

Implementing small-scale poultry-for-nutrition projects: Successes and lessons learned

Stella Nordhagen¹  | Rolf Klemm^{2,3}

¹Africa Regional Office, Helen Keller International, Dakar, Senegal

²Headquarters Nutrition Division, Helen Keller International, Washington, District of Columbia, USA

³Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA

Correspondence

Stella Nordhagen, Helen Keller International, 122 Toundou Rya, BP 29.898, Dakar, Senegal.

Email: snordhagen@hki.org

Funding information

Global Affairs Canada, Grant/Award Number: 7059619

Abstract

This paper examines Helen Keller International's model for nutrition-sensitive poultry production using a programme implemented in four diverse African contexts—three rural and one urban. Consecutive cross-sectional surveys conducted every 5 months among ~15% of participating households show that despite project-provided training and inputs, there was only limited uptake of many “best practices.” Few households constructed improved henhouses; vaccination rates varied and were highest when support was provided. Poultry mortality was high. Egg productivity remained average for village poultry systems, and egg consumption remained low (two to six eggs consumed per household per fortnight). However, children whose mothers were exposed to project messages on nutrition were more likely to eat eggs, and consumption was consistently higher among households with chickens. Women's involvement in chicken rearing was widespread, but their control over revenues from the sale of poultry products was limited. Key lessons learned from implementation were as follows: (a) strong behaviour change communication is needed to encourage egg consumption, (b) nutrition-sensitive village poultry programmes should often focus more on improved practices than improved breeds, (c) supporting women's chicken production is not a route to empowerment without complementary activities that directly support women's ownership and decision making. There is also a need for rigorous research on the role of village poultry in livelihoods, food systems, and consumption as well as the structure of poultry and egg markets in low-resource areas.

KEYWORDS

animal source foods, eggs, gender, nutrition, nutrition-sensitive agriculture, small-scale poultry production

1 | INTRODUCTION

There is renewed interest in poultry production as a means of improving nutrition among young children and women and increasing income. Though poultry meat is also a nutritious animal-source food (ASF), eggs are considered particularly promising from a nutrition standpoint (Iannotti, Lutter, Bunn, & Stewart, 2014). Eggs are a source of critical nutrients (including essential fatty acids, proteins, choline, vitamins A and B12, and selenium) at levels above or comparable with those of other ASFs but are more affordable. Described as having a “nearly

perfect balance of nutrients” (Applegate, 2000), daily consumption of eggs by young children has been shown to improve linear growth (Iannotti et al., 2017), and poultry ownership has been found to be positively associated with poultry meat consumption (Azzari, Zezza, Haile, & Cross, 2015) and nutrition outcomes in children (Headey & Hirvonen, 2016).

There are many practical advantages to poultry as an ASF. Eggs are easily prepared in numerous ways. Chickens can be raised on short cycles, laying eggs at 6 months of age or sooner, and produce regularly. They can be raised in a range of environments with limited inputs

and are more efficient at converting feed to high-quality food and have a smaller environmental footprint than most other livestock (Steinfeld et al., 2006; Upton, 2004; Xin et al., 2011). Income from egg or poultry meat sales can be more regular and steady than that from crops or large-animal meat, as village chickens lay multiple times a year (Mapiye et al., 2008); an egg can be sold without slaughtering an animal; and birds' small size and rapid production cycles make households more likely to slaughter or sell them than larger livestock (Kariuki, Njuki, Mburu, & Waithanji, 2013). Finally, as chickens are smaller, lower value livestock, it can be more culturally feasible for women to own chickens than large animals such as cattle (Guèye, 2000; Iannotti et al., 2014; Mapiye et al., 2008).

Despite these benefits, proven models for boosting egg and chicken production among poor households and encouraging consumption by young children (e.g., Murty, Rao, & Bamji, 2016) are few. More evidence on what works, what does not, and why is needed. Lessons and experiences from Helen Keller International's (HKI's) "Enhanced Homestead Food Production" (EHFP) programme, one of the pioneering approaches to nutrition-sensitive agriculture (Haselow, Stormer, & Pries, 2016), may help fill this gap. Over the past 30 years, HKI has been using this integrated approach to address undernutrition in women and young children, especially among poor households. EHFP began with homestead gardening for improved consumption of vitamin A-rich fruits and vegetables and added a poultry-raising component in 2001 to provide animal protein via meat and eggs. Programme design also recognized that chickens could help raise household incomes and offer an income stream to complement that from crop production, potentially filling gaps during emergencies or the agricultural "lean season" (Leroy & Frongillo, 2007; Murphy & Allen, 2003).

This paper describes HKI's approach to nutrition-sensitive poultry production within EHFP. It draws on an EHFP programme implemented by HKI in four countries in Africa from 2013 to 2016 to describe the poultry-for-nutrition intervention, summarize implementation lessons, and suggest improvements in future programming. Data from a series of monitoring surveys implemented in each country are used to present indicators of poultry production and consumption during the programme.

2 | DESCRIPTION OF INTERVENTION

2.1 | Overview of EHFP

A detailed description of HKI's EHFP approach is available elsewhere (Haselow et al., 2016). Briefly, HKI uses a community-based approach to provide participants with extension services and start-up inputs in collaboration with local non-governmental organizations and government agencies. Local staff train a group of farmers, approximately 75–100% of whom are women, via community-based platforms. Group leaders are identified through participatory processes: Those interested nominate themselves, and their nominations must be supported by fellow community members. They then act as resource farmers and provide technical assistance to others in their communities. The same women (and sometimes men) who participate in

Key messages

- Productivity, egg consumption, and uptake of best poultry-rearing practices are challenging to increase.
- Egg consumption was higher among those exposed to project messages on nutrition and in households with chickens.
- Women were widely involved with poultry but had limited control over revenues from the sale of products.
- Poultry-for-nutrition projects should emphasize strong behaviour change communication to encourage egg consumption.
- Empowering women through chicken production requires improving their ownership and decision-making power.

agricultural and poultry-rearing activities receive nutrition social behaviour change communication (SBCC) promoting the consumption of home-produced micronutrient-rich foods, particularly by young children and pregnant and lactating women. Over time, it is hoped that these women will serve as agents of change, using their new knowledge and skills to help improve nutrition in their communities. Programmes also include activities to encourage women's empowerment and emphasize the inclusion of marginalized families (e.g., low income or caste).

