CONSUMER ACCEPTABILITY OF YELLOW *CASSMOI* AMONG WOMEN OF REPRODUCTIVE AGE IN TELEMU COMMUNITY OF OSUN STATE, NIGERIA

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ABSTRACT

Micronutrient deficiency affects mostly the vulnerable group. Millions of Nigerians are present with a low level of vitamin A. To address this situation, staple foods have been biofortified. Moi-moi is made from cowpea, and it is a common food in Nigeria. This study determined the knowledge, perception, and acceptability of yellow cassava and yellow cassmoi among women of reproductive age. The study was cross-sectional and descriptive in design. Cassmoi is a formulation of Harvest Plus. A total of 50 women were selected for sensory evaluation to determine consumer acceptability using a 5-point hedonic scale; 15 participated in the focus group discussion. Descriptive statistics of frequency and percentage were used, and all relevant data from focus group discussions were presented thematically. Up to 98% accepted the appearance and the aroma. The texture was scored highest (100%) by the respondent. Most (82%) of the respondents preferred cassmoi over conventional bean pudding. There was adequate knowledge of yellow cassava and its products; all (100%) respondents were also willing to utilize yellow cassava often. There were health benefits from yellow cassava as perceived by the respondents, which varied from improved eyesight, improved skin colour, and intellectual capability to the acclaimed improvement of high blood pressure. There was an overall acceptance of the cassmoi as it was preferred to the conventional bean pudding. Many health benefits perceived served as an encouragement to continually consume yellow cassava products.

Keywords: ***Biofortification, Cassmoi, Moimoi, Vitamin A deficiency***

INTRODUCTION

Micronutrient deficiency results from a lack of essential nutrients like vitamin A, iron, and zinc. As a result, it hampers the mental and physical development of children and young adults, having a long-term effect on their livelihoods (Duah et al., 2016). It mainly affects young children, pregnant women, and breastfeeding mothers (WHO, 2009). An estimated 2 billion people, most in developing countries and predominantly in rural areas, suffer from micronutrient deficiency.

Specifically, Vitamin A deficiency (VAD) is a major nutritional concern in impoverished societies, especially in low-income countries (WHO, 2009). Vitamin A is an essential nutrient required in small amounts for the normal functioning of the visual system and the maintenance of cell functions vital for growth, epithelial integrity, red blood cell production, immunity, and reproduction. The primary cause of VAD as a public health issue is a diet that is consistently inadequate in vitamin A, which can lead to depleted body stores and failure to meet physiological needs (Ilona et al., 2015). Notably, millions of Nigerians have low vitamin A levels; therefore, to address this issue, supplementation programs have been ongoing for children during immunization efforts, staple foods have been fortified, and additional supplementation initiatives have

been implemented.

Cassava (Manihot esculenta) is the most widely consumed staple and an important tuber in the tropics and Nigeria (Ilona et al., 2015). It is a rich source of carbohydrates, fiber, and contains negligible amounts of carotenoids; millions rely on cassava for about 25% of their caloric intake (Aniedu and Omodamiro, 2012). Cassava consumers are reported to have a high risk of inadequate vitamin A, zinc, and iron intake (Duah et al., 2016).

Yellow cassava is similar to conventional cassava but has yellow flesh. The yellow coloration signifies the presence of beta-carotene, a component that the body converts to vitamin A for its benefit. The consumption of various products from beta-carotene-rich cassava, developed and distributed, will therefore help in ameliorating the prevalence of vitamin A deficiency.

Moi-moi is mostly made from cowpea, and it is a common food in Nigeria and West Africa. It is consumed at home and sold as street food; it is also part of the popular indigenous food that is prepared among several cultures (Ayoade *et al.*, 2012). *Moi moi* has been a common household food that is often consumed by many Nigerians; therefore, incorporating biofortified cassava into the recipe of *moi moi,* if well accepted, will be significant in reaching a large populace with this micronutrient of need.
To record success in the advent of biofortified staple food, consumer acceptability of these foods is of utmost and cogent importance. This relates to consumers' likes of the food and willingness to incorporate it into their daily meals (Duah *et al.*, 2016). In the last twelve years, many researchers (Aurelie *et al*., 2018; Duah *et al.*, 2016; Meenakshi *et al*., 2012) have undergone a series of research to comprehend the acceptability of biofortified food by consumers.
Yellow cassava is capable of providing 25 % of the daily need of vitamin A to people in sub-Saharan Africa. There is, therefore, a need to incorporate recipes of common foods that can be consumed, making use of vitamin A-rich cassava. Formulation and preparation of homemade or street foods from this developed cassava will have a positive impact on the nutritional status, as a large portion of the population can have access to the food. The success of the introduction of yellow cassava will depend greatly on its acceptability by consumers (Oparinde *et al*., 2016). The primary objective of this study, therefore, was to determine the acceptability of cass*moi* pudding made from yellow cassava among women of reproductive age.

