



Women's agricultural work and nutrition in South Asia: From pathways to a cross-disciplinary, grounded analytical framework



Nitya Rao^{a,*}, Haris Gazdar^b, Devanshi Chanchani^a, Marium Ibrahim^b

^a School of International Development, University of East Anglia, Norwich NR4 7TJ, United Kingdom

^b Collective for Social Science Research, 173-I, Block 2, PECHS, Karachi 75400, Pakistan

ARTICLE INFO

Keywords:
Nutrition
Agriculture
Gender
South Asia

ABSTRACT

In this systematic review, we aim to examine the impact of women's work in agriculture on maternal and child nutrition in South Asia. Building on previous reviews supported under the Leveraging Agriculture for Nutrition in South Asia (LANSA) consortium, and recent published literature, we include findings from new LANSA research. While mapping literature onto the gender-nutrition pathways linking agriculture to nutrition (Kadiyala et al., 2014), we also point to conceptual and methodological directions for further exploration emerging from our work. Key amongst these are a focus on seasonality, poverty, and gender relations, moving beyond both an exclusive focus on women as a unified and homogenous group, and agriculture as an unchanging and common set of activities and production processes. Our analysis suggests the need for a more contextualised approach, and for a richer cross-disciplinary framework for effectively addressing the ways in which women's work mediates agriculture's role in improving child and maternal nutrition in South Asia.

1. Introduction

The phenomenon of “feminization” of agriculture has been well-documented worldwide (Grassi et al., 2015) and especially across South Asia (ILO, 2011). In Pakistan and Nepal, most of the women who work, work in agriculture (Zaidi et al., 2018; Acharya et al., 1999). In Afghanistan, women do as much agricultural work as men, but participate in the more labour-intensive activities in addition to other activities including domestic work (Ashrafi, 2009). Research in India has explored how the demands of agriculture and subsistence activities on women's time, on top of their already heavy work burdens of domestic work and child care, often end up undermining their well-being (Rao with Raju, forthcoming; Pattnaik et al., 2017).

The conditions, constraints and choices faced by South Asia's women agricultural workers are increasingly seen as key factors in understanding the causes of undernutrition and in designing effective policy responses (FAO, 2011), and nutrition research has led the recent revival of interest in women agricultural workers.

The pathways framework developed by Kadiyala et al. (2014) has been helpful in moving the debate on agriculture's contribution to nutrition beyond the implicit assumption that increases in the output of nutritious foods would be sufficient to improve nutrition, to mapping six pathways that unpack the diverse processes mediating such links.

We take this framework as the basis for organizing a systematic

review of published work in the South Asian countries of Afghanistan, Bangladesh, India, Nepal and Pakistan. Alongside this, we also draw on new evidence generated from research under the Leveraging Agriculture for Nutrition in South Asia (LANSA) consortium, particularly in India and Pakistan, to investigate the implications of women's work in agriculture on nutrition along the identified pathways. The paper highlights gaps in data as well as in the conceptual framing of the issue, and implications for research and policy action.

The next section summarizes the state of knowledge identifying key questions that informed the search parameters of the review. The review methodology is described in Section 3 and results are organised using the pathways framework in Section 4. Section 5 sets out the insights emerging from LANSA research. Section 6 discusses the main findings and proposes a cross-disciplinary framework for addressing current gaps in knowledge. Section 7 offers concluding observations.

2. Reviewing the pathways: Past and present

Reviews of literature over the decades have anticipated and supported the hypothesis articulated by the pathways framework that there might be a complex and nonlinear relationship between women's agricultural work and child nutrition. Early studies, mostly ethnographic accounts of women's work and child care practices, focused on changes underway due to greater market integration of rural

* Corresponding author.

E-mail addresses: n.rao@uea.ac.uk (N. Rao), haris@researchcollective.org (H. Gazdar), d.chanchani@uea.ac.uk (D. Chanchani).

communities (e.g. Leslie, 1988). Not finding a direct link between mother's work and child nutritional status, these studies recommended that future research should identify factors that may mediate the relationship – for example access to and quality of substitute childcare, prices of food (particularly food targeted to infants and weaning-age children) or nutrition and health knowledge.¹

Based mostly on research in sub-Saharan Africa, and reflecting some of the concerns of the earlier literature on the potential impact of technological and organisational change in agriculture, Haddad (2000) articulated a pathways approach for assessing agriculture-nutrition linkages. In their systematic review of agriculture-nutrition linkages in India, Kadiyala et al. (2014) combined this approach with the UNICEF framework for nutrition. They organised their review along six distinctive pathways through which agriculture and nutrition could be connected (see Fig. 1 for a simplified version).

While the first three pathways see agriculture contributing to nutrition improvement through increasing the availability of nutritious foods to farming communities (Pathway 1), higher incomes (Pathway 2), and boosting consumption through lower relative prices of nutritious foods (Pathway 3), the remaining three pathways go through women's work in agriculture. Pathway 4 posits that women's increased income and economic empowerment may have a positive effect on nutrition through more pro-nutrition food choices within the household as well as non-food consumption. Women's work in agriculture, however, may draw on their time thus compromising 'caring capacity and practices' such as breastfeeding, preparing food and seeking health interventions, and in effect, reducing the impact of food and non-food consumption (Pathway 5). If the time and energy expended on additional work, especially during peak cultivation seasons, is not compensated adequately, women's own health and nutrition might suffer, which may also have a negative impact on child nutrition (Pathway 6). In principle, women's work in agriculture may lead to improvements in nutrition (Pathway 4), or deterioration (Pathways 5 and 6).

The pathways framework has led to several reviews, which have attempted to weigh up the balance of the evidence that already exists in various ways. Some of these reviews – Kadiyala et al. (2014), Yosef et al. (2015), Pandey et al. (2016), and Ruel et al. (2018) – examine studies in different geographical zones – India, Bangladesh, South Asia, and the global south, respectively. While these reviews do not have an exclusive interest in the gendered pathways, they do separately report findings for the relatively small number of studies, which address these pathways. The reviews by and large follow systematic review methods.

For Pathway 4 the most common type of study included across the reviews investigates the relationship between women's empowerment, or some measure of their relative decision-making power within the household, and nutrition outcomes. The finding from Kadiyala et al. (2014) in India that women's empowerment has a positive impact on nutrition is echoed across other reviews that cover different geographical regions. A large number of the studies in question are evaluations of agricultural interventions that have some element of women's empowerment built into their design. What is missing from these reviews, however, is the linkage between broader changes in agricultural practices and women's empowerment.

A systematic review by Johnston et al. (2018) uses the pathways framework but focuses exclusively on the time-use pathway (Pathway 5) to examine studies from across developing countries. They find that while women make significant time commitments to activities as farmers or farmworkers the nutritional impact of this work is not unidirectional. Similarly, Pandey et al.'s (2016) South Asia review found little evidence that women working in agriculture neglect their children; rather, the characteristics of livelihood have a greater influence

on mothers' own BMI, and in turn on children's nutrition (Pathway 6). Ruel et al. (2018) acknowledge that most agriculture interventions place additional burdens on women's time, with potential negative effects on their own health. This echoes the findings from earlier reviews that also comment on the interlinkages between various pathways – particularly between Pathway 4 on the one hand and Pathways 5 and 6 on the other.

Existing reviews of gendered agriculture-nutrition pathways have not provided conclusive evidence, which might be utilised for effective policy change in a region where the trend towards the feminisation of agriculture is well-established. They do raise important questions though. How do we bring change in gender relations due to broader trends in agricultural practices, and not just specific interventions, into the picture? How do we take a more integrated approach to the three gendered pathways, while also keeping a focus on their distinctive impacts? Does care time inform the decision to work, and the timing and nature of work itself, or does women's decision to work impact care practices? How does the context in which women's work takes place – the prior gendered division of work and care, farming system, seasonality, poverty/class position, and ethnic or caste identity – shape the impact of work on nutrition? Where are the openings for change in terms of policy and programming?

While yielding relatively few studies on gendered pathways, previous reviews have focused on proximate impacts – e.g. women's empowerment measures on nutrition outcomes – without probing contexts and processes, which might have led to those impacts. Our systematic review (Sections 3 and 4) replicates and updates previous searches for the South Asia region covering the period since 2012. We include qualitative as well as mixed methods and quantitative studies, and pay particular attention to any contextual information relevant to statistical findings in the latter. Since we do not expect to find many more studies or a wider coverage of regions and farming systems than previous reviews, we supplement the findings of the systematic review with unpublished mixed methods LANSAs research in India and Pakistan across three types of farming systems. While we utilise the pathways framework to organise our systematic review, we also acknowledge the limitations of this framework, and propose to use our findings to extend and modify it.

