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Effect of nutrition education and psychosocial factors on child feeding practices: findings of a field experiment with biofortified foods and different women categories

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ABSTRACT

Despite the efforts to promote good practices in infant and young child feeding (IYCF), the adoption of such practices has been low. Using data from a sample of 665 women, and the theory of planned behavior, we examine the effect of different types of nutrition education and psychosocial factors on the use of recommended IYCF practices. Regression results show that nutrition education and psychosocial factors have strong positive effect on the extent to which IYCF practices are used, with the latter having conflicting individual but overall positive effect. Moreover, coefficients of latter were mostly less than those of the former indicating that psychosocial factors were less important in explaining variability in usage of IYCF than the nutrition education variables. It further finds that different sets of nutrition education and psychosocial factors affect different categories of women, with interactive nutrition education approaches having a greater effect. The findings also suggest need for targeting of beneficiaries with multiple nutrition education approaches.

KEYWORDS


Child feeding practices; Kenya; nutrition education; orange-fleshed sweetpotato; Poisson regression model; psychosocial factors

Introduction

Most nutrition interventions aimed at combating nutrient deficiency such as vitamin A deficiency among young children target caregivers' behavior change relating to infant and young child feeding (IYCF) practices. Behavior change approaches used usually focus on persuading the targeted beneficiaries to use recommended feeding practices including early initiation and exclusive breastfeeding, continued breastfeeding up to 2 years, dietary diversity, food of the right texture and consistency, proper meal frequency, and a minimum acceptable diet (WHO 2010).

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The interest in influencing the behavior of caregivers to change IYCF behavior derives from the prevalence and persistence of malnutrition globally, and especially in Sub-Saharan Africa (SSA). Despite the progress made in the last three decades, malnutrition still affects every one in three persons globally (Gillespie and Van Den Bold 2017) and is stubbornly high in SSA. The WHO (2017) estimates that 59 million children in SSA suffer from some form of malnutrition. In Kenya, malnutrition rate remains quite high, with 85% of the children under 5 years afflicted by vitamin A deficiency (UNICEF 2017). Malnutrition imposes a heavy cost burden on societies and has life-long effects including reduced livelihood opportunities and potentials (Fanzo 2012).

The slow progress in combating malnutrition in the global south—especially SSA—and its impact on the public sector and individual life outcomes has led to concerted efforts to fight its causes (Low et al. 2017). In this paper, we focus on a large community-level agriculture-nutrition intervention that used a combination of nutrition education and social and behavior communication (social and behavior change communication [SBCC]) strategies to improve IYCF practices among different categories of women in western Kenya. The initiative known as Scaling Up Sweetpotato Through Agriculture and Nutrition (SUSTAIN) used a strong community-based nutrition education¹ and SBCC to promote the incorporation of biofortified orange-fleshed sweetpotato (OFSP) into the diets of children 6–23 months of age. The SBCC focused on addressing cultural/psychosocial factors that hinder or facilitate the adoption of recommended IYCF practices.

Past studies evaluating women's behavior toward IYCF practices in Kenya have focused on variety of factors, including socioeconomic aspects, with attention to HIV-AIDS status of mothers (Dasgupta et al. 2017; Gewa and Leslie 2015; Kimani-Murage et al. 2013; Wanjiku et al. 2015; Wanjohi et al. 2017); community level factors including access to health care facilities and community worker's incentive system (Nguyen et al. 2016); parental role in decision-making and care practices (Chintalapudi et al. 2017); intrahousehold factors including caregivers' competence (Schneider et al. 2017) and the policy environment (Sanghvi et al. 2016). Further, Issaka, Agho, and Renzaho (2017), Habtewold, Islam, and Sharew et al. (2017), and Ogbo, Page, and Idoko et al. (2015) use meta-analysis to examine the effect of multiple factors on IYCF.

To date, however, relatively little research exists on the role of psychosocial factors on IYCF practices. Exceptions include Bai et al. (2011) and Hamilton et al. (2011) who investigated the effect of psychosocial factors on the adoption of exclusive breastfeeding and complementary feeding, respectively, using the theory of planned behavior; McMillan et al. (2008), Swanson and Power (2005), Hendreş et al. (2014), Thomas et al. (2015), Horodynski et al. (2007), Brophy-Herb et al. (2009), and Spinks and Hamilton (2015) who assess the role of psychosocial factors on exclusive breastfeeding under economic hardships, and on mothers' dietary decisions for 2–3-year olds.

Other studies have also examined the role of environmental factors, including nutrition education on IYCF practices. For example, in Kenya, Kimani-Murage et al. (2013) and Kulwa et al. (2014) assess the effect of home environment-based intervention on infant feeding practices.

This study uses a rich data set collected as part of a comprehensive study of the multiple factors influencing maternal and young child feeding behavior/practices to examine the effect of nutrition education and psychosocial on the use of comprehensive IYCF practices among different categories of women. Data were collected on women stratified into (1) pregnant women who were also caregivers of children below 2 years, (2) mothers of 0–5 months old children, (3) mothers of 6–23 months old children, and (4) potential mothers (i.e., women of age 19–49 years who were caregivers of children below 2 years but did not belong to the first three categories at the time of the study). The data specifically allow us to control for personal, household, environmental, and institutional factors while evaluating the effect of different forms of nutrition education on IYCF practices. The data also specifically enable us to assess the role of psychosocial factors on the use of IYCF practices. Further, unlike most studies, we use an approach that allows for the analysis of the effect of nutrition education and psychosocial factors on a set of nine IYCF variables, including the seven standard IYCF practices and two OFSP-focused practices. The approach adopted further allows for the assessment of the individual and combined² effects of various nutrition education components (namely, individual counseling, group health talks through mother-to-mother clubs, health talks at ante/postnatal clinics, and cooking demos). Similarly, we assess both the individual and combined effect of the vector of psychosocial factors (namely, knowledge, attitudes, perceived behavioral control, and subjective norms) on the use of IYCF practices. To assess the complex mix of economic, environmental, personal, and psychosocial factors that drive the use of recommended IYCF, we use an approach that combines all these variables in an econometric model and uses statistical methods to test their partial and joint effects on IYCF.

Methods

Study context

The study focuses on women caregivers' child feeding practices in Homa Bay County of Kenya. The county has high incidence of malnutrition and poverty (Kenya National Bureau of Statistics, 2015). Official government statistics indicate that only 22% of children 6–23 months old receive the recommended complementary feeding. It is also estimated that only 41% of 0–5 months old children have early breastfeeding initiation, with only 35% of them being

exclusively breastfed and that 50% of the 6–23 months old children receive minimum acceptable diet (Kenya National Bureau of Statistics 2013).

