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Effect of nutrition education on the knowledge scores of urban households with home gardens in Morogoro, Tanzania

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Abstract

Background: Home gardens are an old agricultural practice playing a key role in household food security and diversity. Proximity of gardens to the home facilitates easy access to food and reduces household expenditure. Home gardens combined with nutrition education could improve household diets both quantitatively and qualitatively. The objective of this study was to assess the effect of a nutrition education intervention on families with home gardens in Morogoro, Tanzania.

Methods: Two cross-sectional nutrition surveys were conducted at different time points, the baseline in October–November 2013 and endline in May–June 2014. Between the surveys, an intervention consisting of three interactive nutrition education sessions was conducted in December 2013. The study targeted forty households owning home gardens in urban areas of Morogoro municipality. Mixed methods were used to collect data, including semi-structured questionnaires for quantitative data and focus group discussions for qualitative data.

Results: The estimated marginal means showed small statistically non-significant improvements in knowledge scores for vitamin A ($p = 0.145$, partial $\eta^2 = 0.065$) and iron ($p = 0.403$, partial $\eta^2 = 0.022$). There were more positive scores observed for both nutrients at endline compared with baseline. Composite knowledge scores calculated for participants showed improvements in the category with scores between 3 and 6 points, for both nutrients.

Conclusion: While a statistically significant improvement in knowledge scores was not observed, an increase in number of positive scores and composite knowledge scores indicate an improvement in nutrition knowledge among participants. These results show that families having home gardens and who are provided with nutrition education can improve the quality of their household diets. Nutrition education in combination with other agricultural interventions could be a potential tool to improve nutritional status and should be integrated into public health programmes and strategies.

Keywords: Home gardens, Nutrition education, Vegetables, Knowledge scores

Background

Since prehistoric times, home gardens are part of small-scale subsistence agricultural systems and play a central role in household food security [1, 2]. A home garden consists of a small area used for cultivation near the household which provides easy access to vegetables and fruits. The produce from a home garden can be easily harvested and contributes to household food security [3, 4]. The crops grown in a home garden depends on the needs and preferences of a household and sometimes may also be related to medicinal use [1]. Diets lacking in adequate quantities of vegetable and fruit have been listed as one of the top ten reasons for mortality [5]. Home gardens have been associated with an increase in fruit and vegetable consumption which could be also associated with an improvement in the nutritional status [6]. Poor nutrition is associated with a low resistance to illness and poor disease outcomes [7]. Consequences of poor

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nutrition start right from pregnancy for both mother and child, poor growth and development, poor cognitive development, reduced immunity, anaemia results in a reduced capacity to work, all these factors lead to an increased risk of mortality and morbidity [8–10].

Greater opportunities to earn an income in urban areas have resulted in a migration of a majority of people from rural to urban areas [11, 12]. With an increase in urbanization, it is imperative to ensure urban food security. In urban areas, home gardens are usually classified under "urban agriculture". They are becoming increasingly common and play a central role in food security of a household [11]. For the low socio-economic class, ensuring enough food is the main motivating factor to cultivate a home garden and is often a survival strategy [13].

However, cultivating a home garden only is not sufficient to tackle the issue of undernutrition; besides the production of nutritious food other activities are required, such as proper harvesting and storage techniques, gender empowerment and nutrition knowledge and capabilities [14].

According to the country profile of Tanzania, in 2012, the population was 44.9 million of which 33 % are categorized as undernourished and the rate of urbanization, in the past three decades, increased by 38 % [15, 16].

In the current study, we assessed the immediate influence of nutrition education on families with home gardens in the urban area of Morogoro, Tanzania. This study was conducted as part of collaboration between Justus Liebig University, Germany, and Sokoine University of Agriculture, Morogoro, Tanzania.

Methods

Study setting and sample

Morogoro is a town located 192 km west of Dar es Salaam, Tanzania. The study was conducted in the urban area of Morogoro, i.e. within the municipal borders. The municipal area is divided into nineteen wards, of which two wards (namely Kichangani and Chamwino) were purposely selected as the study area. The study area and sample were chosen after consultation with the faculty at the Department of Food Science and Technology at Sokoine University of Agriculture, Morogoro.

