Effects of nutrition-sensitive child-owned poultry intervention on egg intake, anthropometry, gross motor development, anemia and morbidity status among young children in southern Ethiopia: A cluster-randomized community trial

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Introduction

Nutritionally poor cereal-based complementary diets and low intake of animal-source foods contribute to malnutrition and anemia in under two years old Ethiopian children.

- Nearly 4 out of 10 under-five children are stunted and 6 out of 10 are anemic.
- Eggs, relatively cheap animal source foods, are highly nutritious foods associated with better child health and nutritional status, yet intake among Ethiopian under two years old children is too low (17%).
- We hypothesized that a nutrition-sensitive child-owned poultry intervention would increase egg intake and improve health, nutritional and developmental status of under two children.

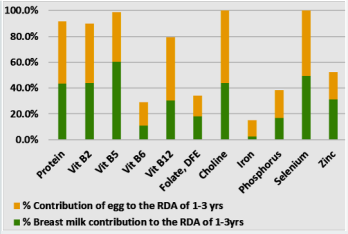

Figure 1. Nutrient contribution of an egg to fulfil daily requirement of children 1-3yrs

Methods

Study design
- Cluster randomized and controlled trial, commenced May to Nov 2018
- Target: Children of 6-18 months old; Average age at enrollment=9.6 months

Intervention Group (IG) (N=127)
- Training of Heath and agriculture extension workers (AEW) on nutrition-smart poultry
- "Chicken and Cage Gift Ceremony"
  - Children received two egg-laying local chickens vaccinated for New Castle disease
  - Children received night coop and materials for the construction of day cage materials
  - Caregivers promised to add more chickens, replace if die, not to sell or share eggs/chickens and feed one egg every day to the child owning the chickens
- Demonstration session of egg preparation - hard-boiled and smashed whole egg
- Demonstration of how to utilize the night coop and construct a day cage.
- Monthly individual counselling with nutrition and poultry messages using BCC cards

Control Group (CG) (N=126): Received the existing nutrition and agriculture training

Figure 2: Chicken and cage gift ceremony and demonstration of egg feeding

Results

Table 1. Socio-demographic Characteristics and Child Feeding Practices at Baseline

Socio-demographic Characteristics		Intervention (N=127)	Control (N=126)
Mothers' age	Mean (SD)	27.3 (4.7)	27.5 (4.2)
Maternal education	Illiterate	97 (66.1%)	85 (54%)
	Formal education	9 (7.1%)	15 (11.9%)
Child age	Mean (SD)	10.9 (3.2)	11.4 (4.3)
Child sex*	Female	46 (36.2%)	69 (54.8%)
Livestock ownership	Any*	64 (50.4%)	84 (66.7%)
	Poultry	26 (20.5%)	33 (26.2%)

Feeding Practices	Intervention (N=127)	Control (N=126)
Currently breastfed	125 (98.4%)	122 (96.8%)
Complementary Feeding	120 (94.5%)	117 (92.9%)
Mean (SD) age of complementary food introduction	6.13 (0.59)	6.2 (0.69)
Ever fed with egg	65 (51.2%)	57 (45.2%)

* p<0.001

Poultry Production

- Child-owned poultry increased (p < 0.001) (β = 3.856; 95% CI of 3.553–4.159).

Table 2. Number and types of chickens owned by children

Chickens gifted	# Child owned chickens at end line: Hen, local	Hen, SASO	Total hens	Rooster	Young chicks	Total	Throughout the intervention period: Dead chickens	Replaced by families
254	361	23	384	67	237	688	329	471

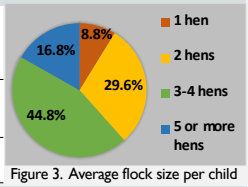

Figure 3. Average flock size per child

- Visiting vet clinic for sick birds' treatment (61.6% vs 14.3%),
- Cage utilization (daytime: 92.8% vs 23.8%; night-time: 100% vs 19%)
- Awareness of disease risk of chicken feces to children (83.2% vs 37.2%)
- No difference in chicken vaccination between the groups (28% vs 14.3%)

Egg Consumption and Dietary Diversity

- Egg intake (24-hour recall)
  - Baseline (BL): 7.9% (IG) and 9.5% (CG)
  - End line (EL): (72% vs 20.7%) (p<0.001; OR=3.841; 95% CI: 2.640-5.589)
- Mean [SD] eggs consumed/week/child: (4.85 eggs [2.41]) vs (0.4 eggs [0.61]) (p<0.001; β=2.202 at 95% CI of 1.971-2.433).
- MDD (BL): 4.7% vs 6.3%
- MDD (End line): 30.3% vs 14% (p = 0.016)
- Vit A-rich fruits and vegetables intake significantly increased among IG children.

