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# Nutrition Education Influences Vitamin A-Related Knowledge, Attitudes, and Practices of Child Caregivers Towards the Production of Orange-Fleshed Sweet Potato in Uganda

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**Abstract:** This study had two major objectives: to assess the effect of nutrition education carried out among urban and peri-urban farming communities in Kampala, Uganda on (a) production of Orange-Fleshed Sweet Potato (OFSP), and (b) vitamin A related knowledge, attitudes and practices of child caregivers. A Cross-sectional sample of households that were involved in farming of orange fleshed sweet potato (OFSP) and had 2–6 year old children (n=457) were purposively selected from four divisions of Kampala Capital City Authority (Kawempe, Rubaga, Makindye and Nakawa) to participate in a controlled, cohort intervention. Respondents in Kawempe division had received training in production of OFSP and nutrition education; Rubaga division only had training in production of OFSP; Nakawa division only had nutrition education while Makindye division did not have any training and served as the control. A coded questionnaire was used to collect caregiver's perceptions of nutrition and production attributes of OFSP compared with other potato varieties as well as Vitamin A related knowledge, attitudes and practices. Chi-square tests were used to test for relationships amongst divisions for variables of interest. A p value of  $\leq 5\%$  was used to judge statistically significant differences. Results showed that all respondents judged OFSP varieties to be better than other potato varieties with respect to: early maturity, yield, multiple utilization, nutritional value, and taste ( $p < 0.05$ ). Respondents who had received nutrition education had better knowledge than other respondents related to vitamin A, OFSP as a source of vitamin A and attitudes towards health and child health practices ( $p < 0.05$ ). About 60% of the respondents that received nutrition education correctly identified at least two sources of vitamin A compared to about 40% for respondents without nutrition education. Results from a seven (7) day recall showed significantly higher consumption of foods that are rich in Vitamin A by respondents from divisions that received nutrition education ( $p < 0.05$ ). Similarly, significantly more respondents who had nutrition education had positive attitudes toward Vitamin A utilization.

**Keywords:** Nutrition Education, Orange-Fleshed Sweet Potato, Caregivers

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## 1. Introduction

Vitamin A deficiency (VAD) is a leading cause of morbidity and mortality among children and the highest global prevalence of vitamin A (40%) is found in sub-Saharan Africa and Southeast Asia countries (1,2,3). Children in developing countries are vulnerable to VAD and evidence in Uganda suggests that the prevalence rate of VAD for children aged 6 – 59 months is 33% (4,5). Recent reports

show that the diet of the majority of people in Uganda consists of plant-based staple foods in the form of cereals, plantains, roots, and tubers, while carotenoid-rich fruits and vegetables and animal sources of retinol are seldom consumed, putting the population at risk of vitamin A deficiency (VAD) (6,7).

Since the consumption of fruits and vegetables rich in carotenoids is low in Uganda, a strategy of food production training coupled with education could be helpful in

increasing the production, availability, access, and consumption of vitamin A rich foods (7). Orange-fleshed sweet potato (OFSP) is an excellent source of pro-vitamin A and in developing countries, and has been found to be a viable long-term food-based strategy that can significantly alleviate VAD (8,9,10).

Nutrition education of caregivers is a feasible intervention and has the potential to help in promoting appropriate feeding practices aimed at impacting child nutritional status, child growth, and child health and development outcomes even in poorly resourced communities (11,12,13). A five-year follow-up of a food-based vitamin A intervention in Tanzania found that knowledge and practices were more favorable to vitamin A dietary intake among preschool children (6–72 months) in the area that received nutrition education than in the one that did not (14). A study conducted in China found higher nutrition knowledge and better reported infant feeding practices among the mothers who received the education intervention than their control group counterparts and that the education group infants were significantly heavier and longer (15). In India, a nutrition education and home gardening project increased knowledge of the signs of vitamin A deficiency and household intakes of dark green vegetables (16). In addition, participating mothers in a study in Malawi who had nutrition education were able to use existing food resources to improve complementary feeding practices and this was associated with enhanced adequacy of energy and several micronutrients in the diets of their children (17).

In Uganda, a project on school-based nutrition education and promotion of orange-fleshed sweet potato as a food-based strategy for increasing Vitamin A uptake was executed to farmers in urban and peri-urban areas of Kampala Capital City Authority (KCCA) by the International Potato Centre (CIP) from 2004 to 2006. The Schools OFSP project involved providing nutrition education alongside the agricultural training to caregivers of children aged 2-6 years. The aim of this research was to assess the effects of nutrition education on the production and adoption of OFSP as a source of vitamin A, and the vitamin A related knowledge, attitudes and practices of child caretakers in Kampala Capital City Authority (KCCA), Uganda.

