Community mobilization during biofortified orange maize feeding trials in Zambia

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Abstract: In some societies, studies involving blood draws, oral vaccinations, or supplementation are surrounded by myths and disbeliefs. If not clarified, they may affect study implementation and negatively impact the outcome of well-intended studies from inadequate participation. Through participatory action research, this paper suggests how future trials could be enhanced with reference to community mobilization, drawing from the experience of two interventions in Zambian children with nutritionally enhanced, biofortified orange maize conducted by the National Food and Nutrition Commission and Tropical Diseases Research Center (Zambia), and University of Wisconsin-Madison (USA). The preparatory phase included site visits, signing of a Memorandum of Understanding, equipment inventory, hiring staff, and community meetings. Prior results were shared before the second intervention. After Institutional Review Boards' approval of procedures, written informed consent was obtained from caregivers. There was overwhelming community participation attributed to the demystification that the project was run by satanists prior to and during the study. Participation led to excellent compliance with 92.8 and 96.4% of subjects completing the final blood draw in 2010 and 2012, respectively. The results of the trials were successfully shared with the district officials and communities from where the study participants were drawn. The positive response by partners and communities, including information sharing, suggests that community mobilization, with the use of varied methods, is effective for full participation of the target groups in feeding trials and would be the case in similar trials if effectively carried out. Community participation in research studies may result in long-term adoption of biofortified foods.

Keywords: Blood draws, Caregivers, Children, Community participation, Information dissemination, Zambia

Introduction

Research involving blood draws, oral vaccinations, supplementation, or a new food product is often surrounded by myths and disbeliefs, especially in rural communities. Study implementation and results of well-intended studies may be impacted from inadequate participation [1]. Addressing these issues before and during study progression is important for smooth operation of interventions and future adoption of study objectives.

Two community-based research studies were undertaken over the course of four years with the primary objective of measuring vitamin A efficacy of orange maize, a biofortified staple crop with enhanced levels of provitamin A carotenoids, as a food intervention [2–5]. Biofortification is a way of increasing nutrients in and/or nutrient

absorption from food crops to improve the health of populations who adopt them [6–8]. These crops are produced either through traditional breeding or transgenic approaches, and most current efforts are with staple crops [6–8]. Considering the widespread consumption of staple crops by rural-based populations who are at risk for micronutrient deficiencies, biofortification is a promising option to effectively and sustainably address the problem of micronutrient malnutrition [9–11]. This is especially true because food sources containing readily available vitamin A, such as eggs and liver, are not always accessible or are too expensive for low-income groups [12], similar to the community in which these trials were undertaken in Zambia. Agricultural interventions to improve nutrition are gaining momentum [13], and describing successes and failures can assist other researchers.

In Zambia, white maize is the main staple and preferred over the orange or yellow varieties, which are sometimes historically associated with animal feed and international food aid. Thus undertaking feeding trials was a cardinal way to understand the acceptability of orange maize in addition to the primary efficacy objectives of the trials, which are reported elsewhere [2, 3]. Given the experience of orange maize interventions among Zambian children in the Eastern Province conducted by the National Food and Nutrition Commission (NFNC), University of Wisconsin-Madison (UW), and the Tropical Diseases Research Center (TDRC), herein we describe the trials' social aspects and suggest how future studies could be enhanced with informed implementation with specific reference to community mobilization (CM).

Case studies of community-based participatory research were reviewed [14] to define CM activities undertaken in Zambia. Tribal research in North America recognizes the sovereignty of the nations and directs the ownership of the research back to the nations [15]. Tribal communities face health disparities and high rates of poverty while maintaining very strong cultural and social habits, which is similar to the situation in rural Zambia. The Healthy Native Communities Fellowship has embraced the stages of the Freirian process of listening, dialogue, action, and reflection to engage communities during research activities [14]. Although some of the Freirian theory of social change in regard to health-related CM has been challenged [16], it remains a starting point and guided the CM activities described below.

