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Research Application Summary

Incorporation of sweetpotatoes into diets of children aged 6-59 months in Trans-Mara East Sub-County, Narok County, Kenya

Chepkwony, M.C., Abong, G.O. & Ngala, S.

Department of food science, nutrition and Technology, College of Agriculture and Veterinary Sciences, University of Nairobi, P. O. Box 92, Kikuyu, Nairobi, Kenya
Corresponding author: chepkechmercy22@gmail.com

Abstract

Sweetpotato versatility, drought tolerance, resistance to diseases and its great contribution to food security makes it an important staple food in the developing countries. Poor soil productivity, insufficient soil moisture, diseases, pests and erratic rainfall, among other factors accelerates food insecurity in arid and semi-arid areas. There is, however, limited information on sweetpotato utilization and contribution to nutrient adequacy especially in children under-five years in Narok County. A cross-sectional study was carried out in January to February 2018 to determine the consumption of sweetpotatoes and their contribution to nutrient adequacy in the diets of 211 children aged between 6-59 months. The study consisted of qualitative and quantitative data collection methods. The data obtained was analysed using SPSS version 20, Nutrisurvey 2007 software and ENA for SMART 2011 software. White-fleshed sweetpotato was the most popular variety in Trans-Mara East. Majority of the respondents (70.6%) had their children on a diet inclusive of sweetpotatoes while the remaining (29.4%) respondents' children were not on such diet. The most common mode of sweetpotato preparation reported was boiling (88.6%) while 11.4% fried. There was no significant difference (Independent sample t-test=2.2, df =208, $p>0.05$) between mean dietary diversity scores for the children reported to consume diets with sweetpotatoes and those who were reported not to consume diets with sweetpotatoes. Lack of sweetpotato consumption led to significant ($p<0.05$) reduction in the iron intake with R2 of 0.26 and beta of -5.4. Consumption of sweetpotatoes did not result in any significant difference ($p>0.05$) in the intake of calcium, vitamin A, zinc, carbohydrates, fibre and protein. There was no significant association between wasting status ($\chi^2=4$, df=2, $P>0.05$), underweight status ($\chi^2=0.6$, df=2, $P>0.05$) stunting status ($\chi^2=2$, df=2, $P>0.05$) and sweetpotato consumption. There is great potential of sweetpotatoes utilization in this region, yet its consumption by children is poor. There is need for increased promotion efforts to increase frequency of sweetpotato consumption, by formulating various ways of making delicious recipes.

Key words: Consumption, dietary diversity, nutrient intakes, sweet potatoes, utilization

Résumé

L'adaptabilité de la patate douce, sa tolérance à la sécheresse, sa résistance aux maladies et sa grande contribution à la sécurité alimentaire en font un aliment de base important dans les pays en développement. Une faible productivité du sol, une humidité insuffisante du sol, des maladies,

ravageurs et précipitations irrégulières, entre autres, accélèrent l'insécurité alimentaire dans les zones arides et semi-arides. Toutefois, il existe peu d'informations sur l'utilisation de la patate douce et sa contribution à l'adéquation des nutriments, en particulier chez les enfants de moins de cinq ans dans le comté de Narok. Une étude transversale a été menée de janvier à février 2018 pour déterminer la consommation des patates douces et leur contribution à l'adéquation nutritionnelle dans l'alimentation de 211 enfants âgés de 6 à 59 mois. Des méthodes de collecte de données qualitatives et quantitatives ont été utilisées. Les données obtenues ont été analysées à l'aide de SPSS version 20, du logiciel Nutrisurvey 2007 et du logiciel ENA-SMART 2011. La patate douce à chair blanche était la variété la plus populaire. La majorité des répondants (70,6%) avaient leurs enfants sur un régime comprenant des patates douces. Le mode de préparation de patate douce couramment signalé était l'ébullition (88,6%) tandis que pour 11,4%, elle était frite. Il n'y avait pas de différence significative (test t d'échantillons indépendants = 2,2, df = 208, p> 0,05) entre les scores moyens de diversité alimentaire pour les enfants suivant des régimes aux patates douces et ceux qui ne les suivent pas. Le manque de consommation de patates douces a conduit à une réduction significative (p <0,05) de l'apport en fer avec un R2 de 0,26 et un bêta de -5,4. La consommation de patates douces n'a entraîné aucune différence significative (p> 0,05) dans l'apport en calcium, vitamine A, zinc, glucides, fibres et protéines. Aussi, il n'y avait pas d'association significative entre le statut d'émaciation ($\chi 2 = 4$, df = 2, P> 0,05), le statut d'insuffisance pondérale ($\chi 2 = 0,6$, df = 2, P> 0,05) le statut de retard de croissance ($\chi 2 = 2$, df = 2, P> 0,05) et la consommation de patates douces. Il y a un grand potentiel d'utilisation des patates douces dans cette région, mais sa consommation par les enfants est faible. Des efforts de promotion accrus sont donc nécessaires pour augmenter la fréquence de la consommation de patates douces, en formulant diverses façons de préparer de délicieuses recettes.

