are often employed, such as