MATERIALS AND METHODS

Study Design

The study was descriptive, cross-sectional in design, with a mixed-method approach.

Study Location

Telemu is a rural community in Ola-oluwa Local Government in Osun State, Nigeria. Its geographical coordinates are $7^{0}4^{0}0'0"$ N, 4^{o} 16' 0" E. The study area belonged to the rainforest agroecological zone with 2 rainy seasons from March to July and from September to October. The community is made up mostly of agrarians. The community was purposively selected based on previous Vitamin A cassava research activity and proximity to the cassava harvest site.

Study Population

The acceptability of yellow *cassmoi* was tested in a location that has been an adopted community for research on yellow cassava products. This community was found suitable as the majority cultivates cassava, produces cassava products, and has a variety of cassava on their farmland. This also played a role in determining the acceptability of the product, irrespective of the outcome of sensory

attributes.

Sampling Procedure

For ease of community entry, the researcher met with the community head and was assigned a leader who assisted with the mobilization of women and preparation of the venue of the meeting. A random sampling procedure was used to select eligible participants. The selected women participated in the focus group discussion (FGD) and sensory evaluation. They prepared the *cassmoi* but with the guidance of the researcher.

Inclusion and Exclusion Criteria

The criteria for including participants were that they were women of reproductive age and willing to provide useful information for the research. Women who are not of reproductive age were excluded.

Focus group discussion

Two focus group discussions were held: the first group comprised eight (8) women, while the second group comprised seven (7) women. The focus group discussion guide incorporated issues such as (i) varieties of traditional cassava found in the locality (ii) knowledge about yellow cassava (iii) source of information on yellow flesh cassava (iv) perceived usage, health benefits, and diseases related to consumption of yellow cassava products (v) kinds of pudding known in the locality (vi) awareness on *cassmoi* and its preparation and (vii) opinions on the profitability of *cassmoi.*

FGD was conducted in the indigenous Yoruba Language for clarity, and each session lasted 35 to 40 minutes. Each session began with a brief introduction of the purpose of the study. All participants were assured of confidentiality and informed that there were no 'yes or no' answers; also, they were encouraged to share their views on the questions discussed. The researcher moderated the session while the assistant researchers acted as note-takers. The Focus Group Discussion was audio recorded, and the participants consented. Also, it was transcribed and translated into English. The transcript was then subjected to content analysis to identify key themes from the discussion.

Sample collection and preparation of yellow cassmoi

Freshly harvested yellow cassava tubers were obtained from IITA, Ibadan; the beans and other ingredients were purchased at Bodija International market, Ibadan. *Cassmoi* is made with vitamin A cassava and beans. The Harvest Plus recipe for the preparation of *cassmoi* was adopted with a few modifications (Harvest Plus, 2023).

To derive the yellow cassava mash, the yellow cassava was peeled, cut into small cubes, and washed thoroughly. The cubed yellow cassava was blended into a smooth paste using an engine-driven miller in two passes and then dewatered lightly by applying little pressure to allow the removal of water and cyanide content. Little pressure is needed to prevent the removal of a substantial quantity of vitamin A.

To derive the bean mash, the bean was soaked for about fifteen minutes, dehulled manually using hand pressure, washed thoroughly, and blended to a thick, smooth paste using an engine-driven miller in two passes.

The yellow cassava mash and beans mash were proportioned in the ratio of 5:1, respectively, that is, 5 cups of yellow cassava mash to 1 beans mash. A 250 ml capacity cup (levelled) was used as the measure. The mash was mixed using a wooden spatula to get uniformity. Two (2) medium onions,12 small scotch bonnet peppers (Rodo), and 7 large pieces of Cayenne pepper (Bawa) were blended in a single pass using an engine-

driven miller and added to the mash. 250ml vegetable oil, 16 grammes bouillon cubes, and salt to taste were also added, and incorporated to get a uniform mix. A desired quantity was scooped into a clean wrapping leaf commonly known in the locality as '*ewe eran'* and steamed for 45 minutes.