Subjects and Methods

After multiple site visits in rural Zambia for meetings with local stakeholders and village chiefs [17, 18] and the orchestration of a baseline vitamin A survey in the area that involved dietary recalls and recipe procurement [19], two orange maize efficacy trials were conducted in the Eastern Province of Zambia with community involvement (Figure 1). The first trial included six sites in 2010 [2, 4], and the second was carried out in four of the original sites in 2012 [3, 5]. The study protocols were reviewed and approved by the Tropical Diseases Research Center (TDRC) and University of Wisconsin-Madison (UW) Health Sciences ethical committees. Written informed consent was obtained, and all data were de-identified for confidentiality purposes. The target population was children aged 3 to 5 years in the first study and 5 to 7 years in the second study. The age range was increased in the second study to only include children who were no longer eligible for the vitamin A supplementation program recommended by the World Health Organization for children up to 5 years of age [20].

Figure 1. The implementation strategy for two feeding trials in Zambian children. Data checking and compliance assurance were important verification strategies during the trials. Preschool education assisted in keeping the children occupied between monitored meals. Community participation in all aspects of the trials ensured >90% of subject follow through.

The feeding aspects and vitamin A outcomes, which involved drawing blood three and four times in trials 1 and 2, respectively, have been published [2–5].

Listening and dialogue

Important community involvement and social mobilization elements were carried out prior to conducting the feeding trials. These included community sensitization, dramatization, household listings, demystification of blood drawing procedures, media coverage (2012 only), recruitment, and enrollment. During community meetings, the team from NFNC and UW explained the objectives and all procedures. It was emphasized that the consents of the local leaders and the parents/guardians of the primary target groups were needed for the study to proceed. In the exploratory phases, resistance was faced in relation to blood draws, which was associated with satanism. This informed the development of the communication package.

Development of the communication package

In prior studies in the area, a high prevalence of low serum retinol concentrations was determined [19]. This information was included as part of the communication package for use during CM. In addition, messages were developed to demystify the thinking associated with blood draws. The number of blood draws and which part of the body the blood would be drawn were included. It was made clear that the blood would exclusively be used to measure vitamin A status and other health-related biomarkers, and the remaining blood would be destroyed. The communication package also included information on compensation for staff recruited from the community, which sustained involvement during actual study implementation.

Community sensitization

Stakeholders conducted sensitization meetings with community members. The magnitude, consequences, and causes of vitamin A deficiency were explained along with government alleviation efforts. At these meetings, the concept of biofortified orange maize was introduced. The investigators explained that a feeding trial was necessary and would only be successful with community participation. In the past, the use of yellow maize was associated with animal feed and therefore was not acceptable by most of the community members. The CM team explained that the orange maize was different because of the vitamin A with which it was enriched. During the meetings, community members were given chances to ask questions that were clarified by the CM team.

Dramatization and media coverage

As part of CM, local drama groups were trained and performed in selected study sites to dramatize the essential aspects of the trials, which included causes of vitamin A deficiency, government alleviation efforts, risk groups, and perceived issues regarding orange maize. This helped

the communities to realize that there was a potential health problem, and with their involvement it could be addressed. Media coverage occurred in the second trial to enhance the information already given to the community during sensitization and dramatization.

Action

Site visits and hiring staff

In the preparatory phase, site visits occurred prior to beginning the trials. Examples from the 2012 trial, which were similar to the 2010 trial, are detailed in Table 1. The second trial included signing a Memorandum of Understanding (MOU) between NFNC and the Nyimba District government [21], which included detailed discussion of the roles and responsibilities of stakeholders (Table 2). Meetings included presenting results from the 2010 trial by the principal investigator (SAT).

The Study Facilitator was hired in a competitive search that included many of the stakeholders involved in orchestration of the study. Community activities were undertaken by the Study Facilitator, who was responsible for supervision of site and shelter renovations and listed all children eligible for enrollment. NFNC was responsible for hiring the nutritionists to weigh and record food intake [4, 5]. The study needed committed site custodians who were responsible for searching for absent subjects to ensure their presence at each meal. Watchmen were needed to guard the sites, which were used for meal preparation, classrooms, accommodations, and equipment storage. Preschool teachers were hired from the selected district as part of community empowerment and to keep the children occupied during the day. Following CM and hiring of staff, recruitment, enrollment, randomization, and initial blood drawing were completed.

The study designs included intensive education components to increase compliance to all procedures (Figure 1); therefore, all children were required to attend classes each day, which was Monday through Saturday. In the second trial, the project was scheduled to end while the Zambian school calendar was in progress. In communication with the Ministry of Education, a phase-out strategy was designed to allow a natural transition by continuing the daily education of the children until the end of the school calendar, testing the children for entry into school, and building schools close to the study sites.