Homa Bay County is an interesting case to study because it benefited from well-structured nutrition education and SBCC activities led by the International Potato Center through the project “SUSTAIN” and its partners. The project adopted a food-basket approach³ in the nutrition campaigns and worked with local partners, especially the government Health Department, in promoting the recommended IYCF practices. The strategies used in disseminating various nutrition messages included nutrition messaging in form of health talks at the ante- [ANC] and postnatal clinics [PNC] and mother-to-mother clubs, nutrition counseling (i.e., one-to-one training on nutrition issues), and cooking demonstrations illustrating how to make weaning and baby foods incorporating OFSP products. Caregivers were specifically taught how to incorporate cooked OFSP leaves and roots into baby foods. Nutrition messaging conducted at the health clinics was accompanied by provision of coupons that allowed the recipients to access subsidized planting material of OFSP from the nearest OFSP vine multipliers. The messaging emphasized the importance of proper child feeding and the benefits of incorporating OFSP in complementary foods. Nutrition counseling, on the other hand, involved one-to-one personal nutrition/health talks with mothers with acute nutrition cases, hence deserving more attention, at the health clinic and during home visits. At the mother-to-mother clubs, nutrition education was provided by community health volunteers’ (CHV) using a counseling cards developed by the project. The cards outlined different IYCF themes. Cooking demonstrations were held periodically during open-day events led by the project and CHVs.

The SBCC campaigns targeted some of the personal, economic, environmental, and cultural/social/psychosocial influencers of IYCF practices, specifically focusing on caregiver’s knowledge, attitudes, perceived behavior control (PBC), and subjective norms. Understanding these drivers of child feeding behavior among different categories of women caregivers is important in targeting different mothers with information aimed at changing IYCF behavior, and in nutrition education campaigns in general. Indeed, Kenya’s Food and Nutrition Security Policy (GOK 2011) calls for improved awareness of drivers of child nutrition and feeding practices in order to change caregivers’ attitudes and behavior toward young child feeding.

Study design and data

This study uses data from a cross-sectional study conducted in Homa Bay County (see [figure 1](#)), Western Kenya, in August and September 2016. The study is based on a sample of 665 respondents who, at the time of the interviews, had a child below 2 years in their households and had received nutrition education from SUSTAIN project and/or its partners. Study participants were randomly selected from a pre-compiled list of pregnant women, mothers of 0–5 months old children,

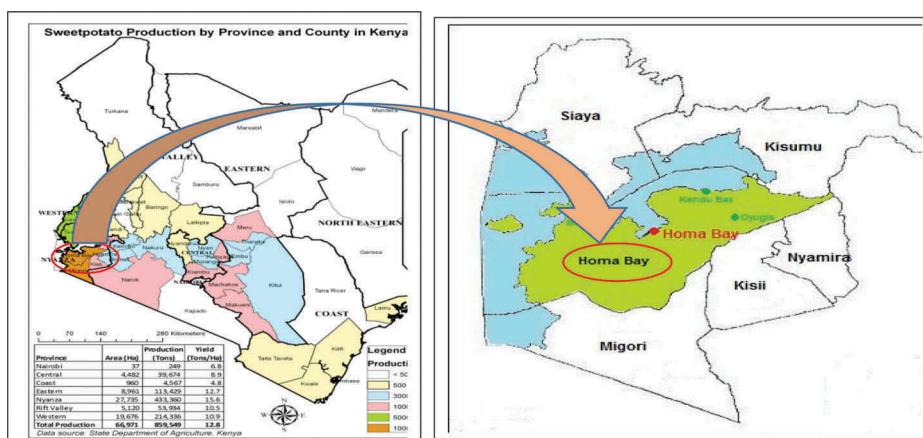


Figure 1. Maps showing the study location.

mothers of 6–23 months old children, and potential mothers. The sampling proceeded as follows: First, Homa Bay County was purposively selected because it had benefitted from SUSTAIN project for the longest period of time (i.e., 3 years), compared to other counties targeted by the project. Next, nine Community Units⁴ (CUs) where the project had been implemented since 2014 were selected purposively. In each chosen CU, villages were listed, and the list generated based on the ministry of health register updated with the help of CHVs who were more familiar and up to date with the local conditions. This ensured that final list of villages was comprehensive and exhaustive and that every village has an equal chance of being sampled for the study. Next, a sample of villages was drawn randomly using probability proportionate to size technique. In each of the sampled villages, eligible households were listed and stratified into the four categories of women with the help of CHV. Lastly, four women were randomly drawn from each of the four lists in each village for personal interviews.

A structured pretested questionnaire was used to collect data through personal interviews and was administered by trained enumerators. During enumerator training, the questions were thoroughly discussed and local language (i.e., Kiswahili and Luo) translations agreed upon collectively for consistency in administering the tool (i.e., asking the questions). Interviews were conducted in the respondents' respective homes. On arrival at a household, the enumerator was required to introduce themselves and read a consent statement to the respondent. If the respondent agreed to the interview, they would proceed with the interview.

Theory

This study draws from theory of planned behavior (TPB), with behavior defined as the use of recommended IYCF practices. The TPB posits that the

most important determinant of a person's behavior is the intention to implement a behavior (Ajzen 2002). Behavior intention in the form of readiness to perform a certain behavior/practice is predicted by three factors, namely, attitudes toward behavior, subjective norms, and PBC. In this study, intention signifies a person's willingness or reluctance to implement the recommended IYCF practices, which is in turn determined by, among other factors, the individual's knowledge.

Attitudes refer to the positive and negative evaluations of a behavior. They can be acquired from experience and comprise affective and cognitive components (Ajzen 2002). Affective attitude is the feelings about the behavior and relates to whether a person finds the behavior enjoyable, or otherwise, to perform. The cognitive attitude, on the other hand, deals with thoughts associated with the practices, for instance, whether performing a behavior is beneficial or harmful.

Subjective norms relate to how a person estimates the effect of social pressure on the person's likelihood to undertake a behavior (Ajzen 2002). They refer to one's belief about, and tendency to behave in accordance with, other people's expectations. That is, doing what others think one should do. This construct therefore deals with a person's perception of his/her approval or disapproval by other important people that is conformity with the societal norms. It reflects the influential role of people's or society's behavior under consideration (Bandura 1977). PBC, on the other hand, refers to the perception of the control one has over performing a behavior. It directly influences behavior (Ajzen 2002). Lastly, knowledge refers to the level of awareness, which in our context relates to awareness of vitamin A and IYCF practices. It helps in the comprehension of the best way to follow in realizing behavioral intention (Pellegrini 2007).