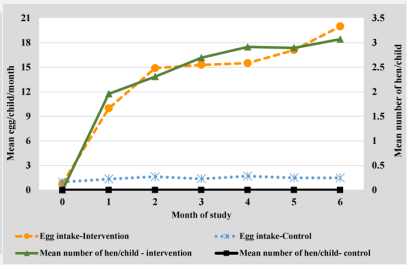

Figure 4: Monthly trend of mean egg intake and hens per child

Anthropometry and Gross Motor Development Outcomes

Table 3. Effect of intervention on anthropometry outcomes

	Baseline		End line		Effect size	
	Intervention (n=122)	Control (n=121)	Intervention (n=122)	Control (n=121)	Adjusted	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	β (95% CI) [a]	*P*
LAZ	-1.32 (1.19)	-1.10 (1.48)	-1.04 (1.04)	-1.58 (1.25)	0.15 (-0.15, 0.44)	*0.325*
WAZ	-1.12 (1.00)	-1.02 (1.17)	-0.20 (0.86)	-1.09 (1.05)	0.38 (0.13, 0.63)	*0.003*
WHZ	-0.65 (0.97)	-0.63 (1.03)	0.43 (0.79)	-0.40 (0.89)	0.43 (0.21, 0.64)	*<0.001*
	N(%)	N(%)	(%)	(%)	OR (95% CI) [b]	*P*
Stunted	35 (28.7)	37 (30.6)	41 (33.6)	50 (41.3)	0.58 (0.37, 0.91)	*0.011*
Underweight	22 (18)	24 (19.8)	6 (4.9)	22 (18.2)	0.46 (0.26. 0.84)	*0.017*
Wasting	11 (9)	10 (8.3)	1 (0.8)	6 (5)	0.52 (0.26, 1.05)	0.067

[a] GEE linear model with autoregressive correlation matrix [b] GEE binary logit adjusted for corresponding Z-score

- With no group difference at baseline, one-fourth of the children could walk with assistance and stand with support and one-fifth could walk without assistance. Few were at the stage of standing with assistance and running.
- Adjusted for baseline stunting or comorbidity of anemia and stunting (CAS), children in IG achieved motor skills of running (*p=0.021*), kicking a ball (*p=0.027*) and throwing a ball (*p=0.046*) at lower ages (17.53 ± 1.70, 18.96 ± 1.73 and 20.90 ± 1.31 months) than those in the control (17.96 ± 2.26, 19.41 ± 2.38 and 21.18 ± 1.64 months) respectively.

Hemoglobin and Anemia Outcomes

Table 4 Effect of intervention on hemoglobin, anemia and concurrent anemia and stunting (CAS)

	Baseline		End line		Effect size	
	Intervention (n=122)	Control (n=121)	Intervention (n=122)	Control (n=121)	Adjusted	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	β (95% CI)	*P*
Hemoglobin	11.1 (1.1)	10.9 (1.4)	11.4 (1.0)	10.6 (1.4)	0.53 (0.28, 0.79) [a]	<0.001
	N (%)	N (%)	N (%)	N (%)	OR (95% CI)	*P*
Anemia	50 (41)	51 (42.1)	26 (21.3)	70 (57.9)	0.36 (0.24, 0.54) [b]	<0.001
CAS	16 (13.1)	13 (10.7)	8 (6.6)	29 (24)	0.43 (0.23, 0.80) [c]	0.007

[a] Adjusted for baseline WAZ score; [b] adjusted for baseline hemoglobin; [c] adjusted for baseline LAZ, WAZ, and WHZ

- The odds of developing anemia and CAS among non-anemic and non-CAS children at baseline reduced by 75% and 78% respectively compared to control.
- About 70% of anemic and >80% of CAS children at baseline no longer had anemia and CAS respectively at end line.

Morbidity Outcomes

- At BL, more than half of the children in both groups exhibited one or more morbidity symptoms.
- No effect on morbidity symptoms at end line

Conclusion and Recommendation

- This nutrition-sensitive poultry intervention that enabled children to own chickens significantly
  - increased chicken production with better management and egg consumption
  - improved the children's nutritional status and gross motor milestone development.
  - increased hemoglobin levels and reduced anemia and concurrent anemia and stunting prevalence
- This is a huge advantage, particularly for low-income countries that suffer from both undernutrition and anemia with poor feeding practices.
- Large-scale implementation of the model or integration with existing interventions is warranted in rural settings where animal-source food intake is low and the burden of undernutrition is high.

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