3. Review methodology

The purpose of this review was to identify and analyse the literature on the implications of women's work in agriculture for maternal and child nutrition outcomes.

3.1. Screening and study selection

Apart from the LANSAs focus countries, namely, Afghanistan, Bangladesh, India, and Pakistan, we have also included Nepal, given the availability of some rich analysis from that country over a period of time. Previous reviews on the implications of women's work in agriculture for maternal and child nutrition outcomes helped develop the search strategy and identify keywords (Balagamwala and Gazdar, 2013; Kadiyala et al., 2014; Yosef et al., 2015; Vir, 2016; Pandey et al., 2016; Johnston et al., 2018, Ruel et al., 2018).

The search was conducted in the months of January and February 2018 on five databases (Web of Science; Scopus; PubMed; IFPRI and ELDIS). These are searchable databases that hold a wide range of peer-reviewed literature, research reports, and conference papers on the theme, and cover wide ranging literature across the social sciences and biomedicine.

We used a combination of terms relating to the search concepts – women and work (such as 'women'; 'work'; 'female labour'; 'feminisation'); agriculture (such as farming, kitchen garden, livestock); and nutrition (such as 'nutrition'; 'child nutrition'; 'BMI'; 'infant feeding'; 'stunting'). Each set of terms was applied to each country of focus, i.e. in

¹ Subsequent studies, for example Glick (2002), also emphasized the importance of identifying and examining mediating factors such as time use, household socio-economic status, and type of work and labour arrangement.

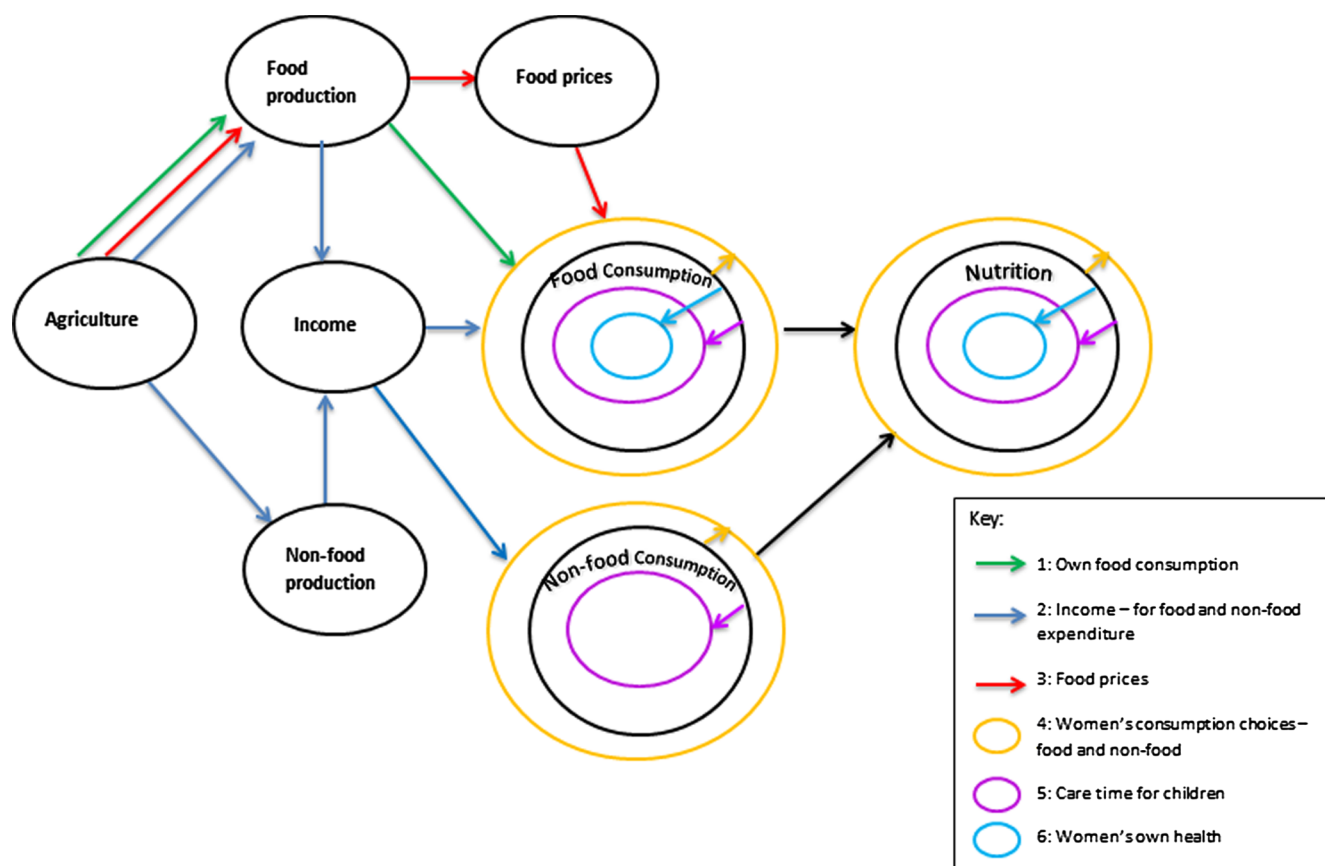


Fig. 1. Gendered agriculture-nutrition pathways. Source: Based on Kadiyala et al. (2014).

combination with India, Pakistan, Bangladesh, Afghanistan and Nepal. The terms were searched in available database search categories that would reveal the widest set of results for the initial stages of title and abstract screening, i.e the terms were searched in the overall topic, abstract and keywords, and not by more narrow categories such as ‘title’ alone. In preliminary searches, we trialled a wider set of search terms, but found the ‘topic’, such as ‘agriculture’ commonly encompassing results of searches using alternate terms such as ‘kitchen garden’ or ‘farming’. The IFPRI publications database was searched by simultaneous application of the following filters a) Location/Country (Southern Asia); b) Topic (Gender); c) Divisions (Poverty Health and Nutrition – PHND, and Agriculture for Nutrition and Health – A4NH) d) Language (English). In the ELDIS database, search filters include the Focus Topics – ‘Gender’ and ‘Agriculture and Food’ (applied together) in combination with each of the five countries of interest (each country in a distinct search). The papers identified through the search covered a wide range of topics relating to agriculture, forestry, kitchen gardens, work, drudgery, agrarian assets, and nutrition.

We limited our search to literature published in English, and to literature published between January 2012 and January 2018, as the intention was to update findings from LANSAs baseline reviews (Balagamwala and Gazdar, 2013; Kadiyala et al., 2014; Yosef et al., 2015). We include peer-reviewed publications (including working papers) that link elements of women’s work in agriculture to nutrition

outcomes, while opinion pieces, grey literature and literature that was not retrieved through the search functions or data sources described above were excluded. Review articles that were brought up in the search process were excluded from analysis, but two relevant articles, Vir (2016) and Pandey et al. (2016) were synthesised as part of Section 2, as were more recent papers by Johnston et al. (2018) and Ruel et al. (2018). Initial title screening was done by 1 reviewer (DC), shortlisted titles and abstracts were screened by two reviewers (NR and DC), who also shared the full text screening. We removed studies in the duplicate across searches, studies for which full texts were inaccessible and studies that were irrelevant. Given the relatively small time window, and that the topic remains a nascent field, 15 studies met the inclusion

Table 1 Search concepts and key terms.

Search concept	Search terms
South Asia	Afghanistan, Bangladesh, India, and Pakistan, Nepal
Women and work	Women, Work; feminisation, female labour, gender, decision-making
Agriculture	Agriculture; farming, kitchen garden, livestock
Health & nutrition	Nutrition, stunting, breastfeeding, BMI, feeding, maternity, malnutrition, care-giving

criteria and are discussed in this review. The search terms are summarised in [Table 1](#).

3.2. Data extraction and quality assessment

After reviewing the full texts, data extraction was conducted with the help of a research assistant (MI). Information on the study location, design, target population, intervention type, comparison group, study length and outcomes were extracted for each included study, and are presented in Annex [Table A2](#).