Empirical methods

The dependent variable in this study, a count variable, cannot be efficiently estimated using the ordinary least squares technique. The most common technique for estimating count dependent variable is the Poisson regression model (Blackburn 2015; Okello and Swinton 2010). This study therefore used the Poisson regression model. The estimated model captures the intensity of using the IYCF practices. A total of nine practices were included in the estimated model. The dependent variable could therefore take the values 0, 1, 2, 3, ..., 9.

The implicit functional form of the Poisson regression model estimated to assess the effect of various components of nutrition education and psychosocial factors on the use of recommended IYCF practices can be specified as

$$\text{Number of IYCF practices} = f(\text{personal characteristics, nutrition education, psychosocial factors, institutional factors}) + \varepsilon \quad (1)$$

where, as above, the dependent variable, Number of IYCF practices, is defined as the count of IYCF practices a caregiver applied and ranged from 0 to 9. The nine practices considered were breastfeeding initiation, exclusive breastfeeding, continued breastfeeding at 1 year, minimum meal frequency, diet diversity, texture of food, minimum diet diversity, incorporating OFSP root in child foods, and incorporating OFSP leaves. These practices were assessed on a binary scale, with Yes = 1 if a practice was used and No = 0 if otherwise, and the total score used for each respondent used as the dependent variable. The practices and their definitions are presented in [table 1](#).

Measurement of psychosocial variables

This study used four latent constructs (i.e., variables), based on the TPB, to proxy psychosocial factors, namely, attitudes, subjective norms, PBC, and knowledge. Prior to the actual survey, the questions capturing the variables on subjective norms and PBC were tested among 60 respondents and the results used to further revise and refine the tool/questionnaire. In addition, post-enumerator training pretest of the entire questionnaire was used to further check the questions for ease of comprehension, clarity, and cultural appropriateness and to test the ease of administering the scales. The collected data were further subjected to statistical tests of reliability. The summary of the results of this test and reliability statistics for the study measures is described in appendices 1A, 1B, and 1C.

Attitudes were measured on a 7-point bipolar scale⁵ using eight items adapted from Fishbein and Ajzen (2010). An example of an item used was “for me providing proper complementary feeding incorporating OFSP is” Bad/Good.

Subjective norms were also measured on a 7-point bipolar scale, using statements adapted to IYCF following Ajzen (2002) guidelines. An example of an item used is “most people who are important to me think that I should provide proper complementary feeding after the age of six months with foods that include OFSP of about 125g at least three times a week” (False/True).

Table 1. Description of infant and young child feeding (IYCF) practices.

Practice	Description
Early breastfeeding initiation	Breastfeeding within the first hour of birth
Exclusive breastfeeding	Giving only breast milk for the first 6 months
Continued breastfeeding at 1 year	Breastfeeding between 12–15 months
Meal frequency	6–8 months, 2 meals; 9–11 months, 3 meals; 12–23 months, 4 meals
Minimum diet diversity	Feeding of at least 4 groups of food per day
Texture of food	Feeding a child on food acceptable texture and consistency
Amount of food per meal	6–8 months, 2–3 tablespoons per feed; 9–11 months, 1/2 250 ml bowl/cup; 12–23 months, 3/4 to 1 250 ml bowl/cup
Feeding OFSP roots	Incorporating OFSP into a child's food
Feeding OFSP leaves	Incorporating OFSP leaves into a child's food

Next, PBC, i.e., the level of confidence in performing a behavior was measured using four items adapted to IYCF following Ajzen (2002). An example of items used is “if I really wanted to, I could provide proper complementary feeding after the age of six months with foods that include OFSP of about 125g at least three times a week” (Likely/Unlikely). Lastly, following Grunert, Scholderer, and Rogeaux (2011), objective knowledge, included as a formative construct, was measured using 13 statements assessing different aspects of complementary feeding, use of OFSP as baby food and vitamin A knowledge. Answers to the knowledge statements were provided on a True (=1)/False (=0) format, with a “Do not know” (=NA) alternative provided. Summary statistics and statements used to measure each construct are presented appendices 1A, 1B, and 1C.

The independent variables were defined as follows, based on the categories:

- (1) **Personal characteristics:** *log age* = natural log of the age of the respondent in years; *log off-farm income* = natural log of total household income earned in 2015 in Kenya shillings from self-employment, casual work, and permanent employment; *birth parity* = dummy variable equal to 1 if the respondent is a first-time mother, 0 otherwise; and *household_size* = total number of people living in the household. Three dummy variables for the women categories targeted during the survey were also included. These were *pregnant* = 1 if woman was pregnant at the time of interview, 0 otherwise; *infant* = 1 if the women had an infant (0–5 months old), 0 otherwise; *young child* = 1 if woman has young children (6–23 months), 0 otherwise; and *potential* = 1 if woman is 19–49 years old (and has been a caregiver before) but was not in the first three categories at the time of the interview, 0 otherwise.
- (2) **Nutrition education variables:** *nutrition counseling* = 1 if the respondent was counseled one-to-one in the health facility where they attended prenatal clinics or PNC, 0 otherwise; *nutrition messaging* = 1 if respondent was trained on child nutrition or received health talk at the health facility where they attended prenatal clinics or PNC, 0 otherwise; *mother club* = 1 if respondent received health talk on child nutrition at the mother-to-mother club, 0 otherwise; *cooking demonstration* = 1 if respondent attended a cooking demonstration, 0 otherwise.
- (3) **Psychosocial factors:** *knowledge* = respondent’s total score of knowledge of maternal and child feeding practices; *attitude* = average index of a respondent’s attitudes toward IYCF; *perceive behavior control* = average index of respondent’s perceived behavior control; *subjective norms* = average index of respondent’s subjective norms estimated as a mean score.
- (4) **Institutional factors:** *clinic* = 1 if respondent attended ANC and PNC, 0 otherwise; *log distance chv* = natural log of distance to CHV in minutes.