## 2. Materials and Methods

The agriculture component of the Schools OFSP project took place from 2004 to 2006. Schools were selected from Kawempe and Rubaga divisions of KCCA as venues for training, and knowledge transfer of the OFSP project. The target group for the intervention included school children, their science and agriculture teachers and parents. Other participants in the training were mainly farmers and non-farmers in the community. The training program promoted two OFSP varieties, “Ejumula” and SPK004 (Kakamega), which have high beta-carotene content averaging 12.47mg and 5.49mg/100g fresh weight basis, respectively (18). These two varieties have performed well in term of yields and their

acceptability by producers, consumers and processors in Uganda is high (18,19). The intervention participants received knowledge, production skills and planting materials of these OFSP varieties.

A variety of training methods were used including presentations, meetings, on-plot demonstrations, drama, farmer-to-farmer extension, farm station visits and the distribution of posters to train and transfer knowledge and technologies on OFSP production and consumption. Farmers were given initial vines and encouraged to multiply and distribute them to new members. At the end of the training component, in the ten schools that participated, 682 school children and 568 farmers had received training.

The nutrition education component of the Schools OFSP project was introduced in 2005 in Kawempe and Nakawa divisions of KCCA. Households with access to farming land and at least one child aged 2-6 years were selected to participate in the school-based training of parents and school children. At least three training sessions were conducted in each school community with an inter-session period of 4-5 weeks. In Kawempe, the training targeted the same school communities as the agricultural training but there was no agricultural intervention in Nakawa division. The training included vitamin A related knowledge for children less than 6 years. A total of 996 parents and 657 school children were trained.

### 2.1. Study Design and Area

The study was carried out in Uganda in four divisions of Kampala City Council Authority; Kawempe, Rubaga, Nakawa and Makindye (excluding Kampala Central division, which is mainly business oriented). Each division received a different intervention delivered through five purposively selected schools (e.g., for the OFSP training, schools that practiced agriculture were those that were included in the study). Both OFSP production and nutrition education interventions took place in the division of Kawempe; OFSP production training only in Rubaga division; nutrition education intervention in Nakawa division, and Makindye had no intervention. The pupils, teachers, parents/caregivers and farmers from communities surrounding the schools who participated in the OFSP project and whose main livelihoods significantly depended on urban and peri-urban agriculture constituted the target group of the Schools OFSP project. The study divisions of Kampala City Council Authority (Kawempe, Rubaga, Nakawa and Makindye) and the interventions carried out are shown in table 1 below.

Table 1. Study divisions.

Division-level Interventions	Orange Fleshed Sweet Potato Production	
	Yes	No
Nutrition Education	Yes	Kawempe Division Nakawa Division
	No	Rubaga Division Makindye Division

A structured production and Knowledge, Attitudes and Practices (KAP) questionnaire was used to evaluate the

adoption of OFSP and assess the knowledge transfer on Vitamin A related nutrition. The respondents for this study were caregivers of young children aged 2-6 years, in the selected divisions of Kampala district who participated in the interventions. Preschool children constitute the most vulnerable group to VAD (5). Data on the intake of vitamin A rich foods of an index child was obtained using a food-frequency questionnaire (FFQ) that was adapted from The Helen Keller International (HKI) Food Frequency Questionnaire. Caregivers of index children were interviewed about the number of times in the past seven (7) days that their children consumed selected local foods capturing the common rich sources of vitamin A. In order to control for breast feeding, the study children were those above two years of age. One child (aged 2-6 years) from each household was used for reference in the study and was called the index child.

## 2.2. Inclusion and Exclusion Criteria

The following criteria were used to include a household in the study:

- Households that were practicing farming and had child caregivers who stayed in the area during the period of study. Households with children that were in the age range of 2-6 years and had no physical or mental health complications.

## 2.3. Ethical Issues

Ethical approval for this research was given by the Uganda National Council for Science and Technology. In addition, written informed consent of all respondents for the study (or their legal guardians if they were minors) was obtained before involving them into the study.