Given the significant diversity in selected studies in terms of research context, scope, design and methodology, assessing quality, and comparing findings posed significant challenges. Indeed, assessing qualitative evidence in systematic reviews is challenging, because qualitative studies commonly do not focus on measurable outcomes, a criterion that has traditionally been important in systematic reviews.² Furthermore, the DFID framework to assessing the strength of evidence, commonly used as a background on which quality assessment grading scales are based ([DFID, 2014](#)),³ gives greater emphasis to internal validity by study design, thus quantitative studies using a randomised control trial design, or quasi-experimental designs receive higher points than do studies that employ longitudinal, descriptive or cross-sectional research designs. While the search process sought to identify both qualitative and quantitative research of relevance, in the final selection of papers meeting inclusion criteria, only two papers adopt qualitative research methods.

Each selected study was assessed for quality, based on the quality criteria developed by [Yosef et al. \(2015\)](#), drawing on the DFID framework, by assigning point values to various criteria – conceptual framing, transparency, appropriateness and rigor, internal and external validity, reliability, and consistency in research design and reporting. With a view to overcome some limits to its application for qualitative research, we adapt the scale slightly to give a higher point value to good quality ethnography or qualitative research for the criterion ‘Is the study internally valid?’ The criteria are given in Annex [Table A1](#).

Of the 15 included studies, 6 studies received between 13 and 18 points and are marked as ‘I’, of high quality, on the grading scale. A majority of these studies ([Sraboni et al., 2014](#); [Schreinemachers et al., 2016](#); [Malapit et al., 2015a,b](#); [Komatsu et al., 2015](#)) analyse either large scale, or country-level survey data to elicit the relationship between dimensions of women’s work in agriculture and child nutrition. [Pritchard et al. \(2017\)](#), employ mixed-methods, and hence depend on qualitative data and interpretive analysis. While not directly tackling the question of women’s work and its links to nutrition, the study presents detailed comparative case study data and insights on the multi-layered connections between class status, land ownership, gender division of labour and nutrition.

Eight studies received between 7 and 12 points, these are marked as ‘II’, of intermediate quality. Seven papers ([Cunningham et al., 2015](#); [Subasinghe et al., 2014](#); [Singh et al., 2012](#); [Schreinemachers et al., 2015](#); [Kishtwaria and Rana, 2012](#); [Haselow et al., 2016](#); [Dulal et al., 2017](#)) rely on quantitative data, while one paper, [Nichols \(2015\)](#) is based on ethnography. Nichols observations on the relationships between state and civil society efforts towards female empowerment, on female work burdens, and in turn, caring practices and dietary intakes, link to proximate rather than anthropometric indicators of nutrition outcomes. They nevertheless provide insights into the gendered processes involved in these relationships. One study ([Guite et al., 2014](#)) received between 1 and 6 points, and is marked as ‘III’, of poor quality, for overall methodological shortcomings. The authors’ claims were

judged to be poorly backed by evidence. The quality grading for each paper is in Annex [Table A2](#).

4. Review findings

In this section, we briefly present the evidence from our review descriptively, and categorised in line with the pathways framework ([Kadiyala et al., 2014](#)).

4.1. Results

Our search strategy returned a total of 534 articles from across the five databases, of which 15 relevant papers were included in the analysis ([Fig. 2](#)).

Full details of the 15 included papers are provided in the Annex [Table A2](#). For the focus countries, we find studies pertaining to India (6); Bangladesh (6), and Nepal (5). Two of the studies cover both Bangladesh and Nepal, hence the higher numbers. Unfortunately, there were no studies that qualified, as per our inclusion criteria, for Afghanistan or Pakistan. In terms of the pathways, as several studies referenced multiple pathways, 9 studies are included in the pathway around women’s empowerment, 7 on the time-care trade-offs, and 6 on maternal nutrition. While the papers are selected to align with the three pathways that link women’s work in agriculture to child nutrition, in our paper, the criteria for pathway 6, which examines the implications of women’s work in agriculture for her own health and nutrition, is not limited to literature with reference to maternity and lactation, but examines the nutrition implications of agrarian work on adult women as a more general category. A summary of the included studies and their main findings are detailed in the next three sub-sections. Given that the scope and quality of the studies is highly varied, and few have explicitly focused on uncovering the interconnections between gender relations and nutrition outcomes, we point to some of the limitations, both conceptual and methodological, in [Section 4.5](#).

4.2. Implications of female work in agriculture for gendered power relations and decision-making with regards nutrition [Pathway 4]

Nine studies, of which seven employ quantitative methods ([Komatsu et al., 2015](#); [Malapit et al., 2015a,b](#); [Schreinemachers et al., 2016](#); [Sraboni et al., 2014](#); [Cunningham et al., 2015](#); [Haselow et al., 2016](#); and [Guite et al., 2014](#)), one employs mixed methods ([Pritchard et al., 2017](#)), and one ethnographic methods ([Nichols, 2015](#)), examine the implications of women’s work in agriculture for gendered power relations, control over economic resources and decision making towards nutrition. The first five listed above have been graded as high quality studies.

Based on cross-sectional survey data, while [Malapit et al. \(2015b\)](#) find for Bangladesh that gender gaps in empowerment are only weakly linked to children’s nutrition, [Cunningham et al. \(2015\)](#) find that in Nepal, some aspects of women’s empowerment in agriculture (autonomy in production, access to and decision making power regarding credit, and maternal satisfaction with time for leisure), were significantly associated with the Length for Age Z score (LAZ), a measure for stunting. However, other aspects of their empowerment index did not demonstrate any clear relationship with LAZ or Weight for Length Z Scores (WLZ), a measure of wasting. While at a general level, women’s empowerment has a positive influence on overall household dietary diversity and per capita calorie availability ([Sraboni et al., 2014, 17](#)), [Malapit et al. \(2015a\)](#) qualify this conclusion by noting that the domains of empowerment that are significant for women’s and children’s diet do not always overlap. Their results indicate that aggregate empowerment alongside group membership, hours worked, and control over income is significantly associated with maternal dietary diversity and BMI; while control over income and gender parity gap emerge as correlates for child outcomes. They suggest that women’s empowerment may mitigate some negative consequences of less diverse

² See for instance [Mallett et al. \(2012\)](#).

³ It has been used as a framework for grading evidence on other reviews on the subject of women’s work in agriculture and nutrition ([Kadiyala et al., 2014](#); [Yosef et al., 2015](#)).

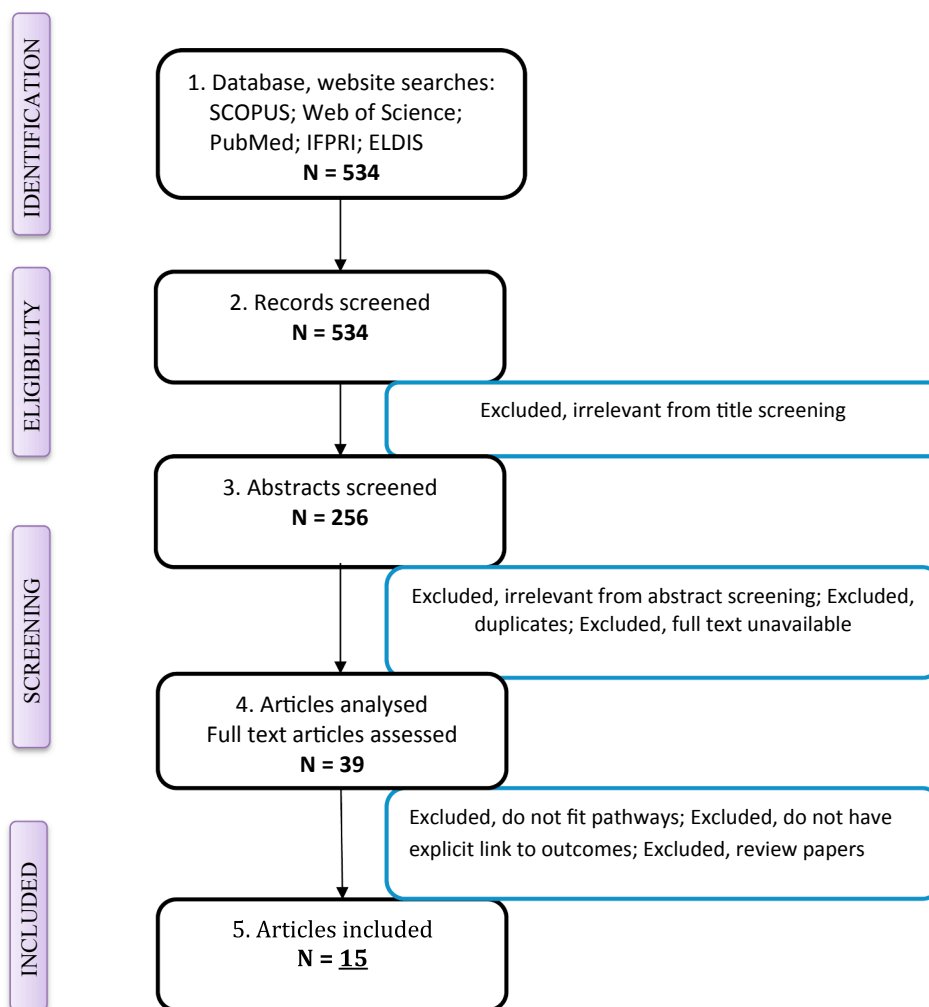


Fig. 2. Flowchart following the systematic screening process.

production portfolios, yet if this results from increasing work intensity of women in labour scarce households, it may not improve maternal BMI (Malapit et al., 2015a, p. 1121).

