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Agricultural and Finance Intervention Increased Dietary Intake and Weight of Children Living in HIV-Affected Households in Western Kenya

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ABSTRACT

We tested whether a multisectoral household agricultural and finance intervention increased the dietary intake and improved the nutritional status of HIV-affected children. Two hospitals in rural Kenya were randomly assigned to be either the intervention or the control arm. The intervention comprised a human-powered water pump, microfinance loan for farm commodities, and training in sustainable farming practices and financial management. In each arm, 100 children (0–59 mo of age) were enrolled from households with HIV-infected adults 18–49 y old. Children were assessed beginning in April 2012 and every 3 mo for 1 y for dietary intake and anthropometry. Children in the intervention arm had a larger increase in weight (β: 0.025 kg/mo, $P = 0.030$), overall frequency of food consumption (β: 0.610 times · wk^{-1} · mo^{-1}, $P = 0.048$), and intakes of staples (β: 0.222, $P = 0.024$), fruits and vegetables (β: 0.425, $P = 0.005$), meat (β: 0.074, $P < 0.001$), and fat (β: 0.057, $P = 0.041$). Livelihood interventions have potential to improve the nutrition of HIV-affected children.This trial was registered at clinicaltrials.gov as NCT01548599. *Curr Dev Nutr* 2020;4:nzaa003.

Keywords: children, dietary intake, nutritional status, HIV, Kenya

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Introduction

HIV/AIDS and household food insecurity are prominent public health issues in sub-Saharan Africa. The number of people living with HIV aged 15–49 y in sub-Saharan Africa increased to 24.2 million in 2018 from 17 million in 2000 (1, 2), and severe household food insecurity increased from 28% in 2014 to 31% in 2016 (3). Kenya has a high burden of HIV/AIDS and food insecurity. The Nyanza region has a high prevalence of HIV (15% among those 15–64 y old) (4) with a high prevalence of stunting (23%) (5). Undernutrition is prevalent in impoverished Kenya, where 26% of children <5 y old are stunted (i.e., height-for-age < −2 SDs of the sex- and age-specific median of the WHO Child Growth Standards), 8% are severely stunted, and 11% are underweight (i.e., weight-for-age <−2 SDs of the Standards median) (5).

HIV/AIDS adversely affects household food security and household wealth because of loss of productive household members, decreased income, and increased caregiver burden (6). The coexistence of HIV/AIDS and household food insecurity aggravates the health, dietary intake, and nutrition of adults and children living in the HIV-affected households (7–9).

Prior work assessed the impact of nutritional programs on health outcomes of general (non-HIV infected) child populations (10–16). Most interventions provided nutritional education, micronutrient supplementation, food fortification, agricultural training, livestock and seeds, and/or food to households, and have been efficacious for growth, disease reduction, and development. There is increasing but insufficient evidence of effectiveness in real-world scenarios. Few studies involved financial interventions aiming to improve nutritional status. Agricultural interventions, such as home or community gardens including agricultural training, improved the dietary diversity of mothers and children (17, 18), growth among children <5 y old (19), and household food security (19). None of these interventions were among HIV-affected families or included a financial component.

Livelihood interventions targeted to adults may have consequent benefits for children (20). We conducted an agricultural and finance intervention among HIV-infected adults and HIV-affected children in the Nyanza region of western Kenya in 2011 (21). The results for the adults have been published, showing that the intervention resulted in improved food security, dietary intake, and HIV health outcomes among adults (22). We posited that intervention-driven improvements in household food security and wealth would improve access to food and support caretaker physical and mental health and empowerment, which would in turn translate into improved nutrition for children (23). This study tested the hypothesis that the Kenyan livelihood intervention provided to households with an HIV-infected adult also improved the dietary intake and nutritional status of children <5 y old living within the same households.

Methods

Setting

The study (NCT01548599) was conducted in Rongo sub-County (intervention arm) and Migori County (control arm) government hospitals located in Migori County in the Nyanza region of western Kenya. The population is mostly rural, ethnically homogeneous (>95% members are Luo), and living in dispersed settlements. The major livelihood is subsistence farming and/or fishing, with the major crops for consumption being maize, sorghum, and cassava. The Nyanza region is one of Kenya's most vulnerable regions to food insecurity because rural poor people do not have enough land and irrigation facilities to do subsistence farming (24).