During the study, a number of additional visits occurred by staff from NFNC, UW, and HarvestPlus (the funders) to mitigate problems and ensure smooth operations. NFNC staff visited every month-end to make payments to the community project staff and to sort out issues related to allowances. The NFNC Executive Director (CM) also undertook a

Table 1. Preparatory visits undertaken by the collaborators with specific objectives prior to the feeding trials

Visit	Collaborators	Objectives
1	NFNC ¹ HarvestPlus	Met with District Commissioner and government ministry heads <ul style="list-style-type: none"> Presented 2009 Background Nutrition Survey by NFNC, TDRC, and HarvestPlus Explained sample size, study arms, meals to be received by subjects, number of blood draws, and educational components Assessed local institutions for food supplies and engaged them as suppliers <ul style="list-style-type: none"> Determined suppliers for each food item based on availability, price, freshness, and sustainability Sites chosen included local farms, local markets, and sourcing from the capital city Inspected sites to determine required repairs, important for forming the budget
2	NFNC UW-Madison	Advertised the positions of Study Facilitator and preschool teachers Discussed the Memorandum of Understanding (MOU) that stipulated the roles for each partner <ul style="list-style-type: none"> NFNC and the District Commissioner's office signed an MOU on May 18, 2012 NFNC and UW-Madison held a signing ceremony and gave speeches, which were recorded by the local press in May 2012
3	NFNC UW-Madison	Conducted interviews for the Study Facilitator and the preschool teachers <ul style="list-style-type: none"> Advertised positions within local areas for community ownership Interviewed and hired staff with representatives from all implementing partners for transparency and ensuring that people from the local district benefit Interview guides created a system of scoring for fairness The District Commissioner, with assistance from the local government, NFNC, and UW-Madison hired the Study Facilitator and preschool teachers locally Nutritionists were interviewed at NFNC in Lusaka, Zambia with participation from UW-Madison and the Study Facilitator Performed an inventory of equipment from previous trial <ul style="list-style-type: none"> Considered crucial for budget determination Maintained careful inventory throughout the trial to prevent theft or loss
4	NFNC UW-Madison Ministry of Works and Supply Study Facilitator	Met with chiefs in-charge of the sites <ul style="list-style-type: none"> Introduced the study Disseminated results of the previous orange maize efficacy study Began renovations of selected sites Discussed MOU between NFNC and the District Commissioner Inspected Zambia National Service and Prisons' fields to assess preparation for food supply
5	NFNC UW-Madison	Delivered building materials for rehabilitation of cooking places, feeding areas, and toilets <ul style="list-style-type: none"> Considered cost-effective to get materials in Lusaka and deliver them to the sites Introduced the trial to the chief in-charge of the selected areas, His Royal Highness Chief Ndake, who was in full support of the study at the time it began Visited community leaders including village headmen, church leaders, and community-based organization leaders <ul style="list-style-type: none"> Explained components of the trial, including deworming prior to recruitment Recruited community to identify site custodians Boosted community acceptance by providing transparency and involvement by community members

¹Abbreviations used: MOU: Memorandum of understanding; NFNC: National Food and Nutrition Commission; TDRC: Tropical Diseases Research Center; UW: University of Wisconsin.

visit to inform partners about project progress. Other stakeholder visits included staff from HarvestPlus-Zambia, students from USA, and HarvestPlus-Washington, DC, to observe how the project was being conducted. At the end of the project, the research team explained to the communities that the results of the study were going to be shared when they became available.

Reflection

During CM and after all participatory action research activities [22], researchers reflected upon the sensitization procedures, involvement of the local community, and the aspects of the trial that were best practices or needed improvement for future studies. The process shifted

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Table 2. Roles and responsibilities of key stakeholders