## 2.4. Sample Size

A sample of 457 households with childcare givers involved in farming and having children of 2-6 years were randomly selected from the four divisions. The sample size was determined using the following formula at 95% confidence (20).

$$\text{Sample size, } n = \frac{\alpha_0(1 - \alpha_0) + \alpha_1(1 - \alpha_1)}{(m.e)} = 111 \text{ household}$$

per division

Where:  $\alpha_0$  = Prevalence proportion of VAD among children (6-59 months) in Central Uganda before the intervention, which was 22% (21).  $\alpha_1$  = Projected prevalence proportion after intervention = 12%, and m.e = minimum error = 0.05. Although the calculated sample size was 444 Households, a total of 457 were recruited representing a response rate of 102.9% to cater for any drop outs. In each school community about 20 households were selected from those that participated in the training except for Makindye division.

## 2.5. Data Management and Analysis

A structured KAP/Production questionnaire was used to collect data on socio-demographic information, OFSP knowledge and production, vitamin A related knowledge,

attitudes and practices Data collection was conducted between July and October 2007. The questionnaire was pre-tested and revised before collecting the data from the respondents. The respondents were interviewed in English and Luganda (the most common language) with other languages interpreted.

The data were entered and cleaned using CsPro3.2 software, International Programs Center, Washington, U.S. and exported to SPSS Statistical Package Version 13, SPSS Inc, Chicago, USA for analysis. Chi-square tests were carried out to establish relationships between response variables and intervention groups with the level of significance set at 5%.

## 3. Results

### 3.1. Socio-Demographic Characteristics

Table 2 shows demographic characteristics of the households involved in the study. Kawempe and Rubaga had about 60% of the respondents below 45 years compared to over 90% for Nakawa and Makindye divisions. Over 90% of the respondents in all the divisions were females except for Rubaga which had 84%. With regard to education, 40% of the respondents had attained primary education while about 38% had secondary education. Fewer respondents (10-17%) had tertiary or University education.

Table 2. Respondent's social demographic characteristics (N=457).

Characteristic	% of responses by Division*			
	Kawempe	Rubaga	Nakawa	Makindye
Age of respondent in years				
18-32	31.9	30.8	46.2	37.6
33-45	31.0	34.2	45.2	44.4
46-59	28.4	22.5	2.9	5.1
60-80	8.6	12.5	2.9	5.1
Sex of respondent				
Male	8.6	15.8	8.7	3.4
Female	91.4	84.2	91.3	96.6
Marital status of respondent				
Single	6.9	9.2	1.9	6.8
Married	68.1	70.0	87.5	77.8
Divorced/separated	7.8	7.5	3.8	6.8
Widowed	17.2	13.3	6.7	8.6
Relationship to household head				
Household head	39.7	40.0	19.2	20.5
Spouse	57.8	55.8	77.9	76.1
Other relative	2.6	4.1	2.9	3.4
Maximum level of formal education				
No formal education	1.7	1.7	8.7	6.8
Lower primary (P1-P4)	6.0	11.7	7.7	7.7
Upper primary (P5-P7) or J1	40.5	31.7	34.6	26.5
Lower secondary (S1-S4) or J2	37.9	35.8	34.6	39.3
Upper secondary (S5-S6)	3.4	1.7	2.9	2.6
College (Technical and National Teachers' Colleges)	7.8	13.3	9.6	15.4
University	2.6	4.2	1.9	1.7
Economic occupation				
Long-term salaried employment	13.8	15.0	15.4	19.7

Characteristic	% of responses by Division*			
	Kawempe	Rubaga	Nakawa	Makindye
Casual laborer	6.0	5.0	5.8	6.0
Licensed business owner	4.3	10.8	3.8	0.9
Unlicensed (petty trader)	23.3	25.8	35.6	31.6
Urban farmer	31.0	22.5	9.6	12.8
Domestic house worker	17.2	15.0	6.7	13.7
Others	4.3	5.8	23.1	15.4
Length of time lived in area				
<12 months	0.9	1.7	0	2.6
1-2 years	4.3	3.3	8.7	9.4
>2 & <5 years	11.2	12.5	19.2	12.8
>5 & <=10 years	18.1	18.3	32.7	14.5
> 10 years	65.5	64.2	39.4	60.7

\*Interventions implemented in the divisions of Kampala Capital City Authority (KCCA): Kawempe division (nutrition education + OFSP production); Rubaga division (OFSP production); Nakawa division (nutrition education); and Makindye division (control)