Socio-demographic data of women

The women provided their socio-demographic data through a semi-structured questionnaire in the Yoruba language, which was administered by the researcher.

Sensory Evaluation

Fifty women (15-49years) randomly selected and met the inclusion criteria were recruited from the community. The women assembled in the community hall where the sensory evaluation took place. Sensory acceptability was carried out using a five-point hedonic scale**.** The participants were presented with prepared yellow *cassmoi* to assess the acceptability in terms of appearance, aroma, taste, texture, and overall acceptability on a five-point hedonic scale where one represents dislike a lot and five represents like a lot. To prevent the participants from influencing one another's responses, the participants were seated a few meters away from each other and were not allowed to communicate during the session. All participants were provided with water to rinse their mouths before tasting the *cassmoi* to ensure no interference with the previous meal eaten, this was to ensure accuracy from the result obtained from the assessment.

Ethical consideration and approval

Community entry was done by making a visit to the king of the village and making the intent of the research known. Verbal consent was obtained to go ahead with the research in the community, and the contact person mobilized the women for participation.

Participants were assured of the strict confidentiality of all information provided. In maintaining confidentiality, anonymity was given to all participants by assigning codes to identify questionnaires instead of participants' names.

The research proposal was approved by the UI/UCH institutional review committee of the Institute of Advanced Medical Research and Training, University of Ibadan (UI/EC/18/0672).

Data analysis

The quantitative data obtained were analyzed using the statistics for the social sciences (SPSS) version 20. Quantitative data were summarized using frequencies, percentages, means, and standard deviation. The qualitative data was obtained through recording using an audio tape and a video recorder. The Focus Group Discussion was transcribed and translated into English. The transcript was then subjected to content analysis to identify key themes from the discussion. Each theme had verbatim quotes from the respondents.

RESULTS

Socio-demographic data of women

Results revealed that more than half (58%) of the women were in the 16-25 years age category, while others were between 26-35 years (28%) or over 35 years (14%). Most (94%) of the women were married. Only a few have attended tertiary institutions; consequently, 46% of the respondents are petty traders. Most households were large with 6-10 people, and 70% had 1-4 children present in the household.

Focus Group Discussion on the Level of Knowledge and Perception of yellow Cassava, products, and yellow cassmoi.

The participants knew yellow cassava; they consume its products and have heard about yellow *cassmoi.* Most of the information they heard about yellow cassava came from

Harvest Plus and the research group that adopted the community a few years ago. *"It was introduced by the cassa vita group about 3 to 4 years ago in this community". (R1)* The people of the community were well-informed about yellow cassava and its perceived health benefits.

> *"Yellow cassava is very good because I know it has good protein in it". (R1)*
> *"I could see changes in the skin color of my child, which was different from the former before participation in the program, and that the intellectual capacity has improved from what it used to be". (R4)*

Due to the perceived health benefits, respondents were willing to consume yellow *cassmoi* and incorporate it into their day-to-day meals.

Sensory Evaluation

The appearance, aroma, taste, texture, and overall acceptability were the characteristics of yellow *cassmoi* examined by the respondents (Table 1). The appearance and aroma of yellow *cassmoi* were similarly accepted by the respondent; 98% of the women scored it highest. Up to 88% rated the taste highest, while all the participants liked the texture of *cassmoi*.

Consumer Acceptability

During the study, yellow *cassmo*i was compared with conventional bean pudding made with only beans. It was discovered that most (82%) of the respondents prefer *cassmoi* to the conventional bean pudding in all its sensory attributes (appearance, taste, aroma, texture, and overall acceptability). With the response derived from the consumption of *cassmoi*, up to 38% of the respondents indicated consuming yellow *cassmoi* twice a week.

