Integrating health and agriculture to maximize the nutritional impact of orange-fleshed sweetpotato: The Mama SASHA proof-of-concept project in Western Kenya

SASHA
Sweetpotato Action for Security and Health in Africa

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The intervention phase of this project has been successfully completed, endline survey data have been collected and analysis for evaluation of impact is underway.

A vine multiplier supplying material to pregnant women (credit M. Wamalwa)

What is the problem?

Vitamin A deficiency (VAD) contributes to significant rates of blindness, disease, and premature death in Sub-Saharan Africa (SSA). Young children and pregnant or lactating women are particularly at risk of VAD. Orange-fleshed sweetpotato (OFSP) is an important source of energy and beta-carotene, which is converted into Vitamin A in the body. One medium-size sweetpotato provides enough to meet the recommended daily allowance of vitamin A for children and non-lactating women. Evaluations of food-based approaches promoting increased OFSP production and consumption have shown significant positive impacts on Vitamin A intake and status.

Pregnancy should be a particularly opportune time to reach women with nutritional and health interventions that can lower their risk of VAD, mitigate negative environmental and socio-economic factors, and enhance the survival and growth of their infants.

This project seeks to explicitly integrate agriculture and nutrition interventions into antenatal health care services to maximize the potential benefits of OFSP on the health status of mothers and children less than 2 years of age. It is the first time such an intervention is being tested at the community-level in SSA – and the first one of its kind to focus explicitly on pregnant women.

What did we want to achieve?

The aim of this 5-year project (2010 through 2014) is to provide solid evidence for the effectiveness of this innovative approach to integrate OFSP promotion and production with public health care services. The expected impacts include significant increases in both the consumption of Vitamin A-rich foods and use of antenatal care services.

Where were we working?

The project was implemented in selected health facilities across Busia and Bungoma districts of Western Province, Kenya. In these areas, sweetpotato is important for food security. But the majority of sweetpotato varieties are either white or yellow-fleshed, containing little beta-carotene. The challenge is to introduce the beta-carotene–rich OFSP varieties and promote their production, uptake, and consumption alongside overall improvement in child and household dietary practices.

How did we make it happen?

The project was implemented within the existing USAID/Kenya AIDS, Population and Health Integrated Assistance Program (APHIA Plus). That program worked directly with communities and public health facilities throughout Western Province to strengthen a wide range of health services.

The Mama SASHA intervention used community health workers to encourage pregnant women to seek early and recommended ante- and postnatal care services. They also established and ran community-level pregnant women's clubs, with monthly dialogue sessions focused on nutrition and health topics. During each antenatal care visit, nurses provided improved nutrition counseling along with vouchers, which women used to obtain OFSP vines to plant. The vine cuttings were obtained from trained secondary vine multipliers, located near the health clinics.

CENTRO INTERNACIONAL DE LA PAPA
CIP
A member of the CGIAR Consortium

SPHI
Sweetpotato for Profit and Health Initiative
Reaching 10 million African households by 2020

Partners include:

- The International Potato Center (CIP), leading from a field office based in Bungoma
- PATH, an international non-profit organization focused on health
- Kenyan Agricultural Research Institute (KARI)
- Local government stakeholders, especially the Ministries of Health and Agriculture
- Community Research in Environment and Development Initiatives (CREADIS)
- Appropriate Rural Development Agriculture Programme (ARDAP)
- With scientific inputs from the University of Toronto, Emory University and the University of Washington

To evaluate the program's impact, an equal number of intervention and control sites were randomly selected from among eight community health facilities. The four intervention sites received the full range of nutrition, outreach, and health services described above, along with the vouchers. The four control group facilities offered the standard APHIA Plus training and sensitization on Infant and Young Child Nutrition services, but without the pregnant women's groups, vouchers, or support for the production of OFSP.

Full implementation of the program began in April 2011 and ended in December 2013.

What have we achieved so far?

Following the 10-month pilot program, where 823 women participating in the intervention areas received vouchers – 75% of whom redeemed them for planting material, we conducted operational research to refine the implementation design.