### 3.2. Production of Orange-Fleshed Sweet Potato (OFSP)

The number of respondents for questions about growing of OFSP dropped to 332 from 457 because during the survey, some of the respondents in the divisions that received agriculture component had not yet started growing OFSP. Table 3 gives the distribution of reasons for stopping and for continuing to grow OFSP. The majority of the respondents had no strong reasons for stopping to grow OFSP (51%, 41%, 56% and 33% in Kawempe, Rubaga, Nakawa and Makindye respectively). ; The other two major reasons for farmers to stop growing OFSP were susceptibility to drought and diseases. However, high nutritional value of OFSP was given as the most important reason for continuing to grow OFSP by 77% of the respondents in Kawempe compared to 56% in Rubaga and 75% of the respondents in Nakawa compared to 25% in Makindye.

Table 3. Child caregivers' reasons and plans to grow OFSP (N=332).

Characteristic	% of responses by Division*				P value
	Kawempe	Rubaga	Nakawa	Makindye	
Most important reason to stop growing OFSP					0.000
Poor yields	1.0	5.5	6.3	0.0	
Susceptible to diseases	12.0	15.5	4.2	8.3	
Poor marketability	1.0	1.8	0.0	16.7	
Susceptibility to drought	19.0	16.4	6.3	8.3	
Lack of vines	2.0	4.5	14.6	8.3	
Spouse objects or prohibits	0.0	0.9	0.0	0.0	
No strong reason to stop	51.0	40.9	56.3	33.3	
Very long maturity period	11.0	0.0	2.1	0.0	
Other, specify	3.0	14.5	10.4	8.3	
Most important reason would not stop growing OFSP					0.000
Very high yielding	11.0	18.2	2.1	8.3	
High marketability	4.0	5.5	2.1	0.0	
High nutritional value	77.0	56.4	75.0	25.0	
Aesthetic reason (taste)	7.0	10.9	10.4	16.7	
None	1.0	1.8	4.2	16.7	
Other	0.0	7.3	6.3	16.7	

\*Interventions implemented in the divisions of Kampala Capital City Authority (KCCA): Kawempe division (nutrition education + OFSP production); Rubaga division (OFSP production); Nakawa division (nutrition education); and Makindye division (control)

Table 4. Factors that motivated caregivers to grow OFSP (N=332).

Characteristic	% of responses by Division*				P value
	Kawempe	Rubaga	Nakawa	Makindye	
Motivation for growing OFSP					0.000
Wanted to try something new	3.0	6.4	16.7	16.7	
Nutritional value of OFSP	62.0	45.9	52.1	0.0	
Commercial potential of OFSP	1.0	0.9	0.0	0.0	
Attractive flesh color	4.0	2.8	6.3	41.7	
Children like it	0.0	5.5	0.0	8.3	
Multiple utilization of OFSP varieties	23.0	28.4	16.7	8.3	
Other	7.0	10.1	6.3	16.7	
Missing	0.0	0.0	2.1	8.3	

\*Interventions implemented in the divisions of Kampala Capital City Authority (KCCA): Kawempe division (nutrition education + OFSP production); Rubaga division (OFSP production); Nakawa division (nutrition education); and Makindye division (control)

Table 4 shows the percentage response on factors that motivated caregivers to grow OFSP. Nutritional value of OFSP varieties and preference for giving it to children were identified as main factors. OFSP varieties were identified as better than non-OFSP with respect to nutritional value by over 80% of the respondents in Kawempe and Rubaga

divisions, where the crop was cultivated compared to 38% and 3% in Nakawa (nutrition education) and Makindye (control) divisions respectively. OFSP varieties were preferred to be given to children by over 80% in Kawempe and Rubaga divisions compared to 41% and 7% in Nakawa and Makindye divisions. When asked why OFSP is preferred

for children, the main reason was because of its nutritional value. Further, the explanation that OFSP contains vitamin A was given by 28% of the respondents who received nutrition education compared to 23% for those with only agricultural training and 8% for those in the control group.

### 3.3. Preference of OFSP Varieties

Respondents were asked to give their most preferred variety among the OFSP and non-OFSP grown and the results are presented in Fig 1 and 2.