Name of Institution	Roles and responsibilities
National Food and Nutrition Commission	<ul style="list-style-type: none">• Advertise preschool teachers' and nutritionists' positions• Share each stakeholder's roles and responsibilities embedded in the Memorandum of Understanding with all stakeholders• Monthly supervision of the project activities including making payments to project staff and bi-weekly purchase of some of the food stuffs on the menu
University of Wisconsin-Madison	<ul style="list-style-type: none">• Management of the scientific part of the trial including protocol development, project menu design, administration of the stable isotope, and daily dosing of the participants with vitamin A or placebo
Tropical Diseases Research Center	<ul style="list-style-type: none">• Responsible for training of research assistants prior to the selection of the study participants, administering informed consent to caregivers of prospective candidates, and blood draws at designated times
District Commissioner's Office	<ul style="list-style-type: none">• Ensured all activities were carried out by designated institutions according to the Memorandum of Understanding
District Health Office	<ul style="list-style-type: none">• Provide deworming tablets to all the eligible children in targeted communities prior to selection of study subjects• Provision of vitamin A capsules at the end of the study to subjects in the white group who did not receive vitamin A in the form of either orange maize or as doses during the study following their parent's consent• Morbidity data collection and treating of sick children on the project
Ministry of Community Development, Mother and Child Health	<ul style="list-style-type: none">• Responsible for community mobilization
Ministry of Education, Science, Vocational Training and Early Childhood Education	<ul style="list-style-type: none">• Learning issues and recruitment of eligible children after end of the project
Ministry of Agriculture and Livestock	<ul style="list-style-type: none">• Educate communities regarding the orange maize and ensure all the orange maize was purchased from farmers in the district before commencement of the trial
The Ministry of Works and Supply	<ul style="list-style-type: none">• Assessed sites to ensure they met standards for habitation, helped list materials required for renovations
All institutions	<ul style="list-style-type: none">• Participated in the interviews for hiring the project preschool teachers

between action and reflection and was iterative [23]. The major observations are described to enhance future trials.

Results

Recruitment and eligibility of children

Children who were currently enrolled in school were not recruited because there were enough children in the community at the target age. About 90% of children lived near the study sites. Although some of the mothers failed to attend meetings, 99% returned during monthly payments and blood draws ensuring compliance.

Response by the community

The response by the local governmental representatives (listed in Table 2), the community and church leaders, and the community members was overwhelmingly positive. This was attributed to the continued demystification by the Zambian Study Facilitator and coordinator (CK) prior to and

during the study. The community meetings continued to inform the participants' caregivers and instill ownership of the project. The collaboration and communication among the local Study Facilitator and coordinator and the UW research team on a day-to-day basis supported successful CM.

Food concerns

In 2010, sometimes food supplies were not delivered on schedule or were not in good condition due to the distance (>340 km) from the capital city. In 2012, an agreement with local vendors was advantageous in terms of having access to fresh food, but it was costly and not reliable. The project was being charged five times the farm price and two times the market price for tomatoes, cabbage, and onions. The only exception was chickens, which were 17% cheaper than other sources.

Some stakeholders were concerned that eating off-site would affect the outcome. However, feeding for seven days was not possible because six days instead of five was already difficult for fieldworkers. Complaints related to food were that too much cabbage (a common food) was on the menu

and the children did not like the green beans [5]. However, this was because the investigators were closely matching the meals to those of the families, which were chosen from the recipes collected in the initial survey work [19]. Additionally, mothers complained that their children were not being satiated; however, dietary recalls revealed that children were not consuming much at home and they ate the green beans [5].

Continued concern was related to orange and not white maize *nshima*, a stiff porridge made from boiling the maize with water. Mothers wanted their children eating white maize, but it was carefully explained to them that this was beyond the study team because assignment to treatment was randomized. Although in the beginning food waste was higher for orange *nshima*, this amount decreased as the studies progressed [4, 5], except for a genotype effect [24], whereby the orange maize took up less water during cooking than the white maize in 2012.

Child Health Weeks and health concerns

During the trials, Zambia held Child Health Weeks, which required children under 5 years to be supplemented with vitamin A capsules [20, 25]. In the first trial, the study was performed in between the Child Health Weeks. In the second trial, the children were no longer eligible, but the team still verified that nobody received the vitamin A supplement during a special measles vaccination campaign, which occurred in addition to Child Health Weeks. The other child health concern was associated with infections affecting outcomes, especially with malaria in 2010 [26] and a chicken pox outbreak in 2012. We anticipated that the occurrence of infections was equal across the treatment groups due to randomization, which was the case with malaria prevalence in 2010 [26], and infections were accounted for in the 2012 outcomes [3, 27].