In this study, a home garden was defined as an area around or close to the house where crops are grown in the ground mainly for household consumption. The minimum number of crops grown in a home garden is one.

Households living in the urban area, i.e. within the municipal borders of the town, were selected to be part of the survey. The main criteria for inclusion in the study were residence in the urban area, possessing a home garden primarily for household use and a low socio-economic status. The latter was defined as earning an income of Tanzanian shillings 150,000–200,000 (1 USD = 1607 T.Shs) at the time of the study.

Based on the time frame, man power and budget considerations, a sample size of forty households was decided to be used for the survey. Since two wards were chosen, the forty households were divided into twenty from each ward. The families were randomly selected from a list of names provided by the Ward Extension Officers. A number of additional households were also identified for being prepared in case of refusal or non-availability of the preselected households. Care was taken to ensure that the households selected were not enrolled in any other study or project by asking the families themselves and cross-checking with the Ward Office. Participation in the study was voluntary. Participating households were informed about all aspects of the study including their right to withdraw their acceptance at any time. Oral informed consent was obtained from each respondent from each of the participating households. Approval to interview the respondents was obtained from the Morogoro Municipality Office, not by an institutional review board, as the study was done in collaboration with Sokoine University of Agriculture and did not include any invasive techniques.

The study was designed as two cross-sectional surveys with an intervention period between the two surveys. The baseline was conducted in October/November 2013 and endline in May/June 2014. The intervention was conducted in December 2013.

Data collection

Semi-structured questionnaires were used to collect data on household characteristics, home gardening practices, food consumption habits, as well as knowledge, attitudes and practices of the selected households. The interview also included a vegetable frequency questionnaire and a 24-h dietary recall. The questionnaire was prepared in English, translated into the local language, Kiswahili, and was back-translated into English to ensure correct information to be gathered. Data was collected by a trained enumerator.

Nutrition education

After the baseline survey, three nutrition education sessions were conducted with the study participants in December 2013. The topics for the nutrition education sessions were determined based on the responses obtained in the baseline survey. Details are outlined in Table 1. The materials for the sessions were prepared with reference to the FAO resource book, "Improving Nutrition through Home gardens—A training package for preparing Field Workers in Africa" [17].

Table 1 Nutrition education sessions

Session	Topic	Key messages	Materials and resources
1.	Home gardens can help to provide balanced meals by improving household dietary diversity	Understand the concept of a balanced and complete meal Understand how to diversify the diet Understand how home gardens can help in diversifying diets and achieving a complete meal	Flipchart Pictures of fruits and vegetables Discussion Question and answers
2.	Importance of vitamins (with a focus on vitamin A, B and C)	Understand the benefits of vitamins Preparation of green leafy vegetables to get maximum nutritional benefit Hygienic cooking practices	Flipchart Pictures Cooking demonstration Local food resources Discussion Questions and answers
3.	Iron intake from food and its importance	Understand the importance of iron as a micronutrient	Video clip Laptop Flipchart Discussion Question and answer

Contents for the session on vitamin A were the role, function and importance of the vitamin in the body, fruits and vegetables rich in provitamin A, and enhancers of absorption for example, the consumption of orange fleshed sweet potato and the addition of fats/oils to the meal. Same details were provided for iron via a short video presentation in Kiswahili followed by a discussion. A cooking demonstration contributes to a "hands-on" experience which helps in better retention of the information provided.

Nutrition education sessions were conducted at the Ward Office when possible and/or in open shaded areas.

Effort was made to ensure that all respondents present participated equally in the sessions by question-and-answer sessions, quizzes and games. Each session was rolled out for 60 min. At the end of each session, the main messages were highlighted. During the following session, the previous lecture was reviewed, and only then was the new topic presented. The nutrition education was conducted by the same enumerator who administered the questionnaires at baseline. She had completed her BSc studies in nutrition and was also trained by the author prior to starting the nutrition education. The nutrition education was conducted in the local language, Kiswahili, and sessions were held weekly.

Statistical analysis

The data were entered in MS Excel and were analysed using the SPSS package version 22.0 (SPSS version 22.0, IBM Corp, New York). Descriptive analysis was done on the data. A knowledge scale was developed based on the questions related to knowledge on vegetables and fruits, vitamin A and iron. For each correct response, a point was awarded, and for every wrong answer, a point was deducted, and the total score was computed. The possible nutrition knowledge score ranged from 0 to 8. The questions covered the importance of consuming vegetables and fruits, knowledge about the existence of vitamin A and iron as well as foods rich in these two nutrients and why these nutrients are important. Respondents were asked to rate the importance on a scale of 1–5 with 1 being "not at all important" and 5 being "very important".