Mots clés: consommation, diversité alimentaire, apports nutritionnels, patates douces, utilisation.

Introduction

Due to sweetpotato versatility, drought tolerance and its great contribution to food security it is considered important staple food in the developing countries of the world (El Sheikha and Ray, 2017). There are many varieties with different skin and flesh which can be white, yellow-orange or deep purple (Sindi *et al*., 2013). Globally, China is the top producer with 71.3 million tonnes which is about 69% of world total production. It is followed by United nations of America that produces 1.34 million tonnes, Brazil with 0.53 million tonnes while in Africa, Nigeria leads in production with 3.77 million tonnes followed by Uganda with 1.86 million tonnes (FAOSTAT, 2017). Sweetpotato production in Kenya is mainly done in central, coastal and western regions of the country which accounts for 75% of total production annually. Out of this production about 80% is produced in the Lake Victoria basin (Tumwegamire *et al*., 2014).

Transmara East Sub-County is a semi-arid region in Narok County and the residents have always depended on seasonal rains for maize production until recently when maize production was rendered almost impossible by Maize Lethal Necrosis Diseases (FAO, 2012). Further studies have shown that soil productivity, insufficient soil moisture and erratic rainfall, have accelerated poverty and food insecurity in many of the households in Trans Mara East Sub-county (Saidi *et al*., 2014). Focus has now shifted to sweetpotato production both in large and small scale. There is, however, limited information on their utilization and contribution to nutrient adequacy especially in children under-five years. The objective of this study was to assess the consumption of sweetpotatoes and their contribution to nutrient adequacy in children aged 6-59 months in Trans-Mara East Sub-County.

Materials and methods

The study was conducted in Trans-Mara East Sub-County of Narok County in Kenya. A cross-sectional survey was employed in this study and the study population comprised all children in Trans-Mara East Sub-County of Narok County. An inclusion criterion was households with children aged 6-59 months while exclusion criterion was children aged 6-59 months with terminal illnesses. Sample size was determined as specified by Fisher. Given that 18% of the population in Narok County is children below five years of age the sample size was found to be 227. An additional of 5% was made to take care of attrition and refusals. The sample size used was therefore, 237. For 24-hour dietary recalls, a sub sample of 30 children was selected by simple random sampling.

Trans-Mara East Sub-County of Narok County was purposely selected because it is a major sweetpotato producer within Narok County. Oloolmasani and Mogondo wards were randomly selected and for each ward, two villages were randomly selected and studied. A list of all households of each village was obtained and households were randomly selected. A detailed semi-structured questionnaire was used to obtain data on demographic and social-economic characteristics of the study households, dietary diversity, nutrient intakes and utilization of sweetpotatoes. Focus group discussions were also used to collect information on consumption of sweetpotatoes, preparation methods and how they are incorporated in children's diet. Weights and heights were measured twice for each indexed child and the average was computed.

Informed consent was sought from the Trans-Mara East Sub-County administrator and the chiefs from Oloolmasani and Mogondo locations. Consent was also sought from the respondents after clearly explaining the study and its objectives. Data analysis was done using SPSS version 23 and significance tested at $p<0.05$. Data for the 24 hour dietary recall were analysed using the Nutrisurvey 2007 software while anthropometric data were analysed using ENA for SMART 2011 software. Data from focus group discussions were reviewed and for each question a summary of key findings were obtained and analysed.