2.2 | Poultry component of EHFP

With respect to the poultry-raising component of EHFP, HKI adapts its strategy to the specific context. In most cases, HKI implements EHFP projects in areas where many households already raise poultry, but often as a secondary endeavour to their main livelihood, with minimal resource input; this aligns to typical village poultry systems (Wong et al., 2017). Birds are mainly indigenous, sometimes mixed with improved breeds, and kept in small flocks (five to 10 birds per household). Chickens scavenge and are rarely provided with high-quality feed; if additional food is given, it is usually kitchen leftovers or cheap grains. Henhouses are rare; when used, they are often poorly constructed. Farmers thus lose many birds to disease and predators (Guèye, 2000). Access to inputs such as vaccines, technical advice, and markets is often limited (Guèye, 2000). The productivity of village poultry, often only 10–12 eggs per hen during each of three cycles per year, is low as a result of the above characteristics (Ahuja & Sen, 2007).

In such contexts, HKI's poultry-raising component focuses on introducing improved production methods through hands-on community-based training (for an example curriculum used in Tanzania, see Muhairwa, Msoffe, Mtambo, & Ashimogo, 2015). Training content includes how to (a) prepare nutritious feed using local ingredients, (b) make a coop/henhouse from local materials, (c) take measures to prevent and control disease, (d) improve egg production, and (e) separate children from animals. Sometimes, projects provide chicks, help arrange for vaccinations, or provide inputs for coop building.

2.3 | Four-country case study programme

From 2013 to 2016, HKI implemented the Creating Homestead Agriculture for Nutrition and Gender Equity Project (CHANGE), in Burkina Faso, Tanzania, Senegal, and Cote d'Ivoire with funding from Global Affairs Canada. Its programme design was informed by the results of an earlier project in Burkina Faso (Olney et al., 2016; Olney, Pedehombga, Ruel, & Dillon, 2015). The goal was to improve the nutritional status of children and women of reproductive age by (a) increasing production, diversity, and consumption of nutritious foods; (b) improving women's access to and control over productive resources; (c) improving nutrition practices; and (d) increasing income through sales of surplus production.

Across all four countries, participants were encouraged to adopt home gardens to grow micronutrient-rich crops to feed their families (particularly young children). Nutrition SBCC was centred on a revised Essential Nutrition Actions and Essential Hygiene Actions (ENA/EHA) toolkit (Guyon, Quinn, Nielsen, & Stone-Jimenez, 2015), with close attention to building community agents' skills for facilitating interactive discussions and counselling. Messages were delivered by trained volunteers through once- or twice-monthly group discussions as well as home visits, radio programmes, and community events. In Cote d'Ivoire and Senegal, a gender-transformative curriculum was also used to shift local gender norms (HKI, 2015).

2.4 | Context-specific poultry component of the CHANGE programme

With respect to the poultry-related intervention, CHANGE sought to increase production through improved practices and/or improved breeds. Because a significant increase in meat consumption was unrealistic in these low-resource contexts, the goal was to increase egg production and consumption by pregnant and lactating women and young children. Thus, in each of the four countries, SBCC strategies promoted consuming eggs and feeding them to children 6–23 months, with minimal focus on the sale of surplus eggs or meat.

Despite these similarities, numerous adaptations were made for specific contexts. Table 1 summarizes the characteristics of the

intervention areas, participants, and poultry production model across the four countries.

In Burkina Faso, CHANGE was implemented in 60 villages in the mainly agro-pastoral Eastern region, reaching about 2,400 participants, and targeting households with children < 12 months of age at baseline (March–May 2014). A baseline survey of the area revealed high levels of household food insecurity, child stunting, and anaemia (Becquey et al., 2014). Participants received two local-breed hens per household but had to pay a part (~USD 1.00) of the cost of each. They were also invited to two group trainings on improved practices. Communities were trained to construct village-level poultry facilities on their own; once constructed, these were provided with 10 local-breed hens and one local rooster.

In Tanzania, CHANGE was implemented in Sengerema and Ukerewe districts of Mwanza Region, bordering Lake Victoria. The region depends mainly on agriculture and fishing. At baseline, this area also had high levels of household food insecurity, stunting among children 6–12 months, and anaemia among children 6–12 months. Fifteen wards were covered by the project, including 1,232 participants (women with children 6–12 months of age at baseline; Abu-Jawdeh et al., 2015). In Tanzania, community-level henhouses were not established because of high population density and scarce land. The project instead identified and trained “poultry resource farmers” (PRFs), selecting people (primarily women) with an affinity for poultry production to serve as models of best practices. These PRFs then provided training and support to about 30 other women. The project distributed chickens to households where the participating woman had none at baseline, around 30% of the total. Each of those households received two hens and one rooster, aged about ~5 months, so that the hens were old enough to be disease resilient and begin producing eggs. Participating households were then regularly supervised by agricultural extension agents and supported by the PRF. Both the Tanzania and Burkina Faso projects were implemented as cluster randomized controlled trials (RCTs), led by the International Food Policy Research Institute (IFPRI). Poultry activities did not vary across the EHFP intervention arms of either RCT.