With a focus on assets, Pritchard et al. (2017) investigate the complex relations between landholding status and household nutrition in two proximate rural communities with different land-livelihood contexts in northern India. The authors find that landholding households have significantly greater milk consumption and this is related to their ability to grow fodder. They observe that conditional on asset ownership, women's work in animal husbandry contributed to an increase in household milk consumption (p. 189). While not focusing directly on intra-household allocations of milk, the authors highlight the importance of paying attention to producing deep contextual knowledge of household circumstances and decision-making dynamics within particular farming systems in food and nutrition research.

A subset of studies, using RCTs, focus on the implications of agricultural interventions, and find in particular that home vegetable gardens in Bangladesh (Schreinemachers et al., 2015); and integrated nutrition programmes, such as the Enhanced Homestead Food Production (EHFP) in Nepal and Bangladesh (Haselow et al., 2016), increased women's level of influence in household decision-making; control over household income; and involvement in tasks involving money.⁴ From ethnographic research in

the Kumaon hills, however, Nichols (2015, p. 1414) has a contradictory finding. She contends that efforts to empower women and make them agents of change with regards to food and nutritional security were often exacerbating unequal female labour burdens, which perpetuated poor food and nutritional security practices.

4.3. Implications of female work in agriculture for care time and practices [Pathway – 5]

Of the seven studies included, six employ quantitative methods, four of them cross-sectional surveys (Komatsu et al., 2015; Malapit et al., 2015a; Cunningham et al., 2015; Singh et al., 2012) and two RCTs (Schreinemachers et al., 2016, 2015), in order to examine the relationship between agricultural work and nutrition through the care time pathway. Here too, only Nichols' (2015) paper is based on ethnographic research.

Overall, there are significant variations in the ways in which women's employment may influence time availability, caring practices and nutritional outcomes. Analysing survey data from five countries, including Bangladesh and Nepal from South Asia, Komatsu et al. (2015) directly tackle the question of whether an increase in women's time in agriculture or productive work and the lack of time for reproductive work leads to poorer maternal and child nutrition. On the agriculture-time question, they find that in contrast to countries such as Ghana and Mozambique, in Nepal, where women are most time-burdened, a woman's engagement in agriculture increases the likelihood of her child's achieving a minimum

⁴ It is to be noted here that one paper (Guite et al., 2014) received a relatively low score on the quality ranking criteria.

acceptable diet. For nutrition in Nepal then, income and consumption effects from agriculture exceed the substitution effect of reduced time in reproductive work (p. 35–36, 38). Similarly, an RCT of a home garden intervention in Bangladesh finds that women in the intervention group only spent an average of 6–7 additional minutes over the control group on the garden per day, which, the authors argue, implies a negligible bearing for caring-time and significant positive gains in vegetable production and consumption (Schreinemachers et al., 2015, 2016).

However, as noted in Section 4.2, there is also evidence to suggest that while group membership and empowerment in agriculture are positively associated with maternal dietary diversity, high workload is negatively associated with maternal BMI in households where the male decision maker is absent (Malapit et al., 2015a, p. 1120). The evidence paints a mixed picture and confirms the importance of overall social context, and individual household situation as they mediate women's agrarian work and care.

From qualitative research in Himachal Pradesh, Nichols (2015) emphasises the feminist concern with time-poverty for food and nutrition security. She notes that food and nutrition practices are mediated by class (with the poorest families securing labouring time at the cost of cooking or eating time) and peak *agrarian seasons* such as planting and harvesting (where women are expending high energy but have little time or inclination to cook, or eat). She argues that interventions by both government and NGOs seek simultaneously to both create a more responsible housewife, while also extricating her from the home as a 'delimited' social space. These gendered social positions create untenable gendered work burdens and compromise food and nutrition security practices. The accentuated time burdens on women during the peak agricultural season are also highlighted by Singh et al. (2012). Cunningham et al. (2015) report a unique finding that maternal satisfaction with leisure time was positively associated with Length for Age Z (LAZ) scores. The authors speculate that perception of and satisfaction with free time may reflect a woman's agency, lack of stress and wellbeing, which in turn can influence caregiving, and child growth (3142).

4.4. Conditions of labour and nutritional status of women [Pathway 6]

Six studies (Schreinemachers et al., 2016; Singh, Sinwal and Rathore, 2012; Subasinghe et al., 2014; Dulal et al., 2017; Kishtwaria and Rana, 2012; and Nichols, 2015) map onto pathway 6 that draws links between women's work in agriculture, and her own health and nutrition. Of these, Nichols (2015) is an ethnographic study, and Schreinemachers et al. (2016) is an RCT; the others employ cross-sectional surveys. Two studies examine the implications of agricultural interventions and find they have an overall positive relationship with dietary diversity. Enhancing homestead food production was positively associated with maternal and child dietary diversity in Nepal (Dulal et al., 2017), while in Bangladesh, nutrition training enhanced home garden production in the 'intervention' group and concurrently addressed micronutrient deficiencies such as iron, Vitamin A and Zinc (Schreinemachers et al., 2016, 485). While not explicitly drawing the links with their nutritional outcomes, a study on technological interventions by Kishtwaria and Rana (2012), in the context of weeding amongst hill farmwomen in India, does however point to the drudgery and energy intensity of much of women's work in agriculture, an issue often overlooked.

A second strand of research, mainly within nutritional studies, relates to energy intake and expenditure and examines the differences across occupational and activity groups. Subasinghe et al. (2014) note

much higher levels of both chronic energy deficiency (CED) and anaemia amongst men and women, who are principally farmers, compared to other occupational groups in their study from South India. This could be linked to the small size of land-holdings and exposure to infectious and parasitic organisms in the fields, in a context where returns to agriculture were low. Likewise, Singh et al. (2012) examine the energy expenditure ratio of women in peak and lean agricultural seasons, to find that while the energy balance was positive during sowing and weeding, it was negative during land preparation and harvesting. While not employing anthropometric measures of nutrition, Nichols (2015) observes that during peak agricultural seasons, when women are expending the greatest energy, they are also eating the least – from fatigue, work pressure, and lack of time.

4.5. What have we learned?

What emerges from the above review is that in the context of South Asia, with high levels of poverty and social inequality, and with rigid gender norms that allocate almost the entire responsibility for care to women, the positive effects of empowerment are often muted by high work burdens and lack of attention to women's own health and nutrition. While pointing to a generally positive relationship between agricultural interventions and nutrition outcomes, what is missing is an investigation of the degree to which agricultural work or income from it might be a source of empowerment for women. One of the problems seems to be the consideration of agriculture as a black box, and not really unpacking what constitutes the farming system, and the nature of work women perform therein, whether as farm managers, household workers, or paid labour, its seasonality, intensity of effort, and the exposure to health risks. Except for a few studies, a majority tend to homogenise women's work in agriculture. A few of the above studies do indicate that women's nutrition may be compromised during peak agricultural seasons, a finding which parallels insights from primary LANSa research. In the following section, in presenting insights from LANSa research, we pay specific attention to some of these variables that constitute 'context', drawing out its implications for future research, policy and practice.

5. Insights from LANSa primary research

Country evidence reviews in India (Kadiyala et al., 2014), Bangladesh (Yosef et al., 2015) and Pakistan (Balagamwala and Gazdar, 2013) had already drawn attention to knowledge gaps in this area, including a paucity of evidence from Pakistan. An analysis of the sources of nutrition improvement in Bangladesh using secondary data also suggested that improvements in women's health and status played a far bigger role than interventions in sectors such as WASH, particularly in rural settings (Headey et al., 2015).