Results and discussion

Demographic and socio- economic characteristics of the households. Majority of the respondents (92.9%) were female while 7.1% were male. The mean household size was 5±2 persons. This is higher than the Kenyan national average household size of 4.6 (KNBS, 2013). Large household size have important implications on the household priorities and evidence shows that large households are likely to be food insecure compared to smaller households (Olayemi, 2012).

Majority of the household heads were males (68.2%) and 31.8% were headed by females. This finding is similar to the country's finding (KDHS, 2014). Education level of the study population was low with 70.4% being primary drop-outs while only a quarter had attained secondary education and post-secondary education. Farming (77.6%) was the most common source of income among the study households. Other households engaged in business and casual labour (19.4%) while 9.6% depended on formal employment. The respondents were mainly women 92.9% while men respondents were 7.1%. This implies that majority of the caregivers for children below five years were women. This agrees well with a study done in Baru Village, Sarolangun, Jambi –India that established that the main role of mothers in a family is to act as a nanny (Merita *et al*., 2017).

Dietary diversity and nutrient intake of study children. The mean dietary diversity score was 4.4+1.6 food groups. Range of food groups consumed by the children was between 2 and 7. Majority of children (69.7%) had high dietary diversity score of more than four food groups while 30.3% had a low dietary diversity score of less than four food groups. This could be because of the bumper harvest the previous season just before the current study. The study children's diet did not meet the RDAs for Carbohydrates, Vitamin A, Calcium and Iron. For the means of carbohydrates, vitamin A and iron which were slightly less than the RDAs could be attributed to underreporting of the intakes using 24 hour dietary recall. Possibility of underreporting has been of concern in other studies like in a study done in Pila, Poland (Merkiel and Chalcarz, 2016).

Sweetpotato production. Majority of the respondents (91.9%) reported that they grow sweetpotatoes compared to 8.1% who did not grow. This shows that sweetpotato is a highly accepted crop in Trans-Mara East. Sweetpotato has a great potential of increasing household food security and alleviating poverty (Niringiye *et al*., 2014). There was a significant difference in the varieties grown in the four villages (÷2=52.7, df=12, $p<0.05$). The main reason for this was that there was an early program by World Vision that promoted the orange-fleshed varieties in some villages within the Sub-County and while others had adopted others had not. Slightly less than half of the respondents (47.9%) grew white-fleshed sweetpotatoes, less than a quarter (17.1%) grew yellow-fleshed sweetpotatoes and 13.7% grew orange-fleshed sweetpotatoes. This finding is similar to an observation made in Sub-Saharan Africa that as much as sweetpotato is known as a food security crop, most varieties grown are high dry matter white-fleshed types that lack beta-carotene (Low *et al*., 2017).

Sweetpotatoes in the diet of study children. Majority of the respondents (70.6%) had their children on a diet inclusive of sweetpotatoes while the remaining (29.4%) respondents' children were not on such diet as shown in Table 1. This implies that sweetpotatoes plays an important role in child feeding and could contribute to improvement of nutrition status of children (Motsa *et al*., 2015). The trend of the diet of these children across the villages wasn't significantly different ($\chi2 =8.9$, df=3, $p>0.05$). Tender age was reported as the key reason (85.5%) why the children didn't consume sweetpotatoes while others (14.5%) cited health and safety reasons as summarized. Of the children that consumed sweetpotatoes, more than half (68.5%) began eating sweetpotatoes at the age of 12-24 months, slightly less than a quarter (23.5%) began at 24-36 months and the rest (8.1%) started aged above 36 months. Two out of one hundred respondents (1.9%) reported that the children began eating sweetpotatoes when they had begun complimentary feeding while 0.9% began when they had stopped breast feeding. Other reasons were that sweetpotatoes were not available earlier on while other children began eating diets inclusive of sweetpotatoes after they had complete teething. Availability of sweetpotatoes was the major reason (52.6%) for its consumption at such early ages. Studies show that sweetpotatoes could be incorporated in child's diet both locally and even for commercial purposes affordably; for instance when used to formulate complementary food it supports growth to the same extent as nutritionally adequate industrial-manufactured infant cereal (Amagloh, 2015).