In Cote d'Ivoire, the project was implemented in four departments in the north: Boundiali, Korhogo, Bondoukou, and Nassian. The areas

TABLE 1 Summary of CHANGE project intervention areas, participants, and poultry model used

Characteristics	Burkina Faso	Côte d'Ivoire	Senegal	Tanzania
Intervention zones	Eastern region, Fada District	North, north-east, Savanes and Zanzan regions	Dakar region, Guédiawaye District	Lake Victoria, Ukerewe and Sengerema districts
Average rainfall (mm/year)	700–800	900–1,200	400–500	1,000–1,200
Agro-ecology	Sahelian, one short rainy season	Guinea savanna, one long rainy season	Urban, Sahelian	Upland, humid zone, bimodal
Population density	Low	Low	Extremely high	High
No. of direct participants	2,400 in 60 villages	2,816 in 42 villages	1,300 in 2 zones	1,232 in 15 wards
Poultry model	<i>Village level:</i> (56/60 villages) local hens and 1 rooster provided <i>Individual level:</i> (some) local hens provided, training on improved practices	<i>Village level:</i> testing 3 systems (local, laying hens, broilers) <i>Individual level:</i> training on improved practices	<i>Individual level:</i> improved-breed laying hens, compact henhouse, training on improved practices	<i>Individual level:</i> (some) local hens, training on improved practices

Note. CHANGE: Creating Homestead Agriculture for Nutrition and Gender Equity Project.

are all primarily agricultural, with high household food insecurity (83.4% at baseline); stunting among children under 5 at baseline ranged from 27% to 46% across districts (Ouattara, 2014). There were 2,876 project participants (women with children < 5 years of age) from 42 villages. In Cote d'Ivoire, greater attention was given to income generation, and the project worked with pre-existing women's agricultural groups to promote more nutrition-sensitive crops, launch collective chicken raising, and encourage the women to use funds from selling their produce to buy the inputs needed for the future, thereby enhancing sustainability and autonomy. Village-level henhouses were constructed in each village and provided with chickens; women's groups were then given training in improved poultry-rearing practices. Across the villages, three different systems for poultry production were tested for performance and feasibility: (a) an intensive system with laying hens for egg production (in two villages), (b) an intensive system with broilers for meat production (in four villages), and (c) a semi-intensive system with local-breed hens and improved roosters in 36 villages. As the flocks grew, some chickens were distributed to individual participants, but there was no direct provision of chickens, as in other countries.

In Senegal, the EHFP model was adapted and pilot tested in an urban setting, encouraging women to produce eggs in their own homes using improved compact henhouses. The target area, Guédiawaye District, is characterized by high population density, low-rise concrete buildings mixed with small courtyards, a poor population, seasonal flooding, and pollution. A total of 1,300 women were reached in two waves. Each woman received a moveable, dual-level henhouse, one-on-one training on improved poultry-rearing practices, three improved-breed (Holland) laying hens, and one improved-breed rooster. In addition, each woman was expected to contribute a local hen to the flock, which could incubate certain eggs to produce chicks while allowing the more productive hens to continue laying.

3 | METHODS

As part of CHANGE, HKI designed and conducted a series of cross-sectional monitoring surveys among a sample of programme beneficiary households to assess implementation performance, intervention coverage, and uptake across the four countries. For each survey, a sample of ~15% of participating households in each village/neighbourhood was selected randomly from the beneficiary list maintained by HKI for that village/neighbourhood. "Beneficiaries" were defined as those targeted to receive services by the project. Surveys were implemented three times per country (except in Tanzania, where only two were done), starting about 1 year after programme implementation, and repeated every 4–5 months (Table 2).

3.1 | Data collection

Data were collected by teams of trained external enumerators in the local language using a tablet-based questionnaire. Primary respondents were the household's main project beneficiary, as identified on the HKI participant list. Information was obtained on project participation and agricultural, poultry-rearing, and nutrition practices. Observable

practices, such as the use of a chicken coop or a feeding tray, were validated during the interview. All other data, including on mortality of chickens, vaccination rates, and egg use, were based on responses to interview questions. Recall periods varied depending on the frequency of the event in question: For frequent events, such as egg production, they referred to short intervals (2 weeks); for rare events, such as chicken death or sale, they referred to longer intervals (4 months). These periods were validated through internal piloting on the basis of feasibility of recall. The survey also included open-ended questions to ascertain participants' reasons for not applying certain project-promoted practices. Information on consumption of eggs in the past 7 days for young children and in the past 24 hr for women was collected via simple recall questions posed to the woman herself/the mother, using standard formats (e.g., Food and Agriculture Organization of the United Nations & FHI360, 2016). All questions about children's nutrition referred to the respondent's youngest child. Data collection instruments were nearly identical across countries and times.

Additionally, in Cote d'Ivoire, a secondary study by project staff (Traoré, 2016) collected data on cost of inputs, profit, and mortality associated with each of three poultry production models, over a year-long period, with the aim of determining the most cost-efficient model. These data are included only where specifically noted. Data from the IFPRI-led impact evaluations in Burkina Faso and Tanzania are not used here, as they are pending publication (Olney, Bilznashka, Becquey, Birba, & Ruel, 2017).

3.2 | Statistical analysis

Descriptive statistics were generated for key poultry-related variables for each consecutive monitoring survey per country. Open-ended responses were coded using Excel. Using the monitoring survey data, we examined associations between chicken ownership and egg consumption by women and children using Pearson's χ^2 test. Data were analysed using StataSE12.

4 | RESULTS

Analysis of the monitoring survey data taken in Jan–Feb 2015, midway through the project, shows 68–80% of project participants reporting participation in ENA/EHA SBCC sessions in the prior month, 71–90% in gardening training in the prior 4 months, and 50–56% in poultry-related training in the prior 4 months. Table 2 presents poultry production and consumption over the three consecutive monitoring surveys. There was no clear trend in flock size increasing during the project. Based on participant recall, mortality remained high throughout the project period: Approximately 45% of participants in each consecutive survey reported losing at least one chicken in the prior 4 months, and there was no clear decline over time.