Kakamega was the most preferred OFSP variety across all

the divisions ( $p < 0.05$ ). In the divisions that received Nutrition Education (Kawempe and Nakawa), 10% more respondents preferred Kakamega to Ejumula compared to 3% for divisions that did not receive Nutrition Education (Rubaga and Makindye). This result demonstrates that Nutritional Education positively impacts on the choice of OFSP varieties. With regard to non-OFSP potato varieties, there was no variety that was consistently preferred across the four Divisions. Dimbuka was most preferred in Kawempe (19%); Kawogo most preferred in Rubaga (30%) and Soroti variety was most preferred in Nakawa (19%) and Makindye (15%).

**Table 5.** Child caregivers preference for OFSP compared to other sweet potato varieties (N=332).

Characteristic	% of responses by Division*				P value
	Kawempe	Rubaga	Nakawa	Makindye	
Comparison of nutritional value					0.000
OFSP better	80.2	83.3	38.5	3.4	
Others better	0		1.0	0	
No difference	0	1.7	0	0	
Don't know	6.0	8.3	6.7	6.8	
Not applicable/missing	13.8	6.7	53.8	89.7	
Variety preference to give to children					0.000
OFSP better	82.8	85.8	41.3	6.8	
Others better	2.6	5.0	3.8	3.4	
No difference	0	1.7	1.0	0	
Don't know/not applicable	14.7	7.5	53.8	89.7	
Reason prefer to give OFSP to children					0.02
OFSP has better nutritional value	46.0	36.4	33.3	33.3	
OFSP contains vitamin A	28.0	22.7	27.1	8.3	
OFSP better liked by children	8.0	10.0	8.3	33.3	
Contains vitamins	7.0	10.9	14.6	0	
Other Reasons	11.0	20.0	16.7	25.1	
Comparison of yield					0.02
OFSP better	72.0	64.5	29.2	50.0	
Non-OFSP better	18.0	23.6	43.8	16.7	
No difference	6.0	8.2	6.3	16.7	
Don't know	4.0	3.6	20.8	16.7	
Comparison of maturity (early)					0.04
OFSP better	62.5	70.0	43.8	33.3	
Non-OFSP better	18.8	16.4	25.0	25.0	
No difference	12.5	6.4	12.5	8.3	
Don't know	6.3	4.5	18.8	33.3	
Missing	0.0	2.7	0.0	0.0	
Comparison of disease resistance					0.04
OFSP better	32.0	19.1	33.3	25.0	
Non-OFSP better	55.0	59.1	31.3	25.0	
No difference	7.0	11.8	8.3	8.3	
Don't know	6.0	10.0	27.1	41.7	
Comparison of drought resistance					0.05
OFSP better	26.0	22.7	31.3	41.7	
Non-OFSP better	62.0	69.1	41.7	33.3	
No difference	6.0	4.5	6.3	0.0	
Don't know	6.0	3.6	20.8	25.0	
Comparison of marketability					0.03
OFSP better	43.0	36.4	35.4	16.7	
Non-OFSP better	31.0	40.9	31.3	50.0	
No difference	0.0	4.5	4.2	0.0	
Don't know	26.0	18.2	29.2	33.3	
Comparison of taste					
OFSP better	74.0	69.1	68.8	33.3	
Non-OFSP better	19.0	21.8	16.7	50.0	
No difference	3.0	5.5	6.3	8.3	
Don't know	4.0	3.6	8.3	8.3	

\*Interventions implemented in the divisions of Kampala Capital City Authority (KCCA): Kawempe division (nutrition education + OFSP production); Rubaga division (OFSP production); Nakawa division (nutrition education); and Makindye division (control)

Table 5 shows the percentage distribution of preference of OFSP compared to other varieties with respect to nutritional value, giving to children. At least 80% of the respondents in Kawempe and Rubaga preferred OFSP varieties with regard to nutritional value. Nakawa (39%) was significantly higher than the percentage in Makindye (3%). A similar trend was observed for variety preferred to give to Children. The main reasons for preferring to give children OFSP varieties were better nutritional value and the fact that OFSP contained vitamin A which was significantly related to nutrition education. Further, respondents across all divisions preferred OFSP varieties to non-OFSP varieties with respect to yield, early maturity and taste, but preferred on OFSP variety with respect to disease and drought resistance. The response on marketability shows that respondents who received Nutrition Education preferred OFSP whereas those who did not receive Nutrition Education preferred non-OFSP varieties

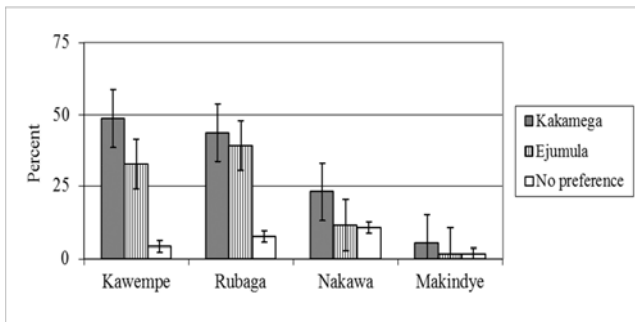


Figure 1. Respondents' preference of OFSP varieties with significant division differences ( $p < 0.05$ ).