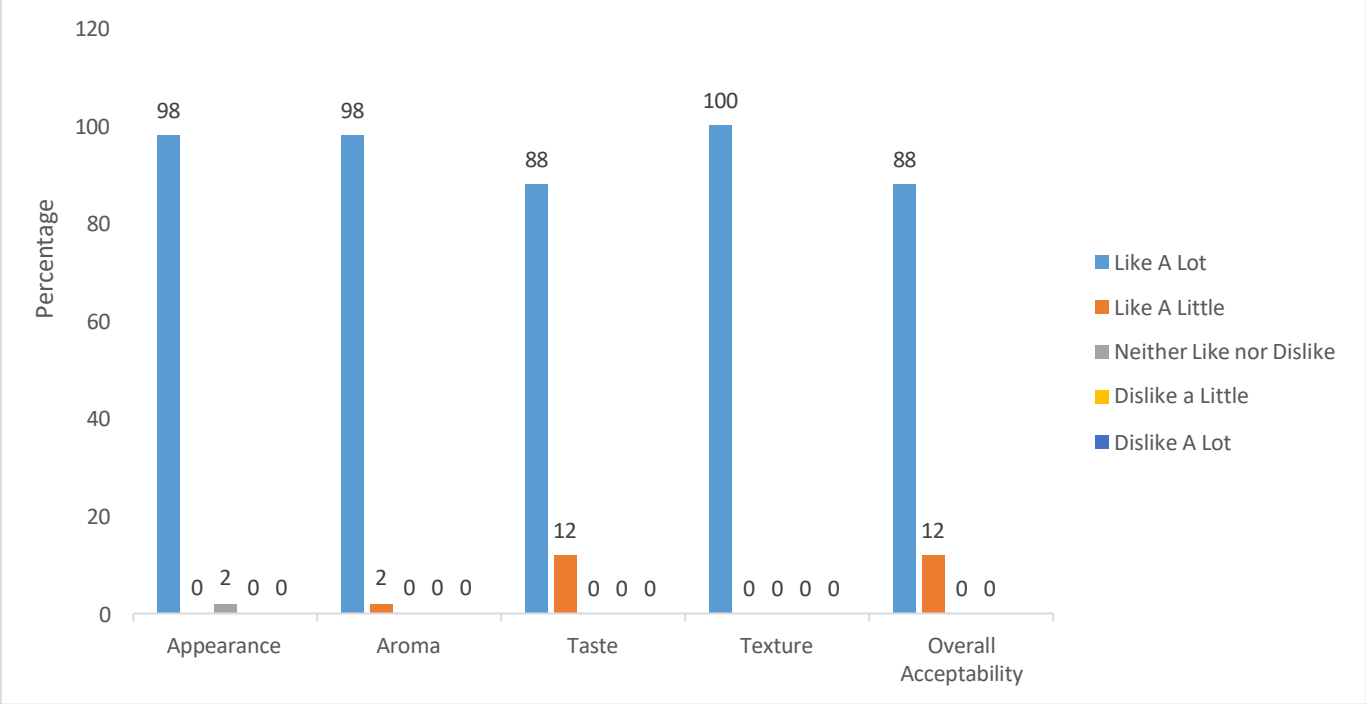

Figure 1: Frequency and percentage of respondents who gave different ratings for the sensory attributes evaluated (n=50)

Table 1: **Thematic Report On Community Awareness, Utilization, And Perceived Benefits Of Yellow Cassava**

Question	Theme	Quotes
Have you heard about yellow cassava?	Awareness	'Yes, I heard about it, it was introduced by the cassa vita group about 3 to 4 years ago to this community.' 'The cassa vita group gave us some years back.'
What food products are commonly produced from yellow cassava?	Utilisation	'We use it for fufu, garri, pounded cassava, *moi moi,* and lafun, but lafun does not draw well, but it is manageable for consumption.'
What are the benefits of yellow cassava?	Medicinal benefits	'The Vitamin A present in the yellow cassava aids fast growth in children, is good for the eye, and cures ulcers.' 'Yellow cassava is very good because I know it has good protein in it.' 'I could see changes in the skin color of my child, which was different from the former, and that the intellectual capacity has improved from what it used to be when consuming yellow cassava products.' 'There was a case of a woman who was given yellow cassava stem and tuber. She is a known hypertensive patient, but I think she heard about yellow cassava somewhere; she told someone to get it for her, which she planted. She prevents all her children from getting there; she is the only one who harvests it and eats it. I don't know any other thing, but I know she has been fine since then.
Are you willing to utilize yellow cassava?	Nutrition campaign	'We are willing to utilize the yellow cassava since we have seen the usefulness, but people who have this yellow cassava on their farmland are not willing to give the stems out and are not willing to sell the tubers to us'. 'We can make use of the yellow cassava if those people from IITA who have brought it in the past can bring it again'.
Are you aware of yellow cassava *moi moi* and its preparation?	Nutrition education	'We have heard about it, but the majority of us here don't know how to prepare it'. 'I will peel the cassava, cube it, rinse it in water, grind with a miller, dewater the paste gotten from grinding using a muslin cloth to remove water completely, the dewatered paste is mixed with ingredients such as *bawa*, onions, *rodo,* and steamed in a pudding leaf or nylon for steaming'.
	Frequency	'I have prepared it before, at least once per week, but that was when the yellow cassava was available on the farm'.