Considering practices, the project encouraged the use of henhouses or coops for improved human hygiene and poultry productivity. However, monitoring data showed that (with the exception of Senegal) rates of fully enclosed chicken rearing never exceeded 6% and showed no clear upward trend during the project. Aside from the urban context of Senegal, where compact henhouses were

TABLE 2 Trends in CHANGE poultry-related indicators, based on three monitoring surveys conducted over 1 year of implementation

Monitoring wave	Burkina Faso			Cote d'Ivoire			Senegal			Tanzania		
	1	2	3	1	2	3	1	2	3	1	2	3
Survey period	Feb 2015	Jul 2015	Dec 2015	Feb 2015	Jul 2015	Feb 2016	Feb 2015	Jul 2015	Jan 2016	Jan 2016	Sep 2015	Jan 2016
No. of households (HH)	378	378	377	401	399	395	73	153	195	NA	150	143
Production												
Percentage keeping chickens	92	88	89	56	77	65	59	100	96	NA	63.3	70.1
Median number of adult chickens (among those keeping)	12	12	14	5	4	4	4	5	4	NA	3	3
Percentage of chicken keepers with 10 or more adult chickens	63	59	67	27	24	28	4	19	14	NA	4	27
Use of improved practices	NA											
Henhouse/coop present (%)	67	78	66	62	66	77	100	98	98	NA	70	52
Henhouse is "improved" (among those with henhouse/coop: %)	37	66	34	45	40	71	—	—	100	NA	41	15
Chickens fed supplementary feed (%)	99	99	87	78	94	99	93	100	98	NA	63	71
Practising fully cooped rearing of chickens (%)	6	0	0	3	2	1	58	84	83	NA	2	0
Percentage losing chickens to illness in past 4 months	39	40	44	42	44	51	47	41	50	NA	39	48
Percentage (of those with chickens) producing at least one egg in past 2 weeks (Wave 1: past week)	63	75	62	49	75	58	70	95	83	NA	42	27
Median number of eggs produced (among those producing)	9	12	7	8	10	3	10	30	15	NA	6	12.7
Avg. number per adult hen (among those producing)	1.3	2.1	2.1	1.3	2.4	1.1	2.3	7.6	6.7	NA	2.5	4.9
Portion selling eggs in last 2 weeks (Wave 1: last week; %)	0	3	1	3	2	1	0	4	4	NA	3	3
Portion selling at least one chicken in last 4 months (Wave 1: last month; %)	35	37	32	32	30	38	5	0	7	NA	7	14
Median earnings from chicken sales in last 4 months (USD among earners; Wave 1: last month)	16.48	10.03	10.03	10.41	11.03	8.36	55.52	NA	8.36	NA	6.88	1.13
Reporting food was a main item purchased with garden/poultry revenue (%)	29	31	18	54	68	47	100	NA	35	NA	82	84
Reported purchasing eggs with revenue (%)	2	5	6	10	25	20	0	NA	0	NA	0	3
Gender and decision making												
Percentage of HH poultry owned by main project participant (woman)	40	40	27	74	65	79	46	43	53	NA	63	64
Of those earning revenue from chickens, percentage of HH in which woman has full decision-making power over its use	18	77	59	62	53	48	100	100	94	NA	71	21
Of those earning revenue from chickens, portion of HH in which woman has full or partial decision-making power over its use (%)	57	86	84	75	70	65	100	100	94	NA	86	49
Consumption												
Percentage of women consuming eggs (past 24 hr)	13	35	27	21	41	26.6	37	69	71	NA	8	9
Percentage of children 6 months to 5 years consuming eggs (past 7 days)	55	80	64	43	64	28 ^a	65	87	73	NA	25	38
Avg. number of eggs consumed by HH in last 2 weeks	2.7	5.5	2.5	2.2	5.9	2.6	5.3	21.8	12.5	NA	2.1	2.0
Avg. number of eggs consumed by youngest child in last 2 weeks (Wave 1: last week)	1.9	3.2	2.1	1.0	2.1	1.3	2.5	7.2	5.4	NA	0.5	1.2
Portion consuming a chicken in last 2 weeks (Wave 1: last week; %)	64	51	52	44	36	38	7	15	31	NA	22	33

Note. CHANGE: Creating Homestead Agriculture for Nutrition and Gender Equity Project; NA: Not applicable.

^aData refer to the past 24 hr.

provided and scavenging was constrained by geography, fully enclosed chicken rearing proved untenable. Considering uptake of partially enclosed chicken rearing, about two thirds of participants (52–78%) in rural areas had coops and enclosed chickens at night, allowing them to range during the day to find their own feed. However, most of these coops/henhouses were not considered “improved” (defined as having a door, a roof, and ventilation) and thus likely did not convey as great of benefits in terms of chicken health, productivity, and environmental sanitation. The original objectives of encouraging coop use were thus largely unmet.

There were several reasons that improved coop/henhouse use was limited. In open-ended survey questions about reasons for not using coops, about 20% participants cited a lack of resources for construction; few viable options existed for coops that were both high quality (including able to withstand the rainy season) and affordable. However, 15–40% of participants did not feel that such henhouses were useful. Their survey responses cited reluctance to house chickens outside of the family compound amid fears they would be stolen or eaten by animals. Non-coop-using participants also cited the economics of providing feed: Scavenging chickens found most of their food themselves, with little effort or investment by the owner, whereas a fully enclosed chicken needed to be fed. Although it was common to give additional feed, this was often just leftover grains (i.e., leaving out a dirty cooking pot for chickens to find).