Blood drawing, beliefs, and misconceptions

Blood drawing was an issue due to religious beliefs and health-related problems, such as anemia, and thus some parents did not enroll their children. Meetings demystified the issues through drama performances and explanations in the local language. Severe anemia was an exclusion criteria, and the amount of blood to be drawn (3-7 mL) was considered insignificant to cause anemia. During subsequent blood draws, three children were withdrawn by parents due to fear that their children's blood was going to be drained. Two parents thought blood drawing was going to worsen the anemic situation of their child, while the other

felt that the remuneration was too little to be able to "purchase" blood once the child became anemic. One of the parents repeatedly called the Study Facilitator and made statements regarding the blood draws. For example, he would say, "You are the one who takes my child's blood and I do not know where you take it," or "You are the one who drinks my child's blood." These incidences required continued debunking by the research team to confirm their trustworthiness.

Staffing issues

In the initial stages of the 2012 trial, many nutritionists and preschool teachers left. However, NFNC, UW, the District Commissioner's office, and the Study Facilitator, because of her prior experience in the 2010 trial as a nutritionist, ensured compliance. Staff who left felt that their remuneration did not match work expectations and the standard of living was below their social class. This was in spite of having read and agreed to the contract terms and conditions. Nonetheless, overall study compliance was excellent in both trials with 92.8 and 96.4% of enrolled subjects completing the final blood draw in 2010 and 2012, respectively [2, 3].

The preschool teachers were recruited with the support of the local government; however, a disparity in payments for the teachers existed where a higher salary was given for certification. The community felt that the teachers should have been drawn from within the study sites. The participating villages were encouraged to continue the preschools once the studies ended so that the children could be taught more cost effectively.

Issues arose related to remuneration of project staff. Most of the participating women complained that they were not given full salary details, even though it was part of the communication package. The cooks, dishwashers, and childcare helpers felt that their allowance was little compared with the assigned work. In 2010, there were seven workers, but only five workers were employed in 2012 as cooks, dishwashers, water carriers, and childcare helpers. Their complaints were supported by some of their spouses at community meetings: "Our wives come to work very early and return home late, but what they bring home in terms of remuneration is very little for six days." Following the complaint, it was realized that there was a communication breakdown. In all the sites, the agreement was to have three mothers work as cooks, dishwashers, and water carriers. However, uniquely, one site decided to expand the group to six to ease workload and they shared their allowances; instead of getting the negotiated amount, the full amount was split between two people. The research team took an opportunity to explain such issues during scheduled meetings for continued smooth study operations.

Final dissemination of the results to the community and issues raised

The 2010 results were shared with district officials and the general public before commencement of the 2012 trial and was considered cardinal, especially because the local partners demanded it. The dissemination was successful, but a few issues were raised: orange maize's status as traditionally bred versus a Genetically Modified Organism (GMO), the amount of blood to be drawn, longer study duration for better results in 2012, Zambian's preference for white versus orange maize, infections, and off-site eating influences on results. The results of the 2012 orange maize study were shared with HarvestPlus-Zambia, the district officials, and the communities on November 19th and 20th, 2013 [17]. The response was overwhelming from the district officials, the chiefs, and local and external partners. The community and church leaders, the study participants with their caregivers, and other community members attended in great numbers [18]. The sharing of the results involved the distribution of orange maize seed and fertilizer by HarvestPlus-Zambia to the caregivers of the participants [18], which was timely because it was the peak of planting season and added value to the project.

Discussion

This report used participatory action research methods to address trial design with specific reference to CM experiences in Zambia and highlights exercises cardinal for successful implementation of feeding trials. Activities included site visits, collaborative efforts, MOUs, shelters, sharing of results, position advertisements and staff hiring, equipment inventory, feeding, and phase-out strategies. Signing an MOU is important in preventing duplication of work by partners or leaving some work undone thinking that it will be covered by others. MOUs are not unique and have been used worldwide [28]. Even with the MOU, some of the partners did not execute their roles. Collaboration with local institutions for food and supply delivery was originally a good idea, but this was challenged by food prices. It is important to explore all alternative markets and individual farmers.

Undertaking a variety of activities contributed to the success of the trials. Sharing results and explaining the need for the second trial to local partners and community members was important and does not need to wait for further studies. It should be undertaken as soon as results are available, otherwise it may be viewed unfavorably by the community, especially considering the launch of orange maize in Zambia [29]. Communities and families feel

respected and recognized. Emanuel et al. described research ethics and highlighted the importance of sharing results with participants based on ethical principles [30].