Interventions implemented in the divisions of Kampala Capital City Authority (KCCA): Kawempe division (nutrition education + OFSP production); Rubaga division (OFSP production); Nakawa division (nutrition education); and Makindye division (control).

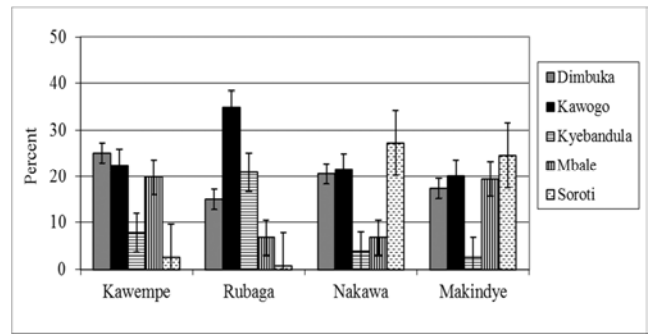


Figure 2. Respondents' preference of non-OFSP varieties with significant division differences ( $p < 0.05$ ).

Interventions implemented in the divisions of Kampala Capital City Authority (KCCA): Kawempe division (nutrition education + OFSP production); Rubaga division (OFSP production); Nakawa division (nutrition education); and Makindye division (control).

### 3.4. Knowledge and Attitudes on Vitamin A

Table 6 shows percentage distribution of respondents who gave correct answers in identifying food sources of vitamin A. Sixty nine per cent (69%), 46%, 54% and 30% of the respondents respectively in Kawempe, Rubaga, Nakawa and Makindye identified at least two vitamin A-rich plant foods. In addition, 61%, 40%, 58% and 33% of the respondents respectively in Kawempe, Rubaga, Nakawa and Makindye identified at least two vitamin A rich animal food sources. It was also noted that divisions which received nutritional education (Kawempe and Nakawa) had more respondents that had better knowledge on vitamin A plant and animal sources than those that did not.

Table 6. Knowledge of correct answers regarding food sources of vitamin A and vitamin A fortified foods (N=457).

Characteristic	% of responses by Division*				P value
	Kawempe	Rubaga	Nakawa	Makindye	
Vitamin A plant rich sources					
No vitamin A food identified	12.9	16.8	22.1	31.6	0.000
One vitamin A food identified	18.1	38.7	24.0	38.5	
Two vitamin A foods identified	21.6	19.3	33.7	12.8	
Three vitamin A foods identified	47.4	25.2	20.2	17.1	
Vitamin A animal rich sources					
No vitamin A food identified	10.3	16.8	8.7	19.7	0.000
One vitamin A food identified	28.4	43.7	33.7	47.0	
Two vitamin A foods identified	47.4	37.0	47.1	32.5	
Three vitamin A foods identified	13.8	2.5	10.6	0.9	
Vitamin A fortified foods					
No correct food identified	55.2	59.7	51.9	66.7	0.050
One correct food identified	27.6	31.9	27.9	24.8	
At least two correct foods identified	17.2	8.4	20.2	8.5	

\*Interventions implemented in the divisions of Kampala Capital City Authority (KCCA): Kawempe division (nutrition education + OFSP production); Rubaga division (OFSP production); Nakawa division (nutrition education); and Makindye division (control)