DISCUSSION

Socio-demographic characteristics of participants

According to the study, a large percentage (88%) of the participants were between the ages of 16-35 years, which constitutes women of reproductive age who are also more vulnerable to vitamin A deficiency (WHO, 2001). Most of the participants had up to secondary education, which could influence their choice and willingness to incorporate new ideas about various recipes of health importance in their menu, such as vitamin A cassava products. Most of the households that participated also have more than three children who belong to another group vulnerable to vitamin A deficiency. This is significant in that adapting biofortified food products such as yellow cassava and other similar staples early enough could decrease the prevalence of Vitamin A deficiency in children and adults (West, 2002). The majority of the women who participated in both the participatory *cassmoi* preparation and consumer acceptability are within the reproductive age and are mainly caregivers to children and are directly in charge of the family meal preparation.

Awareness of yellow cassava, its product, and perceived health benefits.

The focus group discussion during the study revealed that there are three main types of cassava in the community, which are majorly white, and another type introduced into the community was the yellow flesh provitamin A cassava. Most of the respondents were aware of yellow cassava and its products, which implies they had known about the product and had information on the nutritive composition, which relates to health benefits. The result from this research is contrary to the findings of Duah *et al.* (2016), which showed that less than half of the respondents (36.6%) know yellow cassava, and a few of them are aware of its nutritional composition.

Various food items were said to be commonly produced from yellow cassava, which was like the products of white cassava. These are garri, fufu, pounded cassava, and lafun, which are also similar to the findings of Duah *et al.* (2016). According to this study, the perceived benefits of yellow cassava are improved eyesight, improved intellectual capacity, and improved skin color. A respondent compared white and yellow cassava, and she claimed that yellow cassava is good for the eye, heart, and blood, and it prevents stroke. Respondents during the focus group discussion listed the various types of puddings made from other food products aside from the conventional bean pudding, which is 'sapala', also referred to as 'Abari'.

Since the respondents are aware of the benefits of yellow *cassmoi,* they made known various challenges that could reduce the frequency of consumption of yellow *cassmoi,* and this spans from reduced availability of yellow cassava tubers to the limited time available for the preparation of yellow *cassmoi*. A solution was presented by the respondent that a vendor who prepares this meal will be massively patronized.

Sensory evaluation and consumer acceptability of yellow cassmoi

Sensory evaluation is the expression of likes or dislikes for a product, which is a result of variations in humans. In this study, most respondents accepted the yellow *cassmoi* in its appearance, taste, texture, and aroma possible explanation could be background knowledge and information about the health importance of vitamin A in cassava, which came as a result of previous research work carried out in this community (Afolami *et al.,* 2021). A study by Duah *et al.* (2016) reported that nutrition information is important to the acceptability of a food product; about half of

the consumers who took part in the survey were not willing to accept yellow fleshcassava because they did not have any knowledge about it. This means that consumers were more likely to consume biofortified foods if they were provided with information on the nutritional value of the food (Duah *et al.*, 2016). Similar studies revealed that consumers were willing to pay and consume orange-fleshed sweet potatoes more than the white variety when provided with nutrition information (Meenakshi *et al*., 2012). A similar survey related to the acceptability of yellow cassava revealed that 51.2% of the respondents were willing to accept the biofortified yellow cassava, and this was attributed to diet diversity and curiosity (Duah *et al.*, 2016). The relationship between the sensory attributes of the products and the visibility of the nutrition traits was linked (Birol *et al*., 2015). Besides the nutrition information, food products with visible traits are accepted even without nutrition information in the case of Orange Flesh Sweet Potato in Uganda, as well as yellow biofortified cassava in Oyo state (Birol *et al*., 2015).

Willingness To Frequently Consume Cassmoi

From this study, respondents signified their willingness to prepare and eat yellow *cassmoi* weekly as often as twice a week, thrice, and even more. This can be related to the major occupation in the locality, as most are farmers and have farmlands with cassava readily available. Nutrition information is also significant to their choice of the frequency of preparation, as previous research carried out in the location has opened the minds of participants, as visible signs of progress were observed in children used for the survey. Their choices were not influenced because of the sensory attributes but by their perceived benefits from the yellow cassava.