Study design

The study design is detailed elsewhere (21, 22). Two rural government district hospitals supported by Family AIDS Care & Education Services were randomly assigned as either intervention or control. The hospitals had similar inpatient, outpatient, emergency, maternal, child, and HIV Care and Treatment services. Both had adequate and similar numbers of adults receiving antiretroviral therapy (2394 in the intervention hospital and 2718 in the control hospital in 2012) with nonoverlapping catchment areas, mitigating contamination; the 2 locations were similar in terms of rainfall patterns, health, topography, water access, soil composition, and socioeconomic status. The intervention had 3 components: *1*) the KickStart Water pump and required farm commodities, *2*) training in sustainable farming and financial management provided by the Kenyan Ministry of Agriculture, and *3*) a small loan ($150) to purchase the water pump and farming implements provided by Adok-Timo, a microfinance institution. Control participants received no intervention; they were eligible for the intervention at the end of the 1-y follow-up period. We enrolled through clinic announcements adults who were receiving antiretroviral therapy, aged 18–49 y, with access to farmland and surface water, with moderate-to-severe food insecurity at enrollment or malnutrition during the preceding year, and willing to save the down payment for the loan. A total of 140 HIV-infected adults (72 intervention, 68 control) were enrolled from April to July 2012. The present study recruited all children aged 0–59 mo (biological or legally fostered) living within the households of index adult participants in the parent study (22). We followed children for 1 y every 3 mo, assessing dietary intake, weight, height, and midupper arm circumference (MUAC).

Participant enrollment

In each arm, we enrolled 100 children aged 0–59 mo and their primary caregiver (biological parent or legal guardian aged 18–49 y) living within the households of index adult participants in the parent study. We excluded children with severe acute malnutrition (<-3 z scores of the Standards median) and referred them for immediate care if they were not already in care. We obtained written informed consent from the adult participants for their and for their children's participation.

Primary outcomes

Dietary intake and nutritional status of children were the primary outcomes. Frequency of consumption of food groups was assessed using a questionnaire adapted from the World Food Programme Food Consumption Score. Mothers or caretakers were asked how often the child drank or ate in the past 3 mo each of 63 food items provided in a list. Response options were "every day," "5–6 times a week," "3–4 times a week," "1–2 times a week," "2–3 times a month," "once a month," "less than once a month," and "never." Ten food groups were created based on major nutrients present in the food items, adapting guidelines for individual dietary diversity developed by the FAO: staples, legumes, fruits and vegetables, meat, dairy, eggs, fat, sugary foods, condiments (spices, chili, garlic, and royco, which were usually served in small quantities), and tea/coffee (25). Each food group was represented as number of times consumed per week. The frequencies of consumption of all food groups were summed to obtain the overall frequency of consumption.

Child nutritional status was assessed as weight, height, and MUAC. Three consecutive weights were measured using a SECA portable electronic scale, which can be adjusted to 0 and weigh quickly and accurately. Three consecutive measurements of standing height for children ≥24 mo of age and length for children <24 mo of age were taken using a length board. Three MUAC measurements using a measuring tape were taken. If the difference between the first 2 measurements was <0.3 kg or <0.3 cm, the mean of the first 2 measurements was used for the analysis; if the difference was ≥0.3 kg or ≥0.3 cm, the mean of all 3 measurements was used.

In the intervention and control arms, over the 5 visits (i.e., 12 mo) weight of the children had 4.8% and 3.4% missing values, respectively. Missing values of height and MUAC were 4.6% and 5.8% in the intervention arm compared with 3.4% and 4.2% in the control arm, respectively. Missing values for overall frequency of food consumption were 20.8% in the intervention arm and 21.4% in the control arm, with similar percentages for specific food groups.

Ethical approval

The study was approved by the Committee on Human Research at the University of California San Francisco and the Ethical Review Committee at the Kenya Medical Research Institute. The study's purpose was explained to participants and written informed consent was obtained from each adult participant before conducting the survey.

Analysis

Intention-to-treat, repeated-measures analyses were done in Stata version 13 (StataCorp LP), with child as a random effect and arm, month of visit, and their interaction as fixed effects. Month of visit was continuous. All available data were analyzed assuming missingness at random. We estimated the difference between arms in the linear trends

TABLE 1 Baseline characteristics of children and caretakers enrolled in the study in the control and intervention arms in western Kenya, 2012–2013[1]

Baseline characteristics	Control arm	Intervention arm
Children		
Age, mo	31.4 ± 1.8	31.3 ± 1.9
Sex		
Male	54 (56.8)	48 (50.0)
Female	41 (43.2)	48 (50.0)
Weight, kg	11.9 ± 0.4	11.8 ± 0.4
Height, cm	84.9 ± 1.6	85.0 ± 1.6
Midupper arm circumference, cm	15.1 ± 0.1	14.8 ± 0.1
Overall food consumption, times/wk	83.2 ± 4	59.3 ± 3.6
Caretakers		
Age, y	30.6 ± 0.7	29.8 ± 0.6
Sex		
Male	6 (6.2)	20 (20.8)
Female	90 (93.8)	76 (79.2)
Highest level of education		
Primary	74 (77.1)	83 (84.7)
Secondary	18 (18.8)	14 (14.3)
Above secondary	4 (4.2)	1 (1.0)

[1]Values are *n* (%) or mean ± SE.