Most countries also saw challenges in achieving high vaccination rates. These were initially high in Burkina Faso and Senegal, with between 73% and 95% of households reporting in the first two monitoring surveys that all their chickens had been vaccinated in the prior 6 months. However, these rates fell to around 50%, level with rates in the other two countries, at the end of the project, when less support was provided. The project model had generally been to link participants with existing suppliers (e.g., village vaccinators) through free or subsidized services commissioned by the project, with the expectation that participants would return to them independently later on. However, this did not always occur once services were not subsidized. Additionally, there was some confusion about vaccinators' scheduled visits to villages, and the project suffered from a nationwide counterfeit vaccine problem in Tanzania. Improving vaccination coverage thus likely would require deliberate interventions to stabilize quality supply while also supporting demand (i.e., farmers' motivation to seek such services).

The main objective of chicken rearing within this nutrition project was to produce eggs for home consumption. However, likely due to the limited uptake of improved practices, productivity remained about average for village poultry systems, with only about 60% of chicken owners (range 27–95%) reporting any egg production in the past 2 weeks in the monitoring surveys and no obvious trend during the project. Among those producing, the median number of eggs produced (seven to 10 per fortnight) and produced per adult hen (one to four per fortnight) in the rural areas were about average or slightly above for village poultry systems (Fotsa, Sørensen, & Pym, 2014; Mapiye et al., 2008), well below that of more intensive systems. However, this must be interpreted in the context of households' cost–benefit calculus: With few production inputs, even low output can be a sufficient return on investment. This was even more the case here, as some

initial investments (e.g., chickens and, in Senegal, coops) were provided by the project. The exception to the low productivity was Senegal, where intensive production using laying hens was practised and median productivity reached as high as 30 eggs per household per fortnight. For three of four countries, egg production was highest at the beginning of the final year of the project (July 2015) but declined by its end.

Egg consumption remained low in the three rural settings, with two to six eggs reported consumed by the household in the prior fortnight, far less than the number produced. Typically only 13–35% of women reported eating egg in the 24 hr prior to the survey, with this never exceeding 50% of women and being notably lower (8–9%) in Tanzania. Again, the intensive system used in Senegal saw much higher levels of consumption, reaching over an egg a day (for the household) at its peak. Encouragingly, in each country, about half of the eggs eaten in the household were reportedly fed to the youngest child. Household consumption of self-produced chickens was also fairly high, ranging from 31% to 52% of households in the prior 2 weeks at project end. Consumption among young children in the prior 7 days ranged from 25% to 80%, which compares favourably with overall practices in Africa (consumption in the past 24 hr averaging 12% of 6–24 months old; Iannotti et al., 2014).

Eating eggs and feeding them to children are typically uncommon in most of these settings (Iannotti et al., 2014)—particularly in rural areas, where there are often taboos related to egg consumption. In Burkina Faso, for example, formative research conducted as part of the project revealed the belief that if a young child ate eggs, he or she would become a thief as an adult (Keith, 2014). However, project SBCC regularly reinforced the importance of eating eggs and, particularly, feeding them to children. This seemed to influence egg consumption: Knowledge among participants that eggs were a healthy addition to a young child's porridge (a key SBCC message) increased over the project, from 12–41% in Year 2 to 23–77% at project end. Moreover, as shown in Table 3, there was a widespread association between a woman's participation in nutrition SBCC and egg consumption by herself and her young child: The reported prevalence of egg consumption is notably higher, in some cases twice as common, among those participating in nutrition SBCC in the prior month. This difference is significant for 16 of 22 comparisons examined. Table 3 also confirms another expected result: Egg consumption is consistently higher among those with chickens, with the difference being significant in 12 of 18 comparisons examined.

Among households producing eggs, sales remained very rare: Fewer than 4% of producing households reported selling eggs, with self-reported median revenues of USD 0.22–3.60 in the past 2 weeks, even in Senegal where production was high. Eggs that were not eaten were generally kept in the hopes of hatching. This was likely the result of several factors. First, the emphasis of SBCC on consuming eggs may have “stigmatized” their sale. Second, weak market infrastructure and higher prices than other foods in rural areas limited egg demand. Third, in urban Senegal, the market was saturated by eggs supplied by large-scale producers. Low levels of production also made it difficult to efficiently market eggs. Finally, there was a strong desire to hatch more chickens from the eggs. Selling chickens was more common, done by about one third (30–38%) of participating households in Burkina Faso

TABLE 3 Associations between SBCC, chicken ownership, and egg consumption

Country	Survey round	Group / Significance	SBCC association with		Chicken ownership association with	
			Women's egg consumption	Children's egg consumption	Women's egg consumption	Children's egg consumption
Burkina Faso	1	With	15%	60%	14%	57%
		Without	7%	40%	7%	27%
	$P(\chi^2)$	0.059	0.001	0.28	0.001	
	2	With	60%	86%	37%	81%
		Without	40%	66%	25%	66%
	$P(\chi^2)$	0.001	0.000	0.123	0.02	
3	With	31%	69%	29%	65%	
	Without	16%	50%	10%	5%	
$P(\chi^2)$	0.004	0.001	0.009	0.079		
Cote d'Ivoire	1	With	25%	45%	27%	54%
		Without	6%	32%	13%	27%
	$P(\chi^2)$	0.000	0.057	0.001	0.000	
	2	With	45%	60%	46%	60%
		Without	21%	27%	23%	34%
	$P(\chi^2)$	0.000	0.000	0.000	0.000	
3	With	30%	31%	30%	35%	
	Without	19%	21%	19%	16%	
$P(\chi^2)$	0.023	0.175	0.018	0.006		
Senegal	1	With	42%	71%	42%	72%
		Without	28%	46%	30%	50%
	$P(\chi^2)$	0.251	0.104	0.302	0.135	
	2	With	75%	83%		
		Without	56%	71%		
	$P(\chi^2)$	0.024	0.122			
3	With	74%	77%			
	Without	52%	43%			
$P(\chi^2)$	0.031	0.003				
Tanzania	2	With	10%	32%	11%	26%
		Without	4%	7%	4%	22%
	$P(\chi^2)$	0.293	0.001	0.134	0.538	
	3	With	14%	42%	12%	45%
Without		0%	32%	2%	24%	
$P(\chi^2)$	0.006	0.244	0.072	0.02		