Yellow *cassmoi* has been preferred over the conventional *moi moi* pudding made with only beans; emphases were placed on its texture and over other properties, and it is said to be preferred to feed children as a complementary meal. This was consistent with the findings in a study on biofortified food (Talsma *et al.,*2013).

CONCLUSION

More than half of the respondents had good knowledge of yellow cassava and its products. *Cassmoi* is accepted by taste, appearance, aroma, and other organoleptic factors. There is a willingness to incorporate *cassmoi* into their daily menu, which was a result of the perceived health benefits. Major challenge envisaged in the continual consumption of *cassmoi* is the time constraint in the preparation, and this has a potential solution, which is that a vendor who makes this meal will be patronized. Many health benefits seen served as an encouragement to continually consume yellow cassava products.

REFERENCES

Afolami, I., Mwangi, M.N., Samuel, F., Boy, E., Ilona, P., Talsma, E.F., Feskens, E., and Melse-Boonstra, A. (2021). Daily consumption of pro-vitamin A biofortified (yellow) cassava improves serum retinol concentrations in preschool children in Nigeria: a randomized controlled trial. *The American Journal of Clinical Nutrition*, 113(1), 221–231. Https://doi.org/10.1093/ajcn/nqaa290

Aniedu, C. and Omodamiro, R.M. (2012). Use of newly bred β-Carotene cassava in the production of value-added products: Implications for food security in Nigeria. *Global Journal of Science Frontier Research Agriculture and Veterinary Sciences.* 12 (10): 1 - 10.

Aurelie, B., Tomlins, K. and Fliedel, K. (2018). Cassava traits and end-user preference relate traits to consumer liking, sensory perception, and genetics. *Critical Review in Food Science and Nutrition*. 58(4): 547 - 567.

Ayoade, F., Osho, A., Adesanya, O.O., Fayemi, N.E., and Ojo, G.I. (2012). Effect of natural spices on the progression of microbial food spoilage in the steamed bean pudding, moin-moin. *International Journal of Biological and Chemical Science.* 6 (6): 5030-5041.

Birol, E., Meenakshi, J.V., Oparinde, A., Perez, S., and Tomlins, K. (2015). Developing consumers' acceptance of biofortified foods: A Synthesis. *Food Security.* **7**: 555–568. https://doi.org/10.1007/s12571-015- 0464-7

Duah, E.A., Parkes, E., Baah, R.O., Acquatey-Mensah, A., Danquah, A.O., Holger, K., Peter, K., and Aseidu, M.S. (2016). Consumption patterns, perceptions, and total carotenoids, iron, and zinc contents of yellow flesh cassava. *Journal of Food and Nutrition Research* 4 (12): 814-819.

HarvestPlus (2023). Biofortified crops on my plate: A National Biofortification recipe book. www. HarvestPlus.org

Ilona, P., Bouis, H.E., Palenberg, M., and Oparinde, A. (2015). Vitamin A cassava in Nigeria: crop development and delivery. *African Journal of Food, Agriculture, Nutrition and Development.* 17 (2): 12000-12025.

Meenakshi, J.V., Banerji, A. and Manyong, V.K. (2012). Using a discrete choice experiment to elicit the demand for a nutritious food: Willingness-to-Pay for Orange Maize in Rural Zambia. *Journal of Health and Economics*; 31: 62-71.

Oparinde, A., Banerji, A., Birol, E., Ilona, P. (2016). Information and consumer willingness to pay for biofortified yellow cassava: evidence from experimental auctions in Nigeria. *Agricultural Economics.* 47(2): 215-233.

Talsma, E.F., Melse-Boonstra, A., Brenda, P. H., de Kokl Gloria, N. K., Mbera Mwangi, A.M. and Brouwer, I.D. (2013). Biofortified cassava with provitamin A is sensory and culturally acceptable for consumption by primary school children in Kenya. *PLoS ONE.* 8(8): e73433. https://doi.org/10.1371/journal.pone. 0073433

West, K.P. (2002). The extent of vitamin A deficiency among preschool children and women of reproductive age. *Journal of Nutrition*; 132:2857S-2866S, https://doi.org/10.1093/jn/132.9.2857S.

World Health Organization (2001). Vitamin A deficiency and iodine deficiency disorders: prevalence estimates for the global burden of disease. Micronutrient Deficiency Information System (MDIS), Geneva, Switzerland: World Health Organization.

World Health Organization (2009). The global prevalence of vitamin A deficiency in populations at risk, 1995–2005. WHO Global Database on Vitamin A Deficiency; ISBN 978 92 4 159801 9.