Results and discussions

Characteristics of the respondents

Results from the data indicate that 19% of the women respondents were pregnant, 28% were mothers of infants, 30% had young children, and 23% were potential mothers. In addition, 65% of the respondents were married and living with their spouses, which makes men an important part of the immediate social environment within which IYCF occurs. The data also show that 90% had utilized ANC/PNC services and about 78% had received nutrition messaging from a local health facility, 39% of the women had attended a cooking demonstration. The respondents had on average 9 years of schooling. Results also show that most respondents were young and had low level of education, with the average age and years of schooling being 27 and 9 years, respectively. [Table 2](#) presents the summary statistics of the variables used in the estimation of the regression models and used to test the effect of nutrition education and psychosocial factors on the use of IYCF practices.

The first two columns present the results of the whole sample, followed by eight columns present results by women category. The last two columns present the Bonferroni test of differences in means among for the four women categories. Among the personal characteristics, there was statistically significant difference in birth rate between potential mothers and the rest of the women categories. The very small mean (close to 0) for potential mothers indicates, as expected, that majority of women in this category had not had any child and therefore recorded birth parity of 0.

Results show that, among the nutrition education variables, the four categories of women differed with respect to nutrition counseling, nutrition messaging (i.e., the health talks), and cooking demonstration. Once again, potential mothers differed in their participation in these activities from the rest of women categories with respect to nutrition counseling and nutrition messaging. This is in line with a priori expectations because these activities are usually conducted at health facilities and target pregnant and lactating women and mothers of children less than 2 years. For the cooking demonstrations, both mothers of children 6–23 months of age and potential mothers significantly differed from the other two categories of women. Among the psychosocial and institutional variables, the four categories of women different only with respect to knowledge and participation in prenatal clinics/PNC, respectively.

Use of recommended IYCF practices

The results of analysis of the extent of using the recommended IYCF practices assessed are shown in [table 3](#). They show that the most widely applied practice is early breastfeeding initiation (75%), while the least adopted is the provision of a minimum acceptable amount of food (only 10%). The high usage of early

Table 2. Summary statistics of variables used in the Poisson regression model.

Variable	Overall (N = 665)		Pregnant (N = 122)		Infant (N = 187)		Young child (N = 202)		Potential (N = 154)		Test of differences	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	F	p Value
<i>Dependent variable</i>												
IYCF practices	3.18	2.19	2.37	2.34	2.84	1.78	4.07	2.03	3.07	2.34	20.03	.000***
<i>Independent variables</i>												
<i>Personal characteristics</i>												
Age	27.42	7.50	27.47	8.00	28.06	7.93	27.04	6.92	27.08	7.30	0.73	.533
Logage	3.28	0.27	3.27 ^a	0.28	3.30 ^a	0.28	3.27 ^a	0.25	3.26 ^a	0.26	0.52	.667
Birthparity	0.17	0.37	0.18 ^a	0.39	0.22 ^a	0.41	0.22 ^a	0.41	0.02 ^b	0.14	11.10	.000***
Off-farm income (whole year)	132554	143537	134552	144153	141131	131239	126202	153350	128889	144867	0.39	.757
Log off-farm income	11.4	0.99	11.43 ^a	0.94	11.50 ^a	0.93	11.28 ^a	1.12	11.42 ^a	0.90	1.78	.149
Household size	5.74	1.98	5.69 ^a	1.93	5.93 ^a	2.06	5.69 ^a	2.06	5.63 ^a	1.80	0.77	.513
<i>Nutrition education variables</i>												
Motherclub	0.17	0.38	0.15 ^a	0.36	0.17 ^a	0.37	0.16 ^a	0.37	0.21 ^a	0.41	0.74	.531
Nutrition counseling	0.33	0.47	0.34 ^a	0.48	0.41 ^a	0.49	0.35 ^a	0.48	0.18 ^b	0.39	7.32	.000***
Nutrition messaging	0.78	0.41	0.81 ^a	0.39	0.85 ^a	0.36	0.87 ^a	0.34	0.56 ^b	0.50	20.54	.000***
Cooking demonstration	0.39	0.49	0.29 ^a	0.45	0.32 ^a	0.47	0.43 ^b	0.50	0.51 ^b	0.50	6.86	.000***
<i>Psychosocial variables</i>												
Knowledge	11.09	3.56	10.37 ^a	3.48	10.62 ^a	3.69	11.58 ^b	3.45	11.58 ^b	3.44	5.15	.002**
Attitude	5.89	0.57	5.90 ^a	0.59	5.95 ^a	0.54	5.84 ^a	0.60	5.86 ^a	0.57	1.40	.242
Perceived behavior control	5.58	0.76	5.14 ^a	0.94	5.20 ^a	0.85	5.27 ^a	0.84	5.24 ^a	0.82	0.05	.984
Subjective norms	5.22	0.86	5.58 ^a	0.83	5.57 ^a	0.81	5.58 ^a	0.71	5.60 ^a	0.69	0.66	.575
<i>Institutional variables</i>												
Clinic	0.9	0.3	0.99 ^a	0.09	0.97 ^a	0.16	0.97 ^a	0.17	0.66 ^b	0.48	57.92	.000***
Distance to chv (minutes)	16.75	15.92	17.40	16.85	19.11	16.66	16.89	16.41	13.16	12.81	3.47	.016**
Log distance chv	2.54	0.82	2.56 ^a	0.83	2.66 ^a	0.83	2.54 ^a	0.81	2.40 ^{ab}	0.77	2.89	.035**
<i>Women category variables</i>												
Infant	0.28	0.45										
Young child	0.3	0.46										
Potential	0.23	0.42										

"a", "b" represent significant differences in the groups. ***, **, * = significant at 1%, 5%, and 10%, respectively.

initiation of breastfeeding can be attributed to intense government campaigns advocating for mothers to deliver in health facilities where they assisted in putting the baby to the breast soon after birth. Indeed, all the three variables related to breastfeeding practices had usage rates higher than 50% indicating that breastfeeding practices are substantially adopted.

The results further show that practices related to complementary feeding are the least adhered to. For instance, only about 21% of the women provided diverse diets, with slightly more than 11% providing diets that attain the minimum diet diversity. Adherence to meal frequency was the highest among practices relating to complementary feeding, but with only about 35% of the respondents practicing it. Results also show that only 20% of the women had incorporated OFSP in the diets of young children. Remarkably, about 11% had used OFSP leaves for young child feeding. This finding may be related to the fact that SUSTAIN project encouraged mothers to include OFSP leaves as vegetables in their children's diet.

The results of the Bonferoni test of differences in means (demonstrated by superscripted letter) further show that there are differences in the usage of IYCF practices among different mother groups. For instance, as expected, a higher percentage of mothers of children 6–23 months of age and the potential mothers indicated that they would use complementary feeding incorporating OFSP roots than other categories of mothers.