Note. Table compares rates among those with chickens/those participating in SBCC with rates among those without chickens/not participating; probabilities associated with χ^2 tests are reported in bold for $P < 0.1$. All data come from the monitoring surveys described in the methods section. No data reported for Senegal, Waves 2 and 3, as nearly all households owned chickens. SBCC: social behaviour change communication.

and Cote d'Ivoire in the prior 4 months, with median earnings of about USD 10, a meaningful amount in such resource-poor areas. Such revenues may have indirectly impacted nutrition: 18–68% of households earning revenues from poultry or garden products in these two countries (and over 80% in Tanzania) reported using that money to buy food (primarily fish but also salt, oil, and vegetables). Interestingly, about 20% of households in Cote d'Ivoire reported using the money earned from poultry raising and gardening to purchase eggs to eat, whereas this was very rare (0–6%) in the other countries.

Considering breed choice, egg productivity and consumption were, as expected, much higher for the improved-breed laying hens used intensively in Senegal. This suggests a role for improved breeds in poultry-for-nutrition projects, but the trade-offs against indigenous breeds must be weighed carefully, especially in contexts with weak poultry extension services. Improved-breed chickens tend to be more susceptible to disease than their indigenous equivalents and do not fit well within most household systems. Indeed, an earlier HKI project in Tanzania suffered considerable losses due to high mortality of improved chicken breeds; experience has also shown that village production systems can be ill equipped to provide the improved feed and care required for high productivity in improved breeds. As captured in a recent review (Wong et al., 2017), local-breed chickens are often an integral part of low-resource village production systems, resilient to

local diseases, adapted to the climate, and offering a high return relative to the low investment required.

In CHANGE Cote d'Ivoire's comparative evaluation of three different village-level production systems (Traoré, 2016), the improved-breed laying hens were a clear underperformer: Mortality levels were higher, and the hens slower to mature, more complex to raise, and less efficient at converting feed. Although the laying hens produced considerably more eggs than did local breeds, it was insufficient to outweigh these costs. Local chickens were thus identified as the best option for egg production in low-resource homestead-based systems. In contrast, a village-level system aimed at generating revenue was found to be better served by a focus on meat production using broilers, which were quick to reach maturity and by far the most lucrative. A village-level operation could earn over USD 1,000 in profit in a year, more than twice that earned by a laying hen operation. Smaller scale broiler production also proved profitable in Senegal, where participants independently began adding broiler chicks to their flocks. The direct impact of such production on children's nutrition is likely limited, as such birds are typically sold, not consumed, but there could be an indirect income effect.

Gender equity was a key concern for CHANGE, which aimed at empowering women. Poultry rearing, widely practised by African women (Guèye, 2000), can offer women the chance to earn additional

income. However, poultry rearing demands time and labour, which are often overwhelmingly supplied by women and children—who may have little control over the resulting revenues (Dumas, Maranga, Mbullo, Onono, & Young, 2018). In CHANGE, there were fairly high levels of women's involvement in chicken rearing: Women owned two thirds of birds in Cote d'Ivoire and Tanzania and about 40% in Burkina Faso and Senegal. However, women's share of household poultry holdings did not generally increase over the course of the project. Moreover, women's involvement in decision making on the use of any resulting revenues proved hard to increase in Cote d'Ivoire and Tanzania. In Tanzania, the final monitoring survey showed that in only 21% and 49% of surveyed households did women have full or partial control over the revenues resulting from chicken sales, respectively. Additionally, a negative trend in women's decision-making ability over time in two of four countries suggests that “capture” of poultry rearing's benefits by men may have played a role. Such results have implications for not only women's empowerment but also nutrition, as evidence suggests closer links between female livestock holdings and children's nutrition than male holdings (Jin & Iannotti, 2014). Nutrition-sensitive poultry projects thus likely need to place more explicit focus on gender equity to affect change.

5 | LESSONS LEARNED AND NEXT STEPS

The CHANGE project and HKI's prior 15 years of experience in this area have shown that poultry rearing for egg production can be integrated into nutrition-sensitive agriculture projects but that taking some key points into account when designing such projects may help improve nutrition outcomes.

First, the focus cannot be placed on production alone: There needs to be a strong SBCC component to encourage consumption. As noted above (Table 3), attendance at such sessions was positively associated with consumption throughout the CHANGE countries. Strong, focused SBCC is necessary to overcome both taboos against egg consumption by young children and an understandable motivation for poor households to save, rather than eat, eggs: After all, consuming an egg represents a chicken that cannot be raised and sold and is thus an economic loss. Useful approaches in this area include positive deviance (i.e., providing examples of children who have eaten eggs and turned out healthy), aspirational messaging using economic motivations (i.e., emphasizing the economic benefits of a healthy, well-nourished child), approaches that connect a chicken to a child in the caregiver's mind (i.e., officially providing the chicken to the child, not the parents, or describing it as “the child's chicken”), and SBCC that does not discourage egg or chicken sales but still stresses the importance of using income to buy ASFs for children.

Second, the most efficient area of focus in most cases is improved practices, not improved breeds. Delivering chickens is logistically challenging, mortality of young birds can be high, and outsider providers of chickens can be blamed for not only these birds' deaths but also subsequent mortality of other pre-existing chickens—CHANGE Tanzania experienced this. Moreover, improved breeds can suffer from high mortality and poor adaptation to local practices. Where there is a desire to increase ownership levels, an approach using vouchers for

local purchase or postpurchase reimbursement may be a better option. Improved breeds are a more viable option in urban settings, such as CHANGE Senegal, where they are easier to source, are raised intensively and enclosed, and there is access to inputs, support, and markets for sale. On the other hand, training may be preferable to any kind of distribution: Improvements in poultry husbandry, such as how to enrich feed or improve housing, can significantly improve productivity (Mapiye et al., 2008). Although these approaches offer less risk and lower costs, they are not easy, and there is a need to develop more easily adopted “best practices” for low-resource areas.