**Table 7.** Attitudes towards immunization and vitamin A capsules (N=457).

Characteristic	% of responses by Division*				P value
	Kawempe	Rubaga	Nakawa	Makindye	
Immunization kills					0.004
I do not agree	98.1	92.5	97.4	94.5	
I somewhat agree	0.1	2.5	0.3	0	
I agree	0.9	2.5	1.3	2.7	
I strongly agree	0	0.8	0	0.9	
I do not know	0.9	1.7	1.0	1.9	
Compulsory immunization					0.004
I do not agree	2.8	29.8	3.9	28.2	
I somewhat agree	3.4	2.3	3.8	0.9	
I agree	60.9	56.7	60.6	59.0	
I strongly agree	32.9	9.5	31.5	8.5	
I do not know	0	1.7	0.2	3.4	
Capsules reduce Population Numbers					0.002
I do not agree	98.6	50.0	93.2	54.1	
I somewhat agree	0	0	0	0.9	
I agree	0	3.3	1.0	4.9	
I strongly agree	0	1.7	0	0	
I do not know	1.4	55.0	5.8	40.2	
Capsules are needed					0.004
I do not agree	10.3	11.7	11.9	7.7	
I somewhat agree	4.3	6.7	3.9	2.6	
I agree	56.9	56.7	59.4	65.8	
I strongly agree	26.7	17.0	23.3	15.2	
I do not know	1.7	8.0	2.5	8.7	

\*Interventions implemented in the divisions of Kampala Capital City Authority (KCCA): Kawempe division (nutrition education + OFSP production); Rubaga division (OFSP production); Nakawa division (nutrition education); and Makindye division (control)

On Vitamin A related attitudes, results in Table 7 show response on immunization and use of Vitamin A capsules. In response to the question: *A lady called Nambi in Entebbe took her child for immunization. Two weeks after immunization, the child developed a fever and died. Mother feels strongly that the child died because of the immunization. How do you agree with the advice not to take their children for immunization?* Over 92% of the respondents in each division did not agree that immunization kills children. However, when asked whether government should make it a punishable offence for parents who refuse their children to be immunized, about 60% of the respondents in all the divisions of Kampala Capital City Authority (KCCA) agreed. Moreover 32% of the respondents in Kawempe and Nakawa compared to 9% in Rubaga and Makindye who strongly agreed that government should make it a punishable offence for parents who refuse their children to be immunized.

In response to the question: *Some radio presenters have been telling people that giving children vitamin A capsules is grand plan by Bazungu (Whites) to reduce the population of Africans. Do you agree with this?* Over 90% of the respondents in Kawempe and Nakawa did not agree compared about 50% in Rubaga and Makindye. Note that 55% and 40% of the respondents in Rubaga and Makindye respectively gave the 'I do not know' response. When asked whether children should be given vitamin A capsule every six

months, 28% and 23% of the respondents in Kawempe and Nakawa respectively strongly agreed compared to about 15% in Rubaga and Makindye divisions.

The above results show that Nutrition Education impacts positively on Vitamin A related attitudes.

### 3.5. Food Frequency Consumption (FFQ) of Vitamin A Rich Foods

The food frequency of children's weekly consumption of Vitamin-A rich foods was completed by 437 respondents (table 8). The other 20 participants had not had their children with them for all of the previous seven days. Kawempe had 116, Rubaga 117, Nakawa 95 and Makindye 109 respondents for the FFQ. Table 6 shows the results of the frequency of consumption of avocado, ripe mango, ripe papaya, and OFSP in the previous week. There were significant differences in the consumption pattern of these foods among the communities receiving and not receiving nutrition education. Significantly more respondents in Kawempe and Rubaga consumed the foods at least four times a week. For example, 26.7% and 25.6% respectively in Kawempe and Rubaga consumed OFSP at least four times compared to 17.9% and 2.8% respectively for Nakawa and Makindye. Forty percent (40%) and 27% respectively in Kawempe and Rubaga consumed avocado at least four times compared to 20% and 17% respectively for Nakawa and Makindye. Compared to avocado and ripe mangoes, ripe papayas were less frequently consumed.

**Table 8.** Selected vitamin A rich foods consumed by children (N=437).

Division*	Food	% responses by Number of Times by district				Total
		Zero	One to three	Four to six	Seven times	
	Avocado					
Kawempe		11.2	48.3	11.2	29.3	116
Rubaga		25.6	47	11.1	16.2	117
Nakawa		42.1	37.9	9.5	10.5	95
Makindye		48.6	33	6.4	11.9	109
			p<0.05**			
	Ripe Mango					
Kawempe		17.2	42.2	15.5	25	116
Rubaga		24.8	47	13.7	14.5	117
Nakawa		56.8	35.8	4.2	3.2	95
Makindye		43.1	39.4	7.3	10.1	109
			p<0.05**			
	Ripe Papaya					
Kawempe		37.9	44	6	6	116
Rubaga		53	39.3	6	6	117
Nakawa		58.9	31.6	3.2	3.2	95
Makindye		72.5	21.1	2.8	2.8	109
			p<0.05**			
	OFSP					
Kawempe		62.9	26.7	6.9	3.4	116
Rubaga		70.1	25.6	2.6	1.7	117
Nakawa		75.8	17.9	2.1	4.2	95
Makindye		97.2	2.8	0	0	109
			p<0.05**			