The end of August 2013 marked the conclusion of voucher issuance at the health facilities that began in April 2011. As of September 2013, over 5,900 pregnant or lactating women had received 7,159 pairs of vouchers, far exceeding the project's stated goal of reaching 900 women. Out of this, 4,464 pairs of vouchers (63%) were redeemed for vines. Community health workers established 215 pregnant women clubs made up of 2,764 members, and worked together with agricultural extension agents to disseminate information to the broader community on the production and consumption benefits of OFSP through community field days and other OFSP production and food preparation demonstration activities.

A second round of operational research was completed in 2012 to assess health worker, agricultural extension officers, community and pregnant women's acceptance of OFSP linked to increased ANC services. Respondents noted enhanced maternal and child health coupled with improved household food security. Mothers felt their children were less susceptible to disease and more energetic; they and their partners also valued OFSPs' shorter maturity and higher yields than the dominant local variety. Community Health Workers (CHWs) emerged as a critical link for reaching pregnant women and connecting them to antenatal health care services and their community vine multipliers who provided OFSP planting material. Success brought increased workload to health care and agricultural professionals and community health workers, but it also provided enhanced training, more effective nutrition messaging, tangible recommendations to improve diet quality, higher job satisfaction and overall improved motivation upon seeing the positive benefits for pregnant women and ultimately, their babies. Wrap-up meetings were held in intervention communities throughout February 2014.

In October 2012, the longitudinal Cohort for Vitamin A (COVA) study was initiated among 505 women from mid-pregnancy through 9 months postpartum to assess how uptake of the OFSP interventions including knowledge, farming and consumption of OFSP impacts nutrition and health status, including uptake of health services by mothers and their infants. By June 2014, all the four longitudinal visits have been completed by all eligible women and their newborns; 384 women completed the final visit. The final biological samples (plasma and breastmilk) lab analyses are underway. The food consumption survey component of the COVA, conducted when the child was around 9 months old, has been completed and preliminary analysis indicates a doubling of dietary vitamin A intake for both mothers and infants in intervention areas compared to control areas; these differences were attributed to OFSP intakes (Table 1).

Table 1. Median dietary intakes of vitamin A: Retinol, Retinol Activity Equivalents (RAE) and vitamin A precursors among COVA intervention participants at 8-10 months postpartum

Child Dietary Intakes	Overall	Control (N=146)	Intervention (n=139)	P-value
Energy, kcal	497 (360, 676)	470 (339, 651)	509 (377, 749)	
α-carotene, mcg	20 (7, 72)	17 (5, 41)	29 (9, 135)	0.25
β-carotene, mcg	307 (159, 587)	259 (128, 477)	383 (198, 862)	0.021
Retinol, mcg	49 (22, 89)	47 (22, 91)	50 (21, 88)	0.72
Vitamin A, IU	362 (174, 745)	275 (138, 480)	549 (255, 1138)	<0.01
Vitamin A, mcg RAE	86 (52, 144)	81 (42, 131)	101 (62, 171)	0.01
Mother Dietary Intakes	**Overall**	**Control (n=146)**	**Intervention (n=139)**	**P value**
Energy, kcal	2536 (2130, 3023)	2468 (2089, 2939)	2603 (2158, 3113)	
α-carotene, mcg	139 (59, 417)	182 (58, 313)	221 (65, 683)	0.11
β-carotene, mcg	4003 (2071, 7115)	3621 (1924, 5778)	5004 (2282, 9724)	0.01
Retinol, mcg	138 (84, 209)	133 (82, 190)	142 (86, 228)	0.44
Vitamin A, IU	4823 (1657, 8320)	3553 (1519, 6843)	6949 (1852, 14526)	<0.01
Vitamin A, mcg RAE	510 (332, 819)	459 (298, 653)	625 (424, 1073)	<0.01

**Intakes presented as median (interquartile range) and quantified using multi-pass 24 hour recalls among a subsample of 285 COVA mother-child pairs at 8-9 months postpartum. Data on main sources of VA by group not shown.*

A two-month cross-sectional endline survey targeting 2,398 mother-child (under 2 years of age) pairs and 207 pregnant women in intervention and control communities was planned from November 2013 and implemented by the team from mid-March to end of May 2014. This evaluation was to assess whether there have been significant changes in (1) health and nutrition knowledge; (2) consumption of OFSP and other nutrient rich foods; and (3) antenatal and postnatal health care service utilization that have resulted in improved maternal and child health outcomes. Data were digitized the same day they were collected. All control households received OFSP vines at the end of the survey, which occurred during planting season. Data cleaning and biological samples lab analysis are underway. Preliminary data analysis indicates a significant increase in production and consumption of OFSP and other vitamin A rich foods in intervention area households compared to households in control areas as indicated in Table 2.