Three sets of primary studies in LANSa, in regions with high burdens of undernutrition, directly addressed the relationship between women's work and nutrition. Selected insights from these studies are included here to further unpack elements of agricultural work and its context. In India, Rao with Raju (forthcoming) carried out a mixed methods study in villages in two agro-ecological zones – Wardha in the semi-arid cotton-growing area of Maharashtra in the west, and Koraput in Odisha in the east which relies on rainfed paddy farming. Based on prior ethnographic knowledge on work organisation, and local class and caste structures, this study collected data on seasonal variations in time use and adult BMI among male and female agricultural workers. Also in India, a separate study tracked birth weights in villages in the

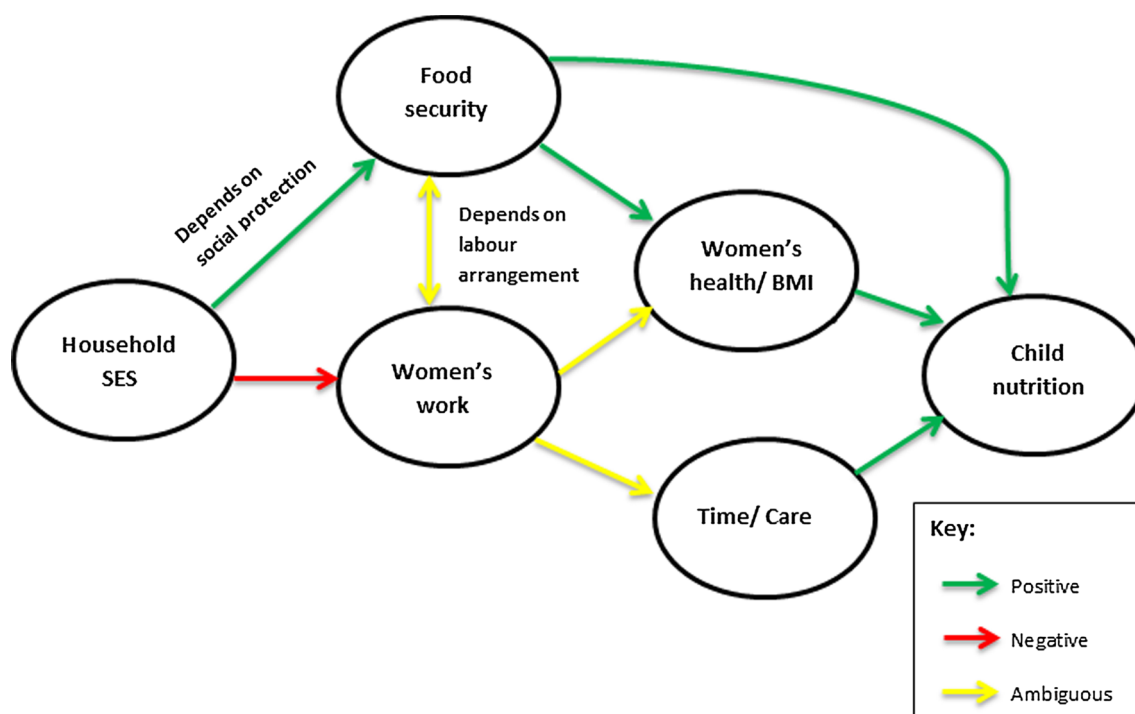


Fig. 3. Women’s work as a mediator between household socio-economic status and food security and nutrition.

Rae Bareilly district of Uttar Pradesh in the wheat and rice-growing north Indian irrigated plains region across agricultural seasons (Madan et al., forthcoming). In Pakistan, a LANSAs study (Women’s Work and Nutrition or WWN) was carried out in the canal-irrigated plains region, focusing on rural Sindh, where the main crops are wheat, cotton and sugarcane (Balagamwala et al., 2015; Mazhar et al., 2017; Pradeilles et al., 2017a,b). This study recruited a sample of mother-child dyads at baseline when the child was between 2 and 12 weeks old, and then resurveyed the same dyads after an interval of around 11 months.

The ethnographic element in the LANSAs studies, particularly Rao with Raju (forthcoming) and the WWN study in Pakistan (Mazhar et al., 2017), highlighted issues in the conceptualisation, visibility and measurement of women’s agricultural work. This reiterates the observation from the systematic review that there is a blurring of the boundary between productive and reproductive work in many parts of South Asia. A time-use survey (Rao with Raju, forthcoming) also made women’s agricultural work more visible. While care is mostly seen as women’s work, many tasks and activities which would be considered to be part of the productive economy – for contributing directly to national income, for example – are not classified as work by communities, families and women. Our studies, therefore, highlight a key element in the discussion of agriculture-nutrition linkages – that agriculture is probably far more feminized than recognised in national data.

A related finding is with respect to what drives women’s agricultural work in different farming systems and communities in South Asia. Asking why women do the work they do in agriculture turns out to be the key to understanding what role agricultural work plays in nutrition through the various pathways. Our systematic review confirms earlier reviews, which found a positive relationship between women’s empowerment (in decision-making related to agriculture as well as household activities) and nutrition. These studies, however, tell us relatively little about the relationship between agricultural work and

empowerment. While interventions that are designed to address empowerment appear to have been successful in various settings, these reach relatively few women, and those too mostly in relatively marginal agro-ecological zones (Schreinemachers et al., 2015; Haselow et al., 2016).

LANSAs studies addressed the question of the motivation behind work directly, but also through inference. When women were asked (Mazhar et al., 2017) why they performed various agricultural tasks, their responses ranged from choice, to constrained choices (mostly to feed their families), to not having a choice (treating certain tasks as things that just needed to be done). There are constraints around seasons and types of crops and prevailing labour arrangements, as well as around class and caste in how much work women end up doing (Rao with Raju, forthcoming). Our studies found women working through pregnancy (Pradeilles et al., 2017a,b; Madan et al., forthcoming). We found a close association between norms around women’s ability to choose with respect to work, and their ability to exercise control over agricultural assets such as land and livestock.

All of the LANSAs studies pay critical attention to women’s health, both as a consequence of work as well as a determinant of child nutrition (Pathway 6). Rao with Raju (forthcoming) and Madan et al. (2018, forthcoming) both focus on seasonal variations in women’s BMI – an aspect of the relationship between agriculture and health that is absent from many of the studies covered in the systematic review. Rao with Raju (forthcoming) find significant differences in seasonal effects across regions, as well as across caste groups within regions. The WWN study in rural Sindh in Pakistan finds a strong correlation between women’s work and their BMI, and between their BMI and children’s nutritional status (Pradeilles et al., 2017a). LANSAs studies (Madan et al., forthcoming, and Pradeilles et al., 2017b, forthcoming) also promise to provide fresh insights into the relationship between women’s work and the birth weight and growth of children.

The issues highlighted by LANSAs studies – the lack of recognition of women’s agricultural work, the issue of choice and constraint in the motivation behind work in different contexts, and the interplay between the pathways – suggest that some of the most nutritionally vulnerable women and children are located in communities and farming systems where women’s agricultural work might be a mediator between household poverty and survival, as well as a pathway between agriculture and nutrition.

6. Discussion

Our starting point in this paper was that the impact of women’s agricultural work on nutrition was complex and existing literature did not easily find a ‘smoking gun’ with respect to any of the pathways. LANSAs research read alongside globally robust evidence of the strong correlation between women’s physical status (height as well as BMI) on birth weights and growth, provides an emergent sense that the main channel through which agricultural work impacts child nutrition might be through Pathway 6.

The review has also affirmed the earlier finding (Johnston et al., 2018) that whether or to what extent women’s work has an impact on nutrition depends a great deal on the context. This is certainly true of comparisons of South Asia with other regions which differ with respect to their agro-ecologies and farming systems, labour market arrangements, gendered divisions of work and care, and other forms of social and institutional inequality (Cavatorta et al., 2015). Even within the region there are variations in how different communities choose to, or are able to, optimise between work, care and leisure; and how women and men might exercise choices in various domains, across seasons and cropping cycles.

To say that ‘context matters’, however, is not sufficient. For policy and analysis both, there is need for a clearer understanding of what matters and how, and how change might happen. Some of the main contextual factors that appear to be important are: drivers of women’s agricultural work (including cropping patterns); household social and economic status; prevailing labour market arrangements; and arrangements and capacity in households and communities with respect to child care.