TABLE 2 Differences between intervention and control arms across 12 mo of follow-up in weight, height, MUAC, and frequency of food consumed among children (aged 0–59 mo) in western Kenya, 2012–2013[1]

Outcomes	Trend in control arm (per month)	Trend in intervention arm (per month)	Difference in trend between arms (per month)	*P* value (for difference in trend between arms)
Anthropometry				
Weight, kg	0.136	0.161	0.025	0.030
Height, cm	0.708	0.745	0.037	0.122
MUAC, cm	−0.011	−0.014	−0.003	0.352
Consumption of food groups, times/wk				
Overall	1.367	1.977	0.610	0.048
Staples	0.131	0.353	0.222	0.024
Legumes	−0.018	0.034	0.052	0.064
Fruits and vegetables	0.260	0.685	0.425	0.005
Meat	−0.009	0.065	0.074	<0.001
Dairy	0.160	0.130	−0.030	0.274
Eggs	0.013	0.011	−0.002	0.457
Fat	0.155	0.212	0.057	0.041
Sugar	0.224	0.357	0.133	0.028
Condiments	0.189	0.030	−0.159	<0.001
Tea/coffee	0.180	0.061	−0.119	<0.001

[1]Intention-to-treat, repeated-measures analyses specifying child as a random effect and arm, month of visit, and their interaction as fixed effects were used to estimate the difference between arms in the linear trends over months (i.e., fitting a straight line over months for each arm) as the interaction between arm and month. MUAC, midupper arm circumference.

over months (i.e., fitting a straight line over months for each arm) using the interaction between arm and month. Because we hypothesized that children in the intervention arm would have a higher slope for the trend over visits in anthropometry and diet (except for condiments and tea/coffee, which would have a lower slope) than children in the control arm, we report 1-tailed *P* values. In sensitivity analyses for dietary intake without 22 children aged <6 mo, inferences were unchanged, with differences in the trends between arms being slightly larger; most of the 22 children consumed some complementary foods by visit 2.

Results

Children and their caretakers in each arm were similar at baseline (**Table 1**). The overall frequency of food consumption of children and the percentage of female caretakers were higher in the control arm.

Weight of the children across the 12 mo of follow-up increased more in the intervention arm than in the control arm (β: 0.025 kg/mo, $P = 0.030$) (**Table 2**). Height and MUAC of the children did not differentially increase between the intervention and control arms over months.

Compared with the control arm, intervention children had a larger increasing linear trend over the 12 mo of follow-up in overall consumption of food (β: 0.610 times · wk^{-1} · mo^{-1}, $P = 0.048$) and in consumption of staples (β: 0.222, $P = 0.024$), fruits and vegetables (β: 0.425, $P = 0.005$), meat (β: 0.074, $P < 0.001$), and fat (β: 0.057, $P = 0.041$). Intervention children had a larger decreasing linear trend in intakes of condiments (β: −0.159, $P < 0.001$) and tea/coffee (β: −0.119, $P < 0.001$) than control children. There were no significant differences between arms in the trends over months in intakes of legumes, dairy, and eggs.

Discussion

The livelihood intervention that improved household food security, dietary intake, and health outcomes for HIV-infected adults (22) also improved weight and dietary intake of children living in the households. The 3 intervention components likely worked together to increase food security and household wealth through improved production of crops and selling surplus in markets (22). The increased food security and wealth likely improved physical (22) and mental health (26, 27) and empowerment of the caretakers (28), which ultimately led to improved infant and young child feeding and body weight. Height and MUAC of children did not differentially improve between arms. Determinants other than dietary intake such as size at birth, pregnancy duration, water, sanitation, and illness influence linear growth and MUAC of children (29) and more time may have been needed to see effects on height or MUAC.

These findings are consistent with those from a study of ultrapoor households in Bangladesh where women were provided income-earning opportunities and strengthened sociopolitical support to build self-awareness, confidence, and income (20). That program improved economic status and food security and resulted in multiple benefits for women. Children fully exposed to the program (i.e., both before and after birth) had better weight-for-height (but not better height-for-age) than children living in households without the program (20).

Although randomly assigning 2 hospitals to intervention and control may have reduced selection bias, having only 2 prevented definitively separating intervention effects from potential other factors and accounting for variation between the hospitals. The 12-mo follow-up period was long enough to test for differential increases in weight and dietary intake but perhaps not for other anthropometric outcomes. We included children of adults who visited the hospitals for antiretroviral therapy and who had access to farming land and surface water, which might limit the generalizability of the results to other populations.

In conclusion, a nutrition-sensitive (30) agricultural and finance intervention that improved household food security, dietary intake, and health among HIV-infected adults improved the weight and dietary intake of children <5 y old living in the households. Livelihood interventions have potential to produce consequent positive effects in children living in HIV-affected households and should be further developed and studied in larger samples with longer follow-up as part of HIV management efforts in Kenya and similar settings.

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