Table 2. Preliminary Results from the Mama SASHA Cross-Sectional Endline Survey

Variable	Overall N=2265	Control N=1,105	Intervention N=1,160	P-value
	Indices and Score [Mean±SD, or n(%) for all such values]			
Mean Caregiver HKI Vitamin A food consumption frequency score. Inadequate (<6) Adequate (>6)	4.64±4.1 1,704 (75.2) 561 (24.8)	4.50±3.9 839 (75.9) 266 (24.1)	4.77±4.3 865 (74.6) 295 (25.4)	0.12
Mean Child HKI Vitamin A food consumption frequency score. Deficient (<6 days) Adequate (>6 days)	3.85±4.2 1,796 (71.7) 710 (28.3)	3.62±3.8 881 (71.9) 345 (28.1)	4.07±4.5 915 (71.5) 365 (28.3)	0.01
Mean Nutrition Knowledge Score. Low (0-7) Medium (7.5-10.5) High (11-24)	8.94±3.9 818 (36.6) 684 (30.6) 736 (32.9)	8.42±3.9 453 (41.6) 321 (29.5) 316 (29.0)	9.43±3.9 365 (31.8) 363 (31.6) 420 (36.6)	0.00001
Mean Health and Childcare Knowledge Score. Low (0-12) Medium (13-15) High (16-25)	13.29±3.2 876 (39.1) 767 (34.3) 595 (26.6)	13.13±3.1 434 (39.8) 404 (37.1) 252 (23.1)	13.4±3.2 442 (38.5) 363 (31.6) 343 (29.9)	0.02
Mean OFSP Knowledge Score. Low (<2) High (3-6)	2.61±1.3 1, 133 (50.6) 1,105 (49.4)	2.19±1.1 705 (64.8) 385 (35.2)	3.00±1.4 428 (37.3) 720 (62.7)	0.00001
Mean Household Dietary Diversity Index. Low (<4) Moderate (5) High (6-10)	4.59±1.4 1,104 (49.3) 578 (25.9) 556 (24.8)	4.46±1.4 576 (52.9) 282 (25.9) 232 (21.3)	4.73±1.5 528 (46.0) 296 (25.8) 324 (28.2)	0.00001
Mean Reference Child Dietary Diversity Index. Low (<3) High (4-7)	2.91±1.2 1,575 (70.5) 661 (29.5)	2.78±1.2 804 (73.8) 286 (26.2)	3.04±1.2 773 (67.3) 375 (32.7)	0.00001
Degrees of Participation. Control/Non-participant in intervention area Partial participation Full participation (Redeemed voucher; pregnant women's club)	1,090 (48.7) 916 (40.9) 232 (10.38)	1,090 (100.0) 0 (0.0) 0 (0.0)	534 (46.0) 391 (33.7) 235 (20.3)	0.00001

HKI score. Is a binomial variable, which is calculate by adding up the number of days the child or caregiver consumed vitamin A rich food over a 7 day period. The sample is considered to be vitamin A deficient if the mean frequency of total consumption of animal and plant sources of vitamin A is 6 days per week or less.

Nutrition Knowledge Score. Is a summative variable. The score is based on nutrition knowledge and knowledge about vitamin A. Higher score given to more suitable answers.

Health and Childcare Knowledge Score. Is a summative variable combining 13 measures of knowledge about health seeking behaviors and childcare. Higher scores are given to more suitable answers.

OFSP Knowledge Score. Is a summative variable created by the combination of measures on the caregiver's agricultural practices and knowledge of OFSP. Higher scores are given to more suitable answers.