Sweetpotato preparation and frequency of consumption. The most common mode of sweetpotato preparation reported was boiling (88.6%) while a few others (11.4%) peeled and fried. From focused group discussions, the caregivers reported that the boiled sweetpotato tubers would be eaten with tea, milk and porridge. In a case where the sweetpotatoes are fried, they would be mixed with other foods like githeri, rice, Irish potatoes or pumpkins. This is consistent with some documented local processing methods which include; boilingsweet potato roots which are peeled or left unpeeled, mixing of sweetpotatoes and beans after boiling separately (Momanyi *et al*., 2016). Diversifying sweetpotato

recipes promotes the production, consumption and economic value of the crop (Sohail *et al*., 2013).

Table 1. Distribution of children by sweetpotato consumption

Sweetpotato consumption	Percentage
Is the indexed child consuming sweetpotatoes?	
Yes	70.6
No	29.4
Reasons why indexed child did not consume sweetpotatoes	
child still young	85.5
Child experience diarrhea or constipation	12.9
Child could get choked	1.6
Age at which indexed child began eating sweetpotatoes	
6-12 months	2.7
12-24 months	68.5
24-36 months	23.5
36-48 months	5.4

About a half (45.5%) of the respondents reported that their children had been fed with white-fleshed sweetpotatoes in the preceding seven days while the rest (54.5%) had not. Less than a half (35 %) of the respondents reported that they had fed their children with yellow fleshed sweet potato in the preceding seven days while majority (65%) had not. About a quarter of the respondents (24.2%) reported that their children had eaten orange-fleshed sweetpotatoes in the preceding seven days while 74.9% had not eaten. The most popular varieties of sweetpotato tubers consumed across the villages were the white-fleshed sweetpotatoes followed by the yellow-fleshed and lastly orange-fleshed sweetpotato varieties. This partly explains the reason why vitamin A intake was below the recommended daily allowance. Lack of information about the importance of the biofortified orange-fleshed sweetpotatoes could be attributed to limited adoption and consumption.

Nutritional status of children. The overall prevalence of global malnutrition was at 3.8%. More female children were severely wasted (4.5%) compared to male children (2.1%). There was no significant association between wasting levels and villages (χ^2=6.4, df=6, p>0.05. Wasting below 5% is considered low and therefore wasting rate was within this range (WHO, 2018a). This is mainly because there was plenty of food in the area during the present study. The overall prevalence of underweight was 9.6% (6.9 - 13.3, 95% C.I.), moderate underweight was at 9.1% (7.4 - 11.2, 95% C.I) and severe underweight was 0.5% (0.0 - 11.4, 95% C.I.). More male children were underweight (11.8%) compared to female children (6%).There was no significant association (p>0.05) between underweight levels and the villages. These results are consistent with the study done in Narok County where 11.6% of children were reported to be underweight and 0.6% severely underweight (KDHS, 2014). Overall prevalence of stunting was high at 28.9% (23.6 - 34.9, 95% C.I.) and prevalence of severe stunting was 11.7% (8.8 - 15.4, 95% C.I). There was no significant difference (p>0.05) for stunting levels across the villages. These results are slightly different from the study for Narok County where the degree of stunting was reported as 32.9% while 8.7% were severely stunted (KDHS, 2014). According to WHO global database stunting level of 20-29% is considered medium (WHO, 2018b). The rate of stunting in Trans-Mara East, which is at 28.9%, is within this range and could be attributed

to food insecurity and inappropriate infant and young child feeding practices.