In most South Asian rural settings at present, women’s agricultural work appears to be driven by household poverty and marginality. Women from wealthier households tend to do less farm work, though with growing male out-migration, they are taking on farm management roles. Farm labourers are more likely to be from socially marginalised communities, given the negative association of women’s farm work with the social standing of a family. Women’s work in agriculture in most South Asian settings, therefore, is more likely to be due to a ‘distress sale of labour’ (Bhalotra, 2010) than empowered agency.

In Fig. 3 we take forward the pathways framework to restate agriculture-nutrition linkages with women’s work not as a causal factor but a mediator between household poverty or socio-economic status and its food security and nutrition. This reframing allows us to focus on precisely those contextual issues in the mediation about which there remain gaps in knowledge and blind spots with respect to policies and interventions.

The questions that this cross-disciplinary framing takes as mostly-answered are the positive linkages between food security, women’s health, and child nutrition. The link between household social and economic status and food security is also mostly positive, though this link might be made weaker for poorer households through effective systems of social protection.⁵ The framework is based on a prior

⁵ We have articulated the framework with respect to food security as this is widely accepted as the most pressing priority for the poor in South Asia. The framework could be extended to include basic priorities of families such as providing for health contingencies and other adverse shocks.

acknowledgement of existing patriarchal norms across much of rural South Asia which order a gendered division of work and care. Variations in these norms (such as those observed across studies and across sites in LANSAs research) and changes in them would alter the context in which the linkages posited in the framework would operate.

A household’s poverty or socio-economic conditions include not only its income and assets, but also its human and social capital. Social capital in the rural South Asian context would implicate caste and social group identity, as well as the range and quality of social connections enabling a household to access local public goods and services and informal sources of social protection. Women from households with relatively high levels of social capital would be less likely to work in agriculture because of the low status associated with farm work (e.g. Rao with Raju, forthcoming), and because of stronger social networks underpinning their food security.

Human capital would also operate in several ways. If, as most studies addressing the time-use pathway suggest, women or families tend to guard care time for children, women’s agricultural work is also likely to be a function of the balance of the burden of care work and potential carers within the household. To the extent that education is a driver and/or a signifier of a woman’s agency, more educated women are more likely to exercise choice with respect to work (e.g. Mazhar et al., 2017).

In this proposed framework, farming systems, cropping patterns and labour arrangements play an important part in how the various linkages work. Cotton and commercial-scale vegetable farming, as observed in some of the LANSAs research sites in India and Pakistan, as well as seasonal demand for labour, would imply restricted flexibility for women farm workers. Binding labour arrangements might have the same effect (e.g. Balagamwala et al., 2015).

The proposed framework highlights a number of questions for future research, as well as possible policy openings for optimising the possible positive linkage between agriculture and nutrition through women’s work participation. On the research side, linkages to the left of the diagram – about the range of contextual factors which influence women’s participation in agricultural work in different settings – need more attention. On the policy side the focus shifts to factors that might lead to altering the context which constrain choices, or more critically agency, with respect to agricultural work.

7. Concluding reflections

The pathways linking women’s work in agriculture to nutrition are complex, and in studying them, the lack of quality evidence has often been posed as a barrier. This is partly from methodological challenges, given that the drivers of undernutrition are multiple, and agriculture-nutrition pathways interconnected, which makes it difficult to both generate evidence, and to delineate direct relationships between gendered agrarian systems and nutrition outcomes.

The review of literature, however, points also to conceptual problems in relation to both agriculture and women’s work. Many of the existing studies and reviews are inconclusive partly because they pay insufficient attention to specificities of particular social groups and agrarian systems, and the gender relations they entail. Smaller ethnographic studies, as well as the LANSAs studies discussed in Section 5, take a more grounded approach, identifying the specific groups of women and the type of work they undertake in particular seasons, and these do result in fairly robust and unambiguous conclusions. So, for instance, studies in both Pakistan and India, conducted in contexts of poverty, and with deprived communities within these geographies, point out that women engaged in cotton harvesting, or paddy transplanting, are more prone to intensive effort and poor health during this season, and if pregnant, more likely to have low birth weight babies. Our research identifies the most vulnerable, whether the landless in Pakistan, or particular tribes/castes in India. While perhaps not broadly generalizable, it helps understand those most vulnerable in particular

contexts, and provides therefore practical options for future interventions.

A second important conclusion from our studies across LANSAs field sites, is that women’s work in agriculture is significant; and for some populations, their total contribution to productive activities is often greater than what more common narratives may suggest. Our research makes a valuable contribution in both making visible the extent of women’s contributions to the ‘total economy’, and in highlighting the seasonal time-squeeze which plausibly has implications for childcare. A strong case exists for the formal recognition of women as farmers and agricultural workers, whose voices must be heard in policy-making, and who need to be provided adequate public support, be it through technology, infrastructure or provision of basic services, in the performance of their productive and reproductive roles. Universal maternity entitlements and child care services that recognise women as workers, can go a long way in improving child nutrition outcomes.

Nutritional research so far has largely focused on large quantitative surveys, and while useful, these are expensive and not easy to implement widely. What we have demonstrated is that combining such surveys with in-depth qualitative research, which takes on board contextual specificities and variations, can help understand the drivers of nutrition outcomes. Issues of identity and status, for instance, play an important part in shaping cultural norms and beliefs around food and feeding practices, of valuing work as socially appropriate or inappropriate, and hence influencing outcomes, but are not easily captured through large surveys.

Appendix

See [Tables A1 and A2](#).

Table A1

Quality assessment criteria (From [Yosef et al., 2015](#)).

Does the study...

Acknowledge existing research? (1 point)
Have a conceptual framework? (1 point)
Have a research question? (1 point)
Contain a hypothesis? (1 point)
Link to raw data? (1 point)
Recognize limitations? (1 point)
Identify a research design? (1 point)
Identify a research method? (1 point)
Explain why it uses a particular design or method? (1 point)
Use a well-suited indicator? (1 point)
Outline results that are generalizable? (1 point)
Use instruments that are reliable for assessing nutrition? (1 point) <i>The authors considered the following to be generally reliable: Clinical measures, 24-hour dietary recalls or food frequency assessments, blood measures of micronutrients, and anthropometry</i>
Contain signposting (writing clarifies key aspects such as aim, structure, and conclusion, and shows connections between sentences and paragraphs)? (1 point)
End with a logical conclusion? (1 point)
Is the study internally valid? (4 points) <i>Internal validity was determined by the study design used. Randomized Controlled Trials: 4 points; Quasi-experimental Studies: 3 points; Longitudinal Studies: 2 points; and Descriptive or Cross-sectional Studies: 1 point</i> High quality/detailed ethnography: 3 points

We have proposed a cross-disciplinary framework that takes the discussion forward from the pathways approach to one where women’s agricultural work is seen as a mediator between household social and economic status and food security and nutrition. This framework calls for specific understandings of social relations around agricultural systems while recognising the unique position that women occupy in the agricultural sector as part of their productive and reproductive roles. Such an approach can help identify suitable policy interventions to support agriculture and women’s work within it, as well as nutrition and health outcomes for women, children and their households through redistributing the consumption of resources and the provision of care.

Competing interests

All authors state that they have no competing interests to declare.

Acknowledgements

This article is part of the research generated by the Leveraging Agriculture for Nutrition in South Asia Research (LANSAs) research consortium, and is funded by UK aid from the UK government. The views expressed do not necessarily reflect the UK Government’s official policies. The authors would like to thank both the internal reviewers and the peer reviewers for their very useful comments on earlier versions of this paper.

Table A2
Overview of studies included in systematic review.