Household dietary diversity index. Was obtained by summing up the consumption of 10 food groups over a 24 hour period. Each food group was quoted as 0 if not consumed or 1 if consumed. The food groups included: 1) starchy staples, 2) dark green leafy vegetables, 3) vitamin A rich fruits and vegetables, 4) fruits and vegetables, 5) organ meat, 6) meat and fish, 7) eggs, 8) legumes, nuts and seeds, 9) milk and milk products, 10) oils and fats. The median value was used to categorize households into two equal groups of dietary diversity: high and low.

Pregnant woman's club in action (Credit F. Grant)

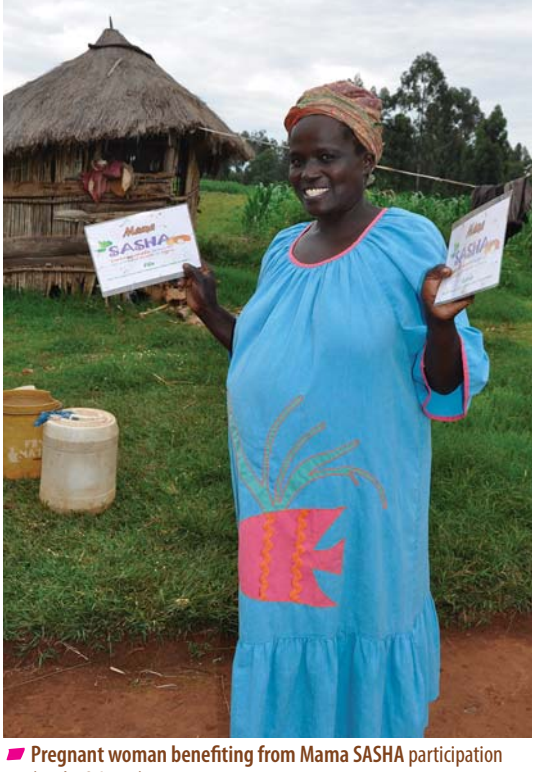
The food groups used for the tabulation of the reference **child's dietary diversity index** include: 1) grains, roots and tubers, 2) legumes and nuts, 3) dairy products 4) flesh foods (meat, fish, poultry and liver/organ meats), 5) eggs, 6) vitamin-A rich fruits and vegetables, and 7) fruits and vegetables. Each food group was quoted as 0 if not consumed during the past 24 h and 1 if consumed. The dietary diversity index was obtained by summing up the quotes for the 7 food groups. The possible range of the dietary diversity index was from 0 to 7. The cut-off of at least 3 food groups consumed out of 7 was used to define minimum dietary diversity based on the median value.

Degree of Participation. Control/non-participant group includes caregivers who did not receive voucher and did not participate in mothers clubs (both control and non-participating intervention members). Partial participation includes caregivers who received voucher but did not redeem and did not participate in mother club, caregivers who received voucher and redeemed vines but did not participate in mother club or caregivers who did not receive voucher but participated in mother club. Full participation includes caregivers who received voucher, redeemed vines and participated in mother club.

In addition, the assessment of the cost-effectiveness of the intervention is underway. So far, over 5,400 women participated in monthly pregnant mother clubs at a cost of $63 per woman. Of 4,629 women who received vouchers, 3,281 women redeemed vouchers and planted OFSP at a cost of $105 per beneficiary. This and other study related preliminary findings were presented at the Micronutrient Forum in Addis Ababa, Ethiopia, in June 2014.

What's next?

The longitudinal cohort study (following the same women over time) complements the cross- sectional household surveys in intervention and control communities. The endline cross-sectional data will also be compared to the baseline cross-sectional data that were collected in the same season of the year. Together, the cross-sectional household surveys and the nested cohort study provide a robust measure of impact of the intervention by 2015. Financial costs will be combined with economic costs and health benefits from the endline surveys to estimate cost–effectiveness of the intervention. Reports with major findings are expected by November 2014 with numerous articles planned for submission in 2015.



Pregnant woman benefiting from Mama SASHA participation (credit C. Levin)

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