Table 3. Extent of using recommended infant and young child feeding practices, % yes of responses ($N = 665$).

Practice	Overall ($N = 665$)	Pregnant ($N = 122$)	Infant ($N = 187$)	Young child ($N = 202$)	Potential ($N = 154$)	Test of differences	
						<i>F</i>	<i>p</i> Value
Early breastfeeding initiation	74	57 ^{a*}	87 ^b	82 ^b	64 ^{ab}	18.27	.000***
Exclusively breastfeeding	65	48 ^a	74 ^b	76 ^b	53 ^a	14.93	.000***
Continued breastfeeding at 1 year	58	40 ^a	49 ^a	77 ^b	60 ^{ab}	18.40	.000***
Minimum meal frequency	36	30 ^a	14 ^a	32 ^b	20 ^a	6.82	.000***
Minimum diet diversity	22	18 ^a	23 ^a	50 ^b	38 ^{ab}	11.65	.000***
Amount of food per meal	11	4 ^a	7 ^a	18 ^b	10 ^a	7.06	.000***
Texture	21	16 ^a	10 ^a	34 ^b	21 ^{ab}	12.83	.000***
Feeding OFSP roots	21	18 ^a	14 ^a	25 ^{ab}	25 ^{ab}	3.14	.024**
Feeding OFSP leaves	11	7 ^a	7 ^a	14 ^a	16 ^{ab}	3.53	.014**

"a", "b" represent significant differences in the groups.

***, **, * = significant at 1%, 5%, and 10%, respectively.

Factors influencing intensity of using recommended IYCF practices

The results of Poisson model for all the women combined are presented in table 4. The first hypothesis tested in this study was that nutrition education has no influence on the intensity of using the recommended IYCF practices. As shown, the results indicate that participation in mother-to-mother clubs, health talks during the clinics, and cooking demonstrations as well and nutrition counseling all had significant individual positive effects on the expected number of IYCF practices used. That is, participation in each of these nutrition education activities and receiving nutrition counseling increased the number of IYCF practices applied in infant and young children feeding. Does this mean that these nutrition education strategies jointly increased the number of IYCF practices used? To address this question, we conducted a Wald joint exclusion restriction test (see Wooldridge 2015, p. 139). This test essentially examines whether positive individual effects translate into joint positive effect on the expected number of IYCF practices used. The test yielded a Wald Chi-square statistic and *p* value of 45.96 and .001, respectively, thus rejecting the hypothesis that the nutrition education strategies have no joint positive effect on the number of practices applied by

Table 4. Factors affecting the intensity of using recommended IYCF practices: Poisson regression results with robust standard errors.

	Coefficients estimates			Marginal effects		
	Coeff.	SE	<i>p</i> Value	dy/dx	SE	<i>p</i> Value
<i>Personal characteristics</i>						
Log age	0.162	0.089	.069*	0.483	0.266	.069*
Birth parity	-0.138	0.068	.044**	-0.393	0.186	.035**
Log off-farm income	-0.066	0.023	.005***	-0.197	0.070	.005***
Household size	-0.014	0.012	.252	-0.042	0.037	.252
<i>Nutrition education variables</i>						
Mother club	0.245	0.064	.000***	0.795	0.223	.000***
Nutrition counseling	0.132	0.052	.011**	0.404	0.163	.013**
Nutrition messaging	0.184	0.074	.012**	0.523	0.198	.008***
Cooking demonstration	0.131	0.052	.012**	0.395	0.160	.014**
<i>Psychosocial variables</i>						
Knowledge	0.037	0.007	.000***	0.109	0.021	.000***
Attitudes	-0.047	0.040	.236	-0.141	0.119	.237
Subjective norms	-0.066	0.034	.053*	-0.196	0.100	.052*
Perceived behavior control	0.112	0.042	.009***	0.333	0.126	.008***
<i>Women category variables</i>						
Infant	0.175	0.089	.050**	0.545	0.285	.056*
Young child	0.473	0.088	.000***	1.563	0.313	.000***
Potential	0.375	0.098	.000***	1.244	0.356	.000***
<i>Institutional variables</i>						
Clinic	0.634	0.146	.000***	1.492	0.260	.000***
Log distance chv	-0.067	0.030	.027**	-0.200	0.090	.027**
Constant	0.051	0.474	.914			
Wald χ^2		249.97			0.000	
Pseudolikelihood				-1344.096		
Pseudo R^2				0.091		

***, **, *Significant at 1%, 5%, and 10%, respectively.

caregivers. In other words, the test results indicate that, other things equal, nutrition messaging/health talks at the clinic, nutrition counseling, health talks at the mother-to-mother clubs, and cooking demonstrations jointly increase the expected number of practices used. Consequently, we reject the first hypothesis that nutrition education has no effect on the extent to which caregivers use IYCF practices.

The marginal effects show that participation in mother-to-mother clubs' health talks increased the expected number of practices used by more than 79%, other things equal. This finding can be attributed to the fact that such fora provided both recommended feeding information and social support (collective action) needed to comply. Results further indicate that respondents who received nutrition counseling used a higher number of practices than their counterparts. Specifically, nutrition counseling increased the expected number of IYCF practices used by about 40%, other things equal. The finding corroborates those of Kimani-Murage et al. (2013) and Latterra et al. (2014) who found that personalized counseling and nutrition support at the health facility level are very effective in increasing the use of recommended IYCF practices.

The results further show that nutrition messaging/health talks during the ANC/PNC increased the expected number of IYCF practices used by about 52%, other things constant. This finding may be because nutrition messaging increases self-efficacy, hence the determination to use recommended practices. Having attended a cooking demonstration also increased the expected number of IYCF practices used by a relatively large proportion (39%), holding other causal factors constant.

Results also show that, among the psychosocial factors, knowledge, subjective norms, and perceived behavioral control have individual significant effect on the number of IYCF practices used. Attitude toward recommended child feeding practices had no effect on the use of IYCF practices among the respondents who participated in this study. Among the psychosocial factors that influenced feeding practices used, knowledge and perceived behavioral control had strong positive effects while subjective norms had negative, albeit moderate, effect.

More specifically, the results of marginal analysis indicate that a unit increase in the knowledge score increased the expected number IYCF practices used by 11%, other factors constant. Similarly, a unit increase in the perceived behavioral control index increased the expected number of IYCF practices used by 33%, other things constant. The findings relating to PBC corroborate those of Bai et al. (2011) who also found that it affects adoption of IYCF. They indicate that the respondents' confidence in their ability to implement IYCF practices strongly influences the number of such practices they implement.