Author	Study design	Participants/Subjects	Comparison groups	Country	Study length	Objectives	Main findings	Pathways addressed	Interaction (diagram 2)	Quality check
1 Cunningham et al. (2015)	Quantitative	4080 mothers and children under 24 months old.	-	Nepal	Cross-sectional Jun-Oct 2012	Relationship between WEAI 5DE, WLZ, LAZ in Nepal	Satisfaction with leisure time, credit decisions and production autonomy are associated with LAZ.	Pathway 4, Pathway 5	SES-Food security, time/care-nutrition	II
2 Dulal et al.(2017)	Quantitative intervention analysis	2101 mothers and 994 children	Data at three different time periods	Nepal	Jun-Jul 2014, Nov-Dec 2014, Apr-May 2015	Impact of Suaahara programme on children's diet and nutrition	Variation by subnational setting and seasonality, with more diet diversity only in the winter season.	Pathway 6	Time/care-nutrition	II
3 Guite et al. (2014)	Quantitative and qualitative intervention analysis	100 women vegetable farmers, 8 NGO and 5 government officials	-	India	Cross-sectional	Impact of SWFSLVP project	Increased capacity of women farmers for low cost vegetable farming, strengthened institutions, increased land leased by women and perceived control over financial matters, and improved nutritional status.	Pathway 4	SES-Food security, time/care-nutrition	III
4 Haselow et al. (2016)	Review of RCT's intervention analysis	Communities in which RCT interventions took place	-	Nepal, Bangladesh	-	Impact of an Enhanced Homestead Food Production (EHFP) programme	Food availability and production increased after the programme, with an increase in women's influence in household decision making and control over income.	Pathway 4	II	II
5 Kishwarria and Rana (2012)	Quantitative	60 hill farm women in 2 hill states of India	-	India	Cross-sectional	Physical health effects of weeding with traditional tools	Women weeding with traditional tools had high heart rates and musculo-skeletal problems which were reduced by working with improved tools/technology.	Pathway 6	Women's work- health	II
6 Komatsu et al. (2015)	Quantitative	Data from 2012 BHIS; Feed the Future surveys in Cambodia, Ghana, Mozambique; baseline survey of Suaahara in Nepal	Poor and non-poor households; different countries.	Bangladesh, Cambodia, Ghana, Mozambique, Nepal	Cross-sectional	Impacts of women's time use on nutrition	There are different impacts of women's time use on reproductive and agricultural work on nutrition for poor and non-poor households	Pathway 5	Time/care-nutrition	I
7 Malapit et al. (2015a)	Quantitative	Data from Suaahara, 3332 rural households where women with children under five years work in agriculture	3 agro-ecological zones of mountains, hills, and terai	Nepal	Cross-sectional Jun-Oct 2012	Relationship between WEAI and children's nutritional status and education scores	Empowerment gaps are weakly linked with nutrition. Better health for girls is linked with women's credit and asset decisionmaking, and poorer health with women's group involvement. Better health for boys is linked with women's life satisfaction	Pathway 4, Pathway 5	SES-Food security	I
8 Malapit et al. (2015b)	Quantitative	3156 households from 2012 BHIS	-	Bangladesh	Cross sectional Dec 2011 to Mar 2012	Relationship between WEAI and maternal and child nutrition	Women's group membership, control over income, reduced workload, and empowerment are linked with better maternal nutrition. Control over income is linked with HAZ, and lower gender parity gap improves children's diet and HAZ	Pathway 4	SES-Food security	I

(continued on next page)

Table A2 (continued)

Author	Study design	Participants/Subjects	Comparison groups	Country	Study length	Objectives	Main findings	Pathways addressed	Interaction (diagram 2)	Quality check
9 Nichols (2015)	Qualitative	Sub-Himalayan North India community	4 villages within the hills region	India	Summer 2013	Impact of mother's time use on their household's food security	Most programs target women for socially scribed responsibilities with consequences for household food security due to lack of time to prepare food by implicitly reinscribing gendered labor burdens while devaluing women's labour. Households dependent on agricultural wage labour were poorest, and had less diet diversity. Gendered divisions of labour within households concretised this within the food procurement and preparation norms of the domestic sphere. Women's work led to consumption of milk which led to better nutrition outcomes	Pathway 4, 5, 6	Time/care-nutrition	II
10 Pritchard et al. (2017)	Mixed methods	100 households surveyed in 2 communities; qualitative interviews with 34 households	Different land-livelihood contexts	India	Feb 2011, Feb 2013, Feb 2014	Relationship between household land ownership and nutrition	Households dependent on agricultural wage labour were poorest, and had less diet diversity. Gendered divisions of labour within households concretised this within the food procurement and preparation norms of the domestic sphere. Women's work led to consumption of milk which led to better nutrition outcomes	Pathway 6	SES-Food security	I
11 Schreinemachers et al. (2015)	RCT intervention analysis	582 poor rural women in 2 districts	479 control, 103 intervention	Bangladesh	Training sessions in 2012, survey in Apr-May 2013	Impact of women's training in home gardens on vegetable production and consumption	Increased supply and consumption of a diverse range of vegetables in poor rural households, thereby contributing to nutrition security	Pathway 4, 5	SES- food security	II
12 Schreinemachers et al. (2016)	RCT intervention analysis	646 households from 4 districts	Baseline: 425 intervention, 252 control; Follow-up: 408 intervention, 238 control	Bangladesh	1 year intervention. Baseline: Apr-May 2013 Follow-up: Apr-May 2014	Impact of women's training in home gardening and nutrition on vegetable production, consumption and micronutrient supply	Increased vegetable production and consumption, and the micronutrient supply. Cost-effective approach to address micronutrient deficiencies among poor rural households	Pathways 5, 6	SES-Food security; time/care-nutrition	I
13 Singh et al. (2012)	Quantitative	90 farm-women who had worked in agriculture for 10 years and were not pregnant, lactating or suffering from chronic disease	Landholding category: small farmer, marginal farmer, landless agricultural laborers; Women's BMI grades i.e. obese, normal, CED	India	Cross-sectional (2006–2007)	Effect of women's agricultural work on nutrition/BMI/diet intake	Most women performed all agriculture, allied and household activities. In all the agriculture activities physiological hazards such as body pain and fatigue were dominant. Dietary, nutritional and energy intake was lower for heavy workers from all BMI and landholding categories	Pathway 5, 6	Women's work- health; Women's health-nutrition	II

(continued on next page)

Table A2 (continued)

Author	Study design	Participants/Subjects	Comparison groups	Country	Study length	Objectives	Main findings	Pathways addressed	Interaction (diagram 2)	Quality check
14 Sraboni et al. (2014)	Quantitative	5503 households from 2012 BHIS	1608 nonfarm HH, 3895 farm HH	Bangladesh	Cross-sectional, Dec 2011 to Mar 2012	Relationship between WEAI and per capita calorie availability, dietary diversity, and adult body mass index (BMI)	Household diet diversity and per capita calorie availability increase if the primary female decision-maker is more empowered. The positive effect of the different dimensions of female empowerment on food security outcomes is greater for less well-off households	Pathway 4	SES-Food security	I
15 Subasinghe et al. (2014)	Quantitative	Adults older than 18 years in 12 villages	–	India	Cross-sectional, 2006–2007	Physical health effects of farming	Farming is associated with chronic energy deficiency in adults (men and women)	Pathway 6	Women's work- health	II

Quality Rank on Yosef 18 point scale (adapted): 13–18 points = I; 7–12 points = II; 0–6 points = III.

References

Acharya, M.P.M., Acharya, B., Sharma, S., 1999. Women in Nepal: Country Briefing Paper. Asian Development Bank, Manila.

Ashrafi, H., 2009. Gender dimension of agriculture and rural employment: special focus on Afghan rural women's access to agriculture and rural development sector. Paper presented at the FAO-IFAD-ILO Workshop on Gaps, trends and current research in gender dimensions of agricultural and rural employment: differentiated pathways out of poverty. 31 March – 2 April 2009, Rome, Italy.

Balagamwala, M., Gazdar, H., 2013. Agriculture and nutrition in Pakistan: pathways and disconnects. *IDS Bull.* 44 (3), 66–74.

Balagamwala, M., Gazdar, H., Mallah, H.B., 2015. Women's agricultural work and nutrition in Pakistan: findings from qualitative research. LANSAs Working Paper 2. < http://lansasouthasia.org/sites/default/files/Women_Agricultural_Work_%20and_%20Nutrition_%20in_%20Pakistan1.pdf > .

Bhalotra, S., 2010. Fatal fluctuations? Cyclicalities in infant mortality in India. *J. Dev. Econ.* 93, 7–19.

Cavatorta, E., Shankar, B., Flores-Martinez, A., 2015. Explaining cross-state disparities in child nutrition in rural India. *World Dev.* 76, 216–237.

Cunningham, K., Ploubidis, G.B., Menon, P., Ruel, M., Kadiyala, S., Uauy, R., Ferguson, E., 2015. Women's empowerment in agriculture and child nutritional status in rural Nepal. *Publ. Health Nutr.* 18 (17), 3134–3145.

DFID, 2014. How to Note: Assessing the Strength of Evidence. < <https://www.gov.uk/government/publications/how-to-note-assessing-the-strength-of-evidence> > .