Third, supporting chicken production by women is not an automatic route to their empowerment without complementary activities that directly support women's ongoing ownership and decision making around the use of their production and any resulting income. Such activities will likely need to involve both women *and* men and go deeper than chickens and eggs alone to tackle underlying gender norms that constrain women's decision-making power in many developing-country settings.

There are a number of promising directions for future work on this topic. There is a need for more rigorous research that quantifies the effects of small-scale poultry on income, food security, access, and consumption of poultry products by households, women, and young children across varying rural and urban contexts. In addition, there is a need to better understand which households are likely to sustain and expand on poultry inputs they receive when direct support ends and how to better support that transition. It would also be helpful to address the methodological problems associated with measuring the impact of small-scale poultry interventions on nutrition outcomes when they are part of a larger package of interventions, as was the case with the CHANGE project. Programmatically, it would be useful to devise novel ways to improve the separation between humans and chickens: Past research (e.g., George et al., 2015; Headey & Hirvonen, 2016) has found negative associations of close-quarters chicken rearing with nutritional outcomes, likely due to exposure to faeces, but poor households (as in CHANGE) often find enclosed chicken rearing to be infeasible.

Finally, poultry-for-nutrition projects have rarely succeeded at building in a marketing component. Indeed, as shown in this project, participants rarely sell chickens and even less frequently sell eggs, even when production levels would allow this. However, market-connected approaches are likely to be important for long-term sustainability and greater impact. Although there are opportunities for marketing poultry meat in urban areas, it is unclear that sufficient demand for eggs or meat exists in many rural areas to support widespread marketing; as noted by Headey, Hirvonen, and Hoddinott (2017), eggs in Africa are a relatively expensive source of nutrients, nine to 10 times as expensive as staples. In urban areas, there is growing competition because of increasing efficiency in broiler-meat production. Meat from indigenous chickens often commands a price premium (Guèye, 2000), but farmers in most rural areas face severe constraints in taking advantage of such opportunities. They also face high transaction costs due to market imperfections stemming from poor physical and institutional infrastructure as well as asymmetric information. There is thus a need to understand the structure of poultry meat and egg markets in low-resource areas and to identify potential opportunities for helping

small-scale producers market their poultry. In this context, family poultry systems must be viewed as part of the wider food system in which households participate as both producers and consumers.

ACKNOWLEDGEMENTS

We extend our sincere thanks to Chessa Lutter and to an anonymous reviewer for comments on an earlier draft of this manuscript. We also acknowledge contributions made by colleagues at Helen Keller International, particularly Abdoulaye Traore, Abdoulaye Pedehombga, Khadidjatou Thiam, Elias Ponsiano, and Tom van Mourik. We also wish to acknowledge the International Food Policy Research Institute, which collaborated with HKI on the CHANGE project.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

CONTRIBUTIONS

SN analysed the data and prepared the manuscript. RK contributed to and reviewed the manuscript. SN and RK approved the final manuscript for submission.