The results also show that a unit increase in subjective norms index results in 20% decrease in the expected number of practices used, other things

constant. This finding suggests that the social environment within which the respondent lived had a negative influence on IYCF practices. This finding is in line with a priori expectations. The western region of Kenya, where the county falls, has a lot of cultural beliefs that can negatively influence feeding behavior, including that a child should not continue to breastfeed after 2 years, that breastfeeding makes a child not eat well, and a boy child cannot be satisfied by breast milk alone.

Notably, the coefficients of nutrition education variables were, except for cooking demonstrations, much larger compared to those of psychosocial variables.⁶ A large coefficient of a variable in a regression model usually denotes the importance (i.e., practical significance) of that variable (see Wooldridge 2015, p. 735) but is not to be confused with statistical significance—the result a *t*-test. In the present case, this indicates that nutrition education variables had greater importance in explaining the variability in the use of IYCF practices than did the psychosocial variables. The greater importance of nutrition education variables over the psychosocial variables is probably due to the strong nutrition education campaign efforts led by the project and its partners.

To test the overall joint effect of psychosocial factors on the intensity of using IYCF practices, we performed the Wald joint exclusion test described above. The Wald Chi-square statistic and *p* value of the test were 38.41 and .001, respectively. The test results therefore indicate that even though attitudes had no effect and subjective norms had negative effect, psychosocial factors examined in this study had an overall/joint positive influence on IYCF practices used. That is, psychosocial factors jointly increased the number of IYCF used, other things being equal. Thus, the hypothesis that psychosocial factors have no effect on the intensity of using IYCF practices was therefore rejected.

Several individual conditioning variables (namely, age, birth parity, off-farm income, and women categories) also significantly influenced the use of IYCF practices. A unit increase in the natural log of the age of the respondent increased the expected number of practices used by about 48%, other things equal. This finding suggests that older mothers tend to use more practices, probably due to experience in infant and child feeding over the years. It is in line with Lohia and Udipi (2014) findings.

Results also show that income earned from off-farm sources affected the expected number of IYCF practices used. Other things constant, increase in natural log of off-farm income by one Kenya Shilling (1 USD = 110 Kenya Shilling) decreases the expected number of practices used by more than 19%. This finding indicates that mothers who participate in off-farm employment activities used fewer recommended IYCF practices, probably because off-farm employments take them away from home, hence they are unable to feed

their infant and/or young children as and when need. Onah et al. (2014) and Ogunba (2015) found similar results among working mothers.

Attending ANC/PNC increases the expected number of IYCF practices used by more than 14%, other things constant, and is in line with findings of Rana et al. (2016). Further, distance to the nearest CHV, a proxy for access to health information, reduces the expected number of IYCF practices used. This effect of distance could also be due to high transaction costs of assessing IYCF-related information. This may specifically relate to the high costs of search for information in and from credible sources. For first-time mothers, in comparison with a mother with more than one child, the expected number of feeding practices was lower by about 39%. This finding corroborates Radwan's (2013) findings and could be attributed to inexperience or lack of information on proper complementary feeding.

Results, however, show that being a mother with a young child and a potential mother increases the expected number of IYCF practices used, other things constant. In line with our finding, Beyene, Worku, and Wassie (2015) found that children who were not "firstborns" were likely to be fed in accordance with the required minimum meal frequency compares to "firstborns." Thus, it would seem that first-time mothers are less knowledgeable about the child feeding than non-first-timers. Do these differences in terms of "birth-parity" imply that certain categories of women should be specifically targeted more with nutrition education? More generally, are there differences among the different categories of women in terms of the effect of the nutrition education and psychosocial factors on child feeding practices?

To address the above question, we estimated Poisson regression models for each category of women. The results of this analysis are presented in table 5. In the model for pregnant mothers, we dropped the variable *clinic*, i.e., participation in health talks at the ANC/PNC due to lack of variability in this category of woman. Starting with nutrition education variables, the results show that different sets nutrition education variable drive the use IYCF practices among different women categories. Among the nutrition education variables, only cooking demonstration and participation in mother-to-mother clubs influenced (positively) the expected number of IYCF practices used in mothers with young children (6–23 months old children) and of infants (0–5 months old children), respectively, while only nutrition counseling influenced ICF usage among potential mothers. Among pregnant mothers, all the nutrition education variables, except cooking demonstrations, significantly influenced (also positively) the expected number of IYCF practices used.

Results also show that among the psychosocial factors, knowledge had a positive and significant effect on the expected number of IYCF used across all the women groups, perceived behavior control had positive effect on the expected number of IYCF used in both pregnant mothers and mothers of infants, while subjective affected the expected number of IYCF used among

potential mothers and mothers with infants. Specifically, results show that subjective norms had a negative effect on the expected number IYCF practices used. The finding regarding the influence of knowledge on IYCF practices adopted was expected. Nutrition education is expected to increase knowledge of the importance of following proper IYCF practices. This is in turn expected to increase the likelihood/intention to implement the practices and, ultimately, the behavior (i.e., the number of IYCF adopted).

Among the institutional variables, participation in ANC/PNC significantly increased the expected number of IYCF practices used by mothers of infants while distance to a CHV had the negative effect on expected number of IYCF practices used in mothers of infants and of 6–23 months old children. Table 5 further shows that different combinations of personal characteristics affect the expected number of IYCF practices in different categories of women. For instance, household size reduces, albeit very weakly, the expected number of IYCF used by potential mothers while birth parity has similar, but very strong effect among pregnant mothers. Age, on the other hand, increases the expected number of IYCF practices used in mothers of infants. The finding on non-farm income is interesting as it shows that participation in non-farm employment reduces the expected number of

Table 5. Factors affecting the use of IYCF practices: Poisson regression results for different women categories.