Dulal, B., Mundy, G., Sawal, R., Rana, P.P., Cunningham, K., 2017. Homestead food production and maternal and child dietary diversity in Nepal: variations in association by season and agroecological zone. *Food Nutr. Bull.* 38 (3), 338–353.

FAO, 2011. The state of food and agriculture. Women in agriculture: closing the gender gap for development. Food and Agriculture Organization, Rome, Italy.

Glick, P., 2002. Women's Employment and Its Relation to Children's Health and Schooling in Developing Countries: Conceptual Links, Empirical Evidence, and Policies. Cornell University.

Grassi, J., Lamberg, J., Huyer, S., 2015. Running Out of Time: The Reduction of Women's Work Burden in Agricultural Production. Food and Agriculture Organisation of the United Nations, Rome, Italy.

Guite, N., Ghosh, S., Brahmachari, A., 2014. Addressing issues of malnutrition in children through public nutrition using local resources of agriculture and land use: evidence from the field based evaluation study in Uttar Pradesh. *Indian J. Commun. Health* 26 (2), 237–244.

Haddad, L., 2000. A conceptual framework for assessing agriculture–nutrition linkages. *Food Nutr. Bull.* 21 (4), 367–373.

Haselow, N.J., Stormer, A., Pries, A., 2016. Evidence-based evolution of an integrated nutrition-focused agriculture approach to address the underlying determinants of stunting. *Mater. Child Nutr.* 12 (1), 155–168.

Headey, D., Hoddinott, J., Ali, D., Tesfaye, R., Dereje, M., 2015. The other Asian enigma: explaining the rapid reduction of undernutrition in Bangladesh. *World Dev.* 66, 749–761.

ILO, 2011. Key indicators of the labour market. KILM, sixth ed.

Johnston, D., Stevano, S., Malapit, H., Kadiyala, S., Hull, E., 2018. Agriculture, gendered time use, and nutritional outcomes: a systematic review. *Food Pol.* 76 (April), 8–18.

Kadiyala, S., Harris, J., Headey, D., Yosef, S., Gillespie, S., 2014. Agriculture and nutrition in India: mapping evidence to pathways. *Ann. N. Y. Acad. Sci.* 1331 (1), 43–56.

Kishtwaria, J., Rana, A., 2012. Ergonomic interventions in weeding operations for drudgery reduction of hill farm women of India. *Work* 41, 4349–4355.

Komatsu, H., Malapit, H.J., Theis, S., 2015. How does women's time in reproductive work and agriculture affect maternal and child nutrition? Evidence from Bangladesh, Cambodia, Ghana, Mozambique, and Nepal. IFPRI Discussion Paper 1486. Washington D.C.

Leslie, J., 1988. Women's work and child nutrition in the Third World. *World Dev.* 16 (11), 1341–1362.

Madan, E.M., Haas, J.D., Menon, P., Gillespie, S., 2018. Seasonal variation in the proximal determinants of undernutrition during the first 1000 days of life in rural South Asia: a comprehensive review. *Glob. Food Secur.* 19, 11–23. <https://doi.org/10.1016/j.gfs.2018.08.008>.

Madan, E.M., Haas, J.D., Frongillo, E.A., Kumar, V., Kumar, A., Menon, P. (forthcoming). A longitudinal study of infant growth and nutritional status amongst smallholder agriculturist households in Uttar Pradesh. PhD. Working Papers.

Malapit, H.J.L., Kadiyala, S., Quisumbing, A.R., Cunningham, K., Tyagi, P., 2015a. Women's empowerment mitigates the negative effects of low production diversity on maternal and child nutrition in Nepal. *J. Dev. Stud.* 51 (8), 1097–1123.

Malapit, H.J.L., Sraboni, E., Quisumbing, A.R., Akhter, A., 2015b. Gender empowerment gaps in agriculture and children's well-being in Bangladesh. IFPRI Discussion Paper, 01470. Washington D.C.

Mallett, R., Hagen-Zanker, J., Slater, R., Duvendack, M., 2012. The benefits and challenges of using systematic reviews in international development research. *J. Dev. Eff.* 4 (3), 445–455.

Mazhar, S., Balagamwala, M., Gazdar, H., 2017. The hidden economic backbone: Women in agriculture. Paper presented at the LUMS International Conference on Gender, Work and Society.

Nichols, C.E., 2015. Time Ni Hota Hai: time poverty and food security in the Kumaon hills, India. *Gender, Place Cult.* 23 (10), 1404–1419.

Pandey, V.L., Dev, S.M., Jayachandran, U., 2016. Impact of agricultural interventions on the nutritional status in South Asia: a review. *Food Pol.* 62, 28–40.

Pattnaik, I., Lahiri-Dutt, K., Lockie, S., Pritchard, B., 2017. The feminization of agriculture or the feminization of agrarian distress? Tracking the trajectory of women in

- agriculture in India. *J. Asia Pac. Econ.* <https://doi.org/10.1080/13547860.2017.1394569>.
- Pradeilles, R., Allen, E., Gazdar, G., Mysorewala, A., Mazhar, S., Dangour, A., Ferguson, E., 2017a. The relationship between crop-related agricultural workload and maternal and infant nutritional status in rural Pakistan. Paper presented at the Agriculture, Nutrition and Health Scientific Symposium & Academy Week 2017. July 2017. Kathmandu, Nepal.
- Pradeilles, R., Allen, E., Gazdar, H., Mysorewala, A., Mazhar, S., Dangour, A., Ferguson, E., 2017b. Maternal cotton-picking during pregnancy is associated with maternal and early infancy nutritional status in rural Pakistan. Paper presented at the 21st IUNS International Congress of Nutrition. October 2017. Buenos Aires, Argentina.
- Pradeilles, R., Norris, T., Ferguson, E., Gazdar, H., Mazhar, S., Mallah, H.B., Budhani, A., Mehmood, R., Aslam S., Dangour, A.D., Allen, E., forthcoming. Factors associated with catch-up growth in early infancy in rural Pakistan: a longitudinal analysis of the Women's Work and Nutrition Study, *Maternal & Child Nutrition*.
- Pritchard, B., Rammohan, A., Sekher, M., 2017. Land ownership, agriculture, and household nutrition: a case study of north Indian villages. *Geogr. Res.* 55 (2), 180–191.
- Rao, N. with S. Raju, forthcoming. Gendered time, seasonality and nutrition: Insights from two Indian districts. *Feminist Econ.*
- Ruel, M.T., Quisumbing, A.R., Balagamwala, M., 2018. Nutrition-sensitive agriculture: what have we learned so far? *Glob. Food Secur.* 17, 128–153.
- Schreinemachers, P., Patalagsa, M.A., Islam, M.R., Uddin, M.N., Ahmad, S., Biswas, S.C., Ahmed, M.T., Yang, R.Y., Hanson, P., Begum, S., Takagi, C., 2015. The effect of women's home gardens on vegetable production and consumption in Bangladesh. *Food Secur.* 7 (1), 97–107.
- Schreinemachers, P., Patalagsa, M.A., Uddin, M.N., 2016. Impact and cost-effectiveness of women's training in home gardening and nutrition in Bangladesh. *J. Dev. Eff.* 8 (4), 473–488.
- Singh, S., Sinwal, S., Rathore, H., 2012. Assessment of energy balance of Indian farm women in relation to their nutritional profile in lean and peak agricultural seasons. *Work* 41, 4363–4371.
- Subasinghe, A.K., Walker, K.Z., Evans, R.G., Srikanth, V., Arabshahi, S., Kartik, K., Kalyanram, K., Thrift, A.G., 2014. Association between farming and chronic energy deficiency in rural South India. *PloS One* 9 (1), e87423.
- Sraboni, E., Malapit, H.J., Quisumbing, A.R., Ahmed, A.U., 2014. Women's empowerment in agriculture: what role for food security in Bangladesh? *World Dev.* 61, 11–52.
- Vir, S.C., 2016. Improving women's nutrition imperative for rapid reduction of childhood stunting in South Asia: coupling of nutrition specific interventions with nutrition sensitive measures essential. *Mater. Child Nutr.* 12 (S1), 72–90.
- Yosef, S., Jones, A.D., Chakraborty, B., Gillespie, S., 2015. Agriculture and nutrition in Bangladesh: mapping evidence to pathways. *Food Nutr. Bull.* 36 (4), 387–404. <https://doi.org/10.1177/0379572115609195>.
- Zaidi, Y., Farooq, S., et al., 2018. Rural Women in Pakistan. Status Report 2018. UN Women Pakistan and National Commission on the Status of Women.