During phase-out activities, continuous CM and identification of subjects who were ready for school enrollment by local ministries were not done. The partners felt that the entry into the district was excellent, but the exit was not because all phase-out activities had not occurred. Nonetheless, external funders supported the erection of one school that will have long-lasting effects. In preparation for similar trials, the budget for phase-out activities should be part of the original budget because relying on outside agencies may be unreliable. Long-term sustainability before the project is closed may ensure continued community support for other interventions.

Zambians have a preference for white maize, which concerned some stakeholders who felt that low consumption of orange maize would negatively influence the outcome. Examination of daily consumption did not reveal a problem in either trial [4, 5]. Subjects were enrolled into a group following random allocation, which was maintained and essential for minimizing bias and balance [31]. Continued nutrition education is needed to enhance wider acceptability of orange maize by the general public. This is important because some people still feel that orange maize is a GMO or associate it with animal feed [18]. Even district officials expressed concern in light of the Government Republic of Zambia policy that no GMO should be fed to humans or animals. It was often clarified that orange maize was biofortified using traditional breeding techniques in Zambia to produce food for a healthier population [29]. The carotenoids that make the maize orange have putative health effects beyond providing vitamin A [32].

It was important to clearly explain to the families the rationale behind the study menu. For example, in the 2012 trial, the difference in vitamin A liver reserves between the orange and white maize groups in reference to the positive control was essential [3]. Therefore, avoiding foods with high vitamin A content was needed to have a true placebo group. The participating families felt that their children were not satiated, in part because more chicken was on the menu in the 2010 trial [4]. Participating families launched a complaint that the meals were monotonous with only one meal of chicken each week. Chicken is a delicacy in this community, and the 2012 trial wanted to mirror the local monotonous diet as closely as possible, with the exception of using more cabbage in place of green leafy vegetables, which contain provitamin A activity. Dietary recalls did not corroborate comments about food satisfaction and displaced some of the negative claims about the rotating menu. Following an explanation regarding the menu, families were promised and received a live chicken at the end of the project.

Some sections of society still hold fears that blood drawing is harmful. Issues of behavior and thought take a long time to change. To transform a society, continued education and communication are needed to allow for smooth implementation of similar trials or health promotion that involve nutrient assessment. The National Institute for Health and Clinical Excellence stated that, "Interventions and programmes should be based on a sound knowledge of community needs and should build upon the existing skills and resources within a community" [33]. Enhanced health and nutrition education for the community was needed to understand the requirements for blood drawing and a restricted menu. Messages regarding causes of anemia should be developed and used in the outreach education.

In terms of staffing, local people were hired because they are usually able to ensure that everything happens according to schedule. For example, the Study Facilitator, two nutritionists, three preschool teachers, site custodians, watchmen, cooks, water carriers, and dishwashers were all from the district. The Study Facilitator was instrumental in solving problems because she had worked in the 2010 trial, understood the culture and language, and easily addressed emerging issues. Nutritionists from outside the area in the 2012 trial found it difficult to adapt to conditions.

Allowances were a source of problems in the 2012 trial and should be carefully determined and clearly explained. Some of the preschool teachers terminated their contracts in part due to wage disparity. To alleviate the problem, two preschool teachers were given honoraria. In future trials, the same position should attract equal pay and not differ by lack of certification, unless those certified take a lead in teaching or developing curriculum. Personnel were required to work on Saturdays, which raised an issue for staff who worship on Saturdays. During the interviews, it was stated that all staff services were required from Monday through Saturday from 08:00 to 17:00 hours. In future trials, an alternative for workers who worship on Saturdays should be part of the budget. Furthermore, the number of local workers should be done in consultation with the community. Responsible officers should explain duty expectations to the hired personnel on an individual basis and not take for granted that signing a contract ensures that the appointee will follow-through. Meetings including salaries and work expectations should be a combined effort with investigators for assurance of transparency.

Conclusions

Using CM and participatory research, the efficacy trials had a number of successes. The following are recommendations for future trials: 1) a comprehensive MOU should be signed by all partners prior to trial commencement, and meetings

should be held periodically for reinforcement; 2) continued nutrition education regarding orange maize as a traditionally biofortified food and not a GMO is suggested; and 3) all activities in the community related to the project should be done respecting and acknowledging local beliefs.

Abbreviations

GMO: Genetically modified organism; CM: Community mobilization; MOU: Memorandum of understanding; NFNC: National Food and Nutrition Commission; TDR: Tropical Diseases Research Center; UW: University of Wisconsin-Madison.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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