	Pregnant (N = 122)		Infant (N = 187)		Young child (N = 202)		Potential (N = 154)	
	Coeff.	p Value	Coeff.	p Value	Coeff.	p Value	Coeff.	p Value
<i>Personal characteristics</i>								
Log age	0.283	.386	0.340	.005	0.040	.777	0.252	.359
Birth parity	-1.000	.000	-0.050	.627	-0.041	.615	0.211	.626
Log off-farm income	-0.172	.043	-0.111	.009	-0.012	.697	-0.133	.052
Household size	-0.010	.823	-0.017	.398	0.001	.996	-0.062	.091
<i>Nutrition education variables</i>								
Mother club	0.589	.006	0.427	.000	0.067	.482	0.188	.197
Nutrition counseling	0.327	0.045	0.107	0.191	0.067	0.341	0.264	0.053
Nutrition messaging	0.434	.050	0.160	.171	0.112	.362	0.202	.228
Cooking demonstration	0.018	.929	0.087	.315	0.127	.083	0.113	.353
<i>Psychosocial variables</i>								
Knowledge	0.047	.039	0.029	.030	0.036	.000	0.047	.004
Attitudes	0.081	.589	-0.032	.683	-0.076	.201	-0.019	.836
Subjective norms	-0.159	.086	-0.111	.047	0.057	.228	-0.140	.035
Perceived behavior control	0.327	.006	0.179	.007	-0.033	.618	0.140	.138
<i>Institutional variables</i>								
Clinic	-	-	0.614	0.050	0.173	0.459	0.675	0.003
Log distance chv	-0.011	.917	-0.130	.006	-0.100	.022	-0.087	.257
Constant	-0.492	.761	0.203	.809	1.197	.083	0.654	.579
Wald χ^2	67.79	.000	93.19	.000	45.56	.000	73.18	.000
Pseudolikelihood	-244.962		-331.741		-413.71		-315.211	
Pseudo R ²	0.1442		0.0794		0.0372		0.1283	

IYCF variables used among pregnant women, mothers of infants and potential mothers and corroborates our findings in the section above. It indicates that participation in non-farm employment competes for caregivers' time that could otherwise be used in proper feeding of an infant or young child.

Summary, conclusions, and policy recommendations

Use of recommended IYCF practices remains low despite the demonstrated benefits. In Kenya, there are a variety of initiatives aimed at increasing the use of these practices. Over the last one decade, the number of such initiative, especially those that bundle nutrition education with agricultural interventions, has increased. In this study, we used data collected from communities that benefitted from a nutrition-sensitive agricultural intervention known as SUSTAIN project, to examine the effect on nutrition education and psychosocial factors on degree to which IYCF practices are used.

The results of descriptive analysis indicate that there was greater usage of the recommended breastfeeding practices that practices related to complementary feeding, likely due to the recent public awareness and campaigns in the country by government agencies and non-governmental organizations. The results of the Poisson model estimated to test the effect of nutrition education and psychosocial factors indicate that these factors strongly influence the extent to which women, in general, use the recommended IYCF practices. The results also indicate that other conditioning factors, namely, personal characteristics and institution factors also affect the degree to which IYCF practices are used. Moreover, among the nutrition education variables, participation in mother-to-mother club health talks had the greatest effect on the extent to which IYCF practices are used, likely because these platforms provide opportunity to discuss, and overcome, some of barriers with peers within the communities. As demonstrated by the test of joint effect of nutrition education variables, this study also finds strong evidence that these nutrition education strategies jointly affect the expected number of IYCF practices used. These findings are in line with Wu et al. (2014) who noted that use of multiple approaches could substantially improve IYCF. Our findings therefore indicate that using a combination of nutrition education strategies has a strong positive effect in improving the use of recommended IYCF practices.

With respect to psychosocial factors, the study findings indicate that nutrition knowledge and the degree to which women, in general, believe that they have control over children's feeding practices (i.e., their perceived behavior control) positively affect the extent of use of IYCF practices. Perceived behavior control had the greatest effect on increasing the expected number of practices used by about 33%. The positive effect of this psychosocial factor on IYCF is in line with findings of Hamilton et al. (2011) and

Behera and Kumar (2015). To the contrary, environmental (societal) factors, captured in this study by the subjective norms, had a negative, albeit moderate, effect on the extent to which women in general apply the recommended IYFC practices. Despite the conflicting direction of effect of the psychosocial factors this study finds that they jointly increase the extent to which women apply the recommended IYCF practices. Analysis by category of women showed that different nutrition education and psychosocial factor influence the four categories of women differently.

Based on the findings, this study concludes that nutrition education and psychosocial factors have a positive influence on the degree to which IYCF practices are used. It further concludes that different combinations of nutrition education and psychosocial factors affect the extent to which different categories of women of reproductive age use the recommended IYCF practices.

The findings of this study have the following implications. First, nutrition education on IYCF incorporating OFSP during complementary feeding should be multifaceted in nature and should especially adopt more interactive strategies which allow targeted beneficiaries to discuss and obtain social support from peers. This implies the need to strengthen of mother-to-mother support clubs and cooking demonstrations. Second, there is need for a strong SBCC strategy that targets cultural/societal and environmental factors that are contrary to the proper IYCF practices. Clearly, such communication should target unfounded myths that influence feeding practices by providing information on the benefits of practices considered uncustomary. Third, the finding that different categories of women are affected by different set of factors implies that the design of nutrition campaigns (education), and the psychosocial factors to target, should consider category of women to be reached. Fourth, the finding that the magnitude of effect of the nutrition education variables was much greater than for the psychosocial variables demonstrates the importance of concerted campaign efforts targeting others with nutrition education on compliance with recommended IYCF practices. This finding therefore implies the need for continued nutrition education of caregivers on proper IYCF.

Notes

1. Nutrition education comprises nutrition messaging, counseling, and cooking demonstrations provided in health facilities, mother-to-mother clubs, and public awareness campaigns.
2. We specifically use partial and joint exclusion restriction statistical tests for this analysis. See Wooldridge (2015, Chapter 4) and Huber and Mellace (2014) for a discussion and application of these tests.
3. This approach recommends consumption of balanced diets covering all micro- and macronutrients required for proper development and wellbeing of the child.

4. A community unit is defined as a health service delivery structure within a designated geographic area covering a specified population manned by a community health volunteer who promotes various health services.
5. This a scale with the following kind of structure: good: 1: 2: 3: 4: 5: 6: 7: bad. The item 4 is the mid or transition point with intensify of good/bad increasing from the transition point outward.
6. We thank the anonymous reviewer for this observation.