ORCID

Stella Nordhagen  <http://orcid.org/0000-0002-3801-3769>

REFERENCES

- Abu-Jawdeh, M., Becquey, E., Birba, O., Golan, J., Le Port, A., Olney, D., ... Van Den Bold, M. (2015). Helen Keller International's Creating Homestead Agriculture for Nutrition and Gender Equity (CHANGE) program in Tanzania. Report submitted to Helen Keller international. Washington, DC: IFPRI.
- Ahuja, V., & Sen, A. (2007). Scope and space for small scale poultry production in developing countries. Indian Institute of Management Working Paper 2007-12-02.
- Applegate, E. (2000). Introduction: Nutritional and functional roles of eggs in the diet. *Journal of the American College of Nutrition*, 19, 495S–498S.
- Azzari, C., Zezza, A., Haile, B., & Cross, E. (2015). Does livestock ownership affect animal source foods consumption and child nutritional status? Evidence from rural Uganda. *Journal of Development Studies*, 51, 1034–1059.
- Becquey, E., Birba, O., Golan, J., Le Port, A., Olney, D., Rawat, R., & Van Den Bold, M. (2014). Baseline report: Helen Keller International's Creating Homestead Agriculture for Nutrition and Gender Equity (CHANGE) program in Burkina Faso, unpublished, December 15.
- Dumas, S. E., Maranga, A., Mbullo, P., Onono, M., & Young, S. L. (2018). Men are in front at eating time, but not when it comes to rearing the chicken: Unpacking the gendered benefits and costs of livestock ownership in Kenya. *Food and Nutrition Bulletin*, 39, 3–27.
- Food and Agriculture Organization of the United Nations, & FHI360 (2016). *Minimum dietary diversity for women: A guide for measurement*. Rome, Italy: FAO.
- Fotsa, J., Sørensen, P., & Pym, R. A. (2014). Breeding and reproduction. In FAO (Ed.), *Decision tools for family poultry development, animal production and health guidelines No. 16* (18–25). Rome, Italy: FAO.
- George, C. M., Oldja, L., Biswas, S. K., Perin, J., Lee, G. O., Ahmed, S., ... Faruque, A. G. (2015). Fecal markers of environmental enteropathy are associated with animal exposure and caregiver hygiene in Bangladesh. *American Journal of Tropical Medicine and Hygiene*, 93, 269–275.
- Guèye, E. F. (2000). The role of family poultry in poverty alleviation, food security and the promotion of gender equality in rural Africa. *Outlook on Agriculture*, 29, 129–136.
- Guyon, A., Quinn, V., Nielsen, J., & Stone-Jimenez, M. (2015). *Essential Nutrition Actions and Essential Hygiene Actions training guide: Health workers and nutrition managers*. Washington, DC: USAID, JSI, Helen Keller International, CORE Group.
- 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. *Maternal and Child Nutrition*, 12(S1), 155–168.
- Headey, D., & Hirvonen, K. (2016). Is exposure to poultry harmful to child nutrition? An observational analysis for rural Ethiopia. *PLoS One*, 11, e0160590.
- Headey, D., Hirvonen, K., & Hoddinott, J. (2017). Animal sourced foods and child stunting. IFPRI discussion paper 01695. Washington, DC: IFPRI.
- Helen Keller International (HKI) (2015). *Cultivons les Relations*. New York, NY: Helen Keller International. Retrieved from <http://www.hki.org/sites/default/files/knowledge-resources/2016-Cultivons-les-Relations.pdf>.
- Iannotti, L. L., Lutter, C. K., Bunn, D. A., & Stewart, C. P. (2014). Eggs: The uncracked potential for improving maternal and young child nutrition among the world's poor. *Nutrition Reviews*, 72, 355–368.
- Iannotti, L. L., Lutter, C. K., Stewart, C. P., Gallegos Riofrío, C. A., Malo, C., Reinhart, G., ... Waters, W. F. (2017). Eggs in early complementary feeding and child growth: A randomized controlled trial. *Pediatrics*, 140, e20163459.
- Jin, M., & Iannotti, L. L. (2014). Livestock production, animal source food intake, and young child growth: The role of gender for ensuring nutrition impacts. *Social Science and Medicine*, 105, 16–21.
- Kariuki, J., Njuki, J., Mburu, S., & Waithanji, E. (2013). Women, livestock ownership and food security. In J. Njuki, & P. C. Sanganyo (Eds.), *Women, livestock ownership and markets: Bridging the gender gap in eastern and southern Africa*. (pp. 95–110). Abingdon: Routledge.
- Keith, N. (2014). Plan Stratégique en Communication pour un Changement Social et Comportementale en Nutrition - Project CHANGE Burkina Faso. Unpublished report provided to HKI Burkina Faso, Ouagadougou.
- Leroy, J. L., & Frongillo, E. A. (2007). Can interventions to promote animal production ameliorate undernutrition? *The Journal of Nutrition*, 137, 2311–2316.
- Mapiye, C., Mwale, M., Mupangwa, J. F., Chimonyo, M., Foti, R., & Mutenje, M. J. (2008). A research review of village chicken production constraints and opportunities in Zimbabwe. *Asian-Australasian Journal of Animal Science*, 21, 1680–1688.
- Muhairwa, A. P., Msoffe, P. L., Mtambo, M. M. A., & Ashimogo, G. (2015). *The guide for local chicken keeping in rural areas*. PANTIL Project Edition. Morogoro, Tanzania: Department of Veterinary Medicine and Community Health, Sokoine University of Agriculture. ISBN No 987-9987-525-01-0.
- Murphy, S. P., & Allen, L. H. (2003). Nutritional importance of animal source foods. *Journal of Nutrition*, 133, 3932S–3935S.
- Murty, P. V. V. S., Rao, M. V., & Bamji, M. S. (2016). Impact of enriching the diet of women and children through health and nutrition education, introduction of homestead gardens and backyard poultry in rural India. *Agricultural Research*, 5, 210–217.
- Olney, D. K., Bilzashka, L., Becquey, E., Birba, O., & Ruel, M. (2017). Adding a WASH Intervention and a lipid-based nutrient supplement to an integrated agriculture and nutrition program improved the nutritional status of young Burkinabé children. *FASEB Journal*, 31, 455.1.
- Olney, D. K., Bilzashka, L., Pedehombga, A., Dillon, A., Ruel, M. T., & Heckert, J. (2016). A 2-year integrated agriculture and nutrition program targeted to mothers of young children in Burkina Faso reduces underweight among mothers and increases their empowerment: A

- cluster-randomized controlled trial. *Journal of Nutrition*, 146, 1109–1117.
- Olney, D. K., Pedehombga, A., Ruel, M. T., & Dillon, A. (2015). A 2-year integrated agriculture and nutrition and health behavior change communication program targeted to women in Burkina Faso reduces anemia, wasting, and diarrhea in children 3–12.9 months of age at baseline: A cluster-randomized controlled trial. *Journal of Nutrition*, 145, 1317–1324.
- Ouattara, S. M. (2014). Rapport étude de base: Projet CHANGE. Report prepared for Helen Keller International, Abidjan, Cote d'Ivoire.
- Steinfeld, H., Gerber, P. J., Wassenaar, T., Castel, V., Rosales, M., & De Haan, C. (2006). *Livestock's long shadow, environmental issues and options*. Rome: Publishing Management Services, FAO Information Division.
- Traoré, A. (2016). Etude comparative de différentes approches d'élevage avicole du projet CHANGE. Unpublished report. Abidjan, Ivory Coast: Helen Keller International.
- Upton, M. (2004). The role of livestock in economic development and poverty reduction. PPLPI working paper #10. Rome: Publishing Management Group, FAO Information Division.
- Wong, J. T., de Bruyn, J., Bagnol, B., Grieve, H., Li, M., Pym, R., & Alders, R. G. (2017). Small-scale poultry and food security in resource-poor settings: A review. *Global Food Security*, 15, 43–52.
- Xin, H., Gates, R. S., Green, A. R., Mitloehner, F. M., Moore, P. A., & Wathes, C. M. (2011). Environmental impacts and sustainability of egg production systems. *Poultry Science*, 90, 263–277.

How to cite this article: Nordhagen S, Klemm R. Implementing small-scale poultry-for-nutrition projects: Successes and lessons learned. *Matern Child Nutr*. 2018;14(S3): e12676. <https://doi.org/10.1111/mcn.12676>