\*Interventions implemented in the divisions of Kampala Capital City Authority (KCCA): Kawempe division (nutrition education + OFSP production); Rubaga division (OFSP production); Nakawa division (nutrition education); and Makindye division (control)

\*\*for each food, significance (p value) is for number of times of consumption between divisions

## 4. Discussion

Majority of the Child caregivers were females and had attained at least primary level education, which may have helped in the acquisition of knowledge, positive attitudes and practices related to vitamin A and OFSP. Agricultural interventions are most effective when combined with promotional and nutrition education interventions (22,23). While the efficacy of orange-fleshed sweet potatoes to increase serum retinol levels has been proved, a review of previous agricultural/food-based interventions to reduce general and specific nutrient deficiencies concluded that strategies that only aim to increase production and availability of nutrient-rich foods are less likely to achieve nutrition outcomes and impacts than strategies with strong nutrition education and behavioral change components alongside the agricultural interventions (22,23).

In the current study, Kawempe and Rubaga had the highest percentage of respondents who have ever grown and eaten OFSP and identified vitamin A as a major reason for continuing to grow OFSP. This is because both of these divisions had the nutrition training intervention to support production of OFSP. The differences by division are highly significant and are associated mainly with the agricultural intervention. However, a comparison of Nakawa with Makindye shows that nutritional education had positive impacts for caregiver choices. Nevertheless, Makindye percentages were based on very few respondents who had

ever grown OFSP and may distort the comparisons to other divisions. Furthermore, respondents in all divisions identified OFSP as a better variety in nutritional value and as a preferred variety to be given to children to eat compared to other varieties and so this may suggest that nutrition education played a role in the knowledge and attitude of the respondents about OFSP as a nutritious food for children.

Knowledge of how the caregivers can ensure good child health is very important. Respondents who received nutrition education had better knowledge of vitamin A sources and more positive attitudes on vitamin immunization and the need for use of capsules by their children. Consistent with findings from previous studies (15,16,17,24,25), the current findings show that nutrition education to caregivers enhances their attitudes, knowledge and practice of food-based interventions for increasing Vitamin A uptake.

Index children consumed more Vitamin A rich foods by index children showing significant differences among the divisions. Kawempe and Rubaga divisions (where production of OFSP took place) consumed more of the vitamin A foods including OFSP. This shows that as much as people may have the right knowledge and attitude, they may not necessarily be able to put them to practice. If a food was produced locally in the divisions that received training and resources to support production, there appeared to be a higher likelihood that it would be consumed, as was the case of OFSP.



This study was done as part of a larger study on the adoption of OFSP as food-based intervention for increased uptake of Vitamin A by children. The study shows that nutrition education interventions are a critical component in realizing the impact of the OFSP intervention since the community who received both production training and nutrition education had the best outcomes with respect to motivation factors for growing OFSP, knowledge and attitudes on Vitamin A.

## 5. Conclusion

The results of this study show that agricultural training has a positive effect on the adoption and production of OFSP, but when combined with nutrition education on the benefits of OFSP farmers have a better motivation for growing OFSP. A food-based strategy for addressing nutritional concerns is therefore likely to be more successful and sustainable if nutrition education is integrated with agricultural training. Findings in the study further show that divisions with nutrition education had respondents with more knowledge and positive attitudes on vitamin A related child health practices. Nutrition education and vitamin A related knowledge and practices aimed at having good child health should be taken up by the public health sector so as to boost the fight against Vitamin A deficiency and other nutritional disorders.

## Authors' Contributions

J. Nabugoomu was a Master of Science student and Research Assistant on the Schools OFSP project of the International Potato Center (CIP). J. Nabugoomu, A. Namutebi, A. N. Kaaya, and G. Nasinyama were responsible for supervision of fieldwork and the acquisition of data for this particular study. Data analysis and interpretation was performed by J. Nabugoomu; the manuscript was drafted by Josephine Nabugoomu; the manuscript was revised critically for substantial intellectual content by J. Nabugoomu, A. Namutebi, A. N. Kaaya, and G. Nasinyama.

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