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Appendix 1A: Summary statistics for the exclusive breastfeeding variables

Construct	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Factor loadings	% Variance explained	Cronbach alpha
Attitudes: For me exclusively breastfeeding an infant for the first 6 months is...											
A1	5.94	1.27	6.14	1.10	5.91	1.23	5.93	1.26	0.722		
A2	5.91	1.15	6.02	1.13	5.89	1.22	5.85	1.06	0.739		
A3	5.18	1.75	5.34	1.55	5.05	1.73	5.16	1.47	0.419		
A4	5.91	1.03	5.95	1.11	5.86	1.14	5.89	1.03	0.725	43.74	0.785
A5	6.07	1.27	6.17	1.11	6.15	1.17	5.94	1.27	0.728		
A6	5.76	1.11	5.93	1.08	5.82	1.15	5.74	1.08	0.727		
A7	5.91	1.20	6.04	1.20	5.87	1.20	5.85	1.17	0.739		
A8	5.77	1.24	5.56	1.38	5.56	1.37	5.54	1.32	0.449		
Subjective norms: Now think about what ought to be, in the sense of whether exclusive breastfeeding for the first 6 months would be approved or disapproved: ...exclusively breastfeed an infant for the first 6 months (Strongly disagree_Strongly agree)											
SN1	5.48	1.35	5.69	1.21	5.49	1.33	5.41	1.27	0.758		
Most people who are important to me think that I should											
SN2	5.62	1.36	5.76	1.29	5.58	1.31	5.42	1.35	0.714	55.33	0.721
SN3	4.80	1.58	4.96	1.37	5.01	1.45	5.07	1.43	0.766		
SN4	4.31	1.95	4.63	1.78	4.67	1.70	4.63	1.73	0.735		
Perceived behavior control: Now think about yourself, i.e., the power you personally hold regarding exclusively breastfeeding for the first six months. To what degree do you agree with the following statements: ...exclusively breastfeed an infant for the first 6 months											
PBC1	5.46	1.65	5.47	1.67	5.46	1.45	5.29	1.50	0.775		
PBC2	5.50	1.35	5.50	1.19	5.53	1.12	5.43	1.37	0.750	56.04	0.735
PBC3	5.52	1.39	5.70	1.22	5.58	1.21	5.38	1.27	0.752		
PBC4	5.70	1.19	5.68	1.18	5.67	1.16	5.65	1.22	0.717		

* Wordings were presented in reverse order.

Appendix1B: Results for the complementary feeding incorporating OFSP variables

Construct	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Factor Loadings	% Variance extracted	Cronbach alpha
Attitudes: For me, providing proper complementary feeding after the age of 6 months with foods that include orange-fleshed sweetpotato of about 125 g at least 3 times a week is...											
A1	6.26	0.84	6.18	1.06	6.18	0.88	6.17	0.91	0.597		
A2	6.21	0.88	6.17	1.00	6.12	0.84	6.07	0.85	0.674		
A3	5.13	1.59	5.11	1.70	4.97	1.63	4.94	1.63	0.437		
A4	6.01	1.02	6.11	1.08	6.11	0.82	5.93	0.89	0.659		
A5	6.37	0.91	6.34	0.81	6.18	0.91	6.32	0.81	0.583		0.712
A6	6.00	1.01	6.14	0.87	5.99	0.95	5.86	0.90	0.582	44.09	
A7	6.28	0.93	6.28	0.84	6.14	0.93	6.17	0.99	0.609		
A8	5.52	1.42	5.78	1.23	5.47	1.41	5.53	1.36	0.606		
Subjective norms: Now think about what ought to be, in the sense of whether proper complementary feeding after the age of 6 months with foods that include orange-fleshed sweetpotato of about 125 g at least 3 times a week would be approved or disapproved: me (Strongly disagree_ strong Agree)											
SN1	5.15	1.43	5.27	1.36	5.39	1.27	5.32	1.23	0.807		
SN2	5.82	1.10	5.80	1.08	5.75	1.02	5.64	1.03	0.555	53.54	0.705
SN3	5.16	1.60	5.06	1.57	5.32	1.46	5.33	1.30	0.870		
SN4	4.55	1.84	4.47	1.82	4.79	1.69	5.06	1.55	0.855		
Perceived behavior control: Now think about yourself, i.e., the power you personally hold regarding providing proper complementary feeding. Please tell me your position on the following statements											

(Continued)



(Continued).

Construct	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Factor Loadings	% Variance extracted	Cronbach alpha
PBC1	5.71	0.97	5.62	1.23	5.59	1.11	5.63	1.11	5.63	1.11	0.670	54.68	0.723
	I am confident providing proper complementary feeding after the age of 6 months with foods that include orange-fleshed sweetpotato of about 125 g at least 3 times a week (False_True*)												
PBC2	5.47	1.19	5.40	1.30	5.54	1.22	5.57	1.15	5.57	1.15	0.803		
	Is completely up to me to provide proper complementary feeding after the age of 6 months with foods that include orange-fleshed sweetpotato of about 125 g at least 3 times a week												
PBC3	5.66	1.11	5.70	1.20	5.64	1.11	5.65	1.02	5.65	1.02	0.667		
	If I really wanted to, I could provide proper complementary feeding after the age of 6 months with foods that include orange-fleshed sweetpotato of about 125 g at least 3 times a week (Unlikely_Likely*)												
PBC4	5.61	1.30	5.59	1.32	5.59	1.27	5.65	1.21	5.65	1.21	0.805		
	Providing proper complementary feeding after the age of 6 months with foods that include orange-fleshed sweetpotato of about 125 g at least 3 times a week (Not at all_Total control*)												

*Wordings were presented in reverse order.

Appendix 1C: Descriptive statistics for the knowledge questions

Statement	% True	% False	% Don't know
Breast feeding should be initiated within 1 h after birth	93	3	4
It is okay to give drinking water to a child aged 2 month	28	70	2
It is WRONG to continue breastfeeding a child UP TO 2 years	13	85	2
Breastfeeding mothers should eat more food than non-breastfeeding mothers	92	7	1
It is okay to express breast milk for a child 6–8 months	48	42	10
Expressed breast milk is okay to feed a baby within 12 h when stored outside refrigeration conditions	22	43	34
It is okay to give a 4-month-old child porridge	19	80	1
Mary provided a balanced diet to her child during these meals	44	54	1
Mary provided food to her 8-month-old baby in the required frequency on this day	51	44	5
The diversity/number of food types that Mary fed her 8-month-old child is okay to ensure her baby grows up healthy	41	57	3
The food of a child 9–12 months should not flow freely from a spoon	72	24	4
It is okay to feed a child on porridge using a feeding bottle	39	59	2
Children 6–23 months should not eat eggs	44	48	8
Children who continue to breastfeed after 1 year do not eat other foods well	60	37	3
The orange fleshed sweetpotato is a good source of vitamin A	89	0	11
The orange color of OFSP means it is good for baby food	79	9	12