Association between sweetpotato consumption, demographics and socio-economic characteristics. Children from female headed households were four times less likely to consume diets with sweetpotatoes compared to the male headed households (Binary logistic, OR=0.4, 95% CI). This could be because female headed households are more likely to be of low socio-economic status; evidenced by low education levels, and may not afford other varieties of foods. Since sweetpotatoes are readily available it becomes a common food in such households. This agrees well with a study in Nigeria that found out that sweetpotato is generally a more important crop for women than for men due to the crop's relatively low labor requirements and short maturity time (David, S. 2015). Another explanation for this could be the notion that sweetpotato is among crops considered to belong to women because men tend to switch to crops that are commercially lucrative (Okonya and Kroschel, 2013). There was no significant relationship between household's main source of income (χ^2=9.3, df =6, p>0.05), education level of the household head (χ^2=8.6, df=12, p>0.05) and consumption of sweetpotatoes. This could be because the households under study are in the same region and may have similar characteristics including the crops grown in the area and the sources of income.

Table 2. Mean nutrient intake per day for children aged 12-36 months based on sweetpotato consumption

Consume sweetpotatoes	Carbohydrates (g)	Fibre (g)	Protein (g)	Vitamin A (µg RAE)	Zinc (mg)	Calcium (mg)	Iron (mg)
Yes	116.7±21.4a	20.6±6.7a	11.6±3.0a	283±237.9a	3.7±1.2a	619.7±109.9a	8.3±5.3a
No	83.4±76.2a	26±24.8a	16.1±9.8a	198.7±172.4a	4.2±2.1a	623.8±89.7a	2.8±1.6b

Values with different letters in the superscript are statistically different at p<0.05

could be the notion that sweetpotato is among crops considered to belong to women because men tend to switch to crops that are commercially lucrative (Okonya and Kroschel, 2013). There was no significant relationship between household's main source of income (χ^2=9.3, df =6, p>0.05), education level of the household head (χ^2=8.6, df=12, p>0.05) and consumption of sweetpotatoes. This could be because the households under study are in the same region and may have similar characteristics including the crops grown in the area and the sources of income.

Consumption of sweetpotatoes, dietary diversity and nutrient intakes of children aged 12-36 months. From students t-test, there was no significant difference (Independent sample t-test=2.2, df =208, p>0.05) between dietary diversity scores for the children reported to consume diets inclusive of sweetpotatoes and those who were reported not to consume diets inclusive of sweetpotatoes. Other than iron intake, the other nutrient intakes were not significantly different between children reported to consume sweetpotatoes and those that do not consume sweetpotatoes (Table 2). Lack of sweetpotato consumption led to significant (p<0.05) reduction in the iron intake with R^2 of 0.26 and beta of -5.4.The consumption did not result in any significant difference (p>0.05) in the intake of calcium, vitamin A, carbohydrates, fibre, protein and zinc. This is could be because of minimal inclusion of sweetpotatoes in diets of children.

Association between nutrition status and sweetpotato consumption. There was however no significant association (χ^2=4, df=2, P>0.05) between sweetpotato consumption and wasting status.

There was no significant association underweight (χ^2=0.6, df=2, P>0.05) between sweetpotato consumption and underweight status. This could be explained by the fact that sweetpotatoes is not considered a major food crop and therefore its consumption and use is child feeding is minimal. It could also be attributed to presence of other starchy staples during the study period. There was no significant association (χ^2=2, df=2, P>0.05) between sweetpotato consumption and stunting status. This finding is different from a recent study western Kenya found that linking orange-fleshed sweet potatoes and enhanced nutrition messages into healthcare services led to significant reduction in stunting among children under two (Low, 2015).

Conclusion

Sweetpotato is produced by almost all the households in Trans-Mara East. They are introduced to diets of children aged 6-59 months mainly in form of boiled roots. Despite the fact that there are various varieties grown in the area, their utilization and especially of the more nutritious orange fleshed is low. Therefore, their contribution to nutrient adequacy and thus nutrition status is also not significant.

Recommendations

In spite of the extensive availability of sweetpotatoes within the Narok County, the utilization and use is greatly limited. There is need for promotion of utilization of sweetpotatoes in nutrition programmes to increase the frequency of utilization of sweetpotato with emphasis on highly nutritious orange fleshed varieties. This can be done by educating caregivers on the nutritional importance of consumption of sweetpotato particularly by children to improve the daily nutrient intakes and promotion of alternative methods of preparing sweetpotato-based products including the leaves.

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