For the household data, namely the number of household members, average age of the respondent, education, income, marital status and the occupation, descriptive statistics were run, frequency tables generated and the means with standard deviation and percentages are reported, respectively. Descriptive statistics were also run on variables like the motivation to start a home garden, benefits of a home garden and the crops presently being cultivated as well as for the knowledge questions.

Improvement of the knowledge score was evaluated using repeated-measures ANOVA controlling for participation in the nutrition education sessions and educational level of the respondent, and estimated marginal means are reported. The significance level was set at 5 %. The knowledge scores were also ranked using the Wilcoxon signed-rank test to understand whether there was an improvement or a decrease.

Results

Household characteristics

Women from forty households participated in the baseline survey. Four of the respondents were lost at endline; three of them had travelled to their respective home towns, while one family had shifted from Morogoro to Dar es Salaam. Therefore, for this analysis a cohort of thirty-six households was used. The general household characteristics are listed in Table 2.

Table 2 Main household characteristics (*N* = 36)

Variable	Value
Mean size of HH (mean values (SD))	5.4 (1.8)
Mean age of respondent (years, mean value (SD))	40.75 (16.12)
Marital status	
Single/widowed/divorced/separated	42.5 %
Married/living with partner	57.5 %
Education level	
Illiterate/no formal schooling	20.0 %
Few years of primary/completed primary school	72.5 %
Secondary school and above	7.5 %
Occupation	
Farmer	35 %
Private or business employee	32.5 %
Housewife	22.5 %
Daily wage labourer	5.0 %
Others	5.0 %
Mean expenditure on vegetables per a week (T.Shs)	3825.00

The mean amount of money spent by households in a week on purchasing vegetables was Tanzanian shillings 3825.00 at baseline and 4605.56 at endline. In our study, half of the households food purchase decisions were made by the respondents themselves (55 %) and the other half indicated that their husbands, the grandmothers, mother-in-laws or the main bread winner in the family made the decisions. Home gardens were under the responsibility of the women and children, and occasionally other family members helped out. It was observed that 80 % of the households owned a mobile phone and 77.5 % owned their house. These houses were small and simple, built from bricks with a tin roof, with no electric wiring or toilet facilities. The latrines were usually outside the houses.

Home garden details

The number of crops cultivated in a home garden ranged from 1 to 7 at baseline and 1 to 6 at endline. Most commonly consumed foods from the home gardens were sweet potato leaves, pumpkin leaves, amaranth, cowpea leaves and cassava leaves. Other crops cultivated were okra, African nightshade, Chinese cabbage and spinach. The most common reason for cultivation of a home garden was the felt need to provide vegetables to the family (55 %). One respondent also expressed the opinion that having a home garden also was traditional for an African household. The women indicated "more food to eat" (63.9 %) and an "added source of income" (33.3 %) as the main benefits of having a home garden, and other benefits included improved health of family members and other reasons. No significant correlation was observed between number of crops grown in the home garden and number of people in the household and the household income and the motivation to start a home garden.

Knowledge scores

At baseline, four respondents said it was important and thirty-two respondents found it is very important to consume vegetables; while at endline, these numbers were eleven and twenty-five, respectively. For fruits, at baseline, six respondents revealed consumption of fruit was important and thirty said it was very important and at endline these numbers were ten and twenty-five, respectively. Repeated-measures ANOVA does not show any statistically significant effect of the nutrition education on the knowledge scores between baseline and endline. Number of nutrition education sessions attended and education level of the respondent were used as covariates. For vitamin A (Fig. 1), the estimated marginal means show that there was a slight but not significant improvement in the mean knowledge scores from 4.76 (SEM = 0.470) to 5.65 (SEM = 0.410) and for iron (Fig. 2) from 2.05 (SEM = 0.309) to 2.49 (SEM = 0.378). These small improvements did not reach statistical significance for both the nutrients, vitamin A ($p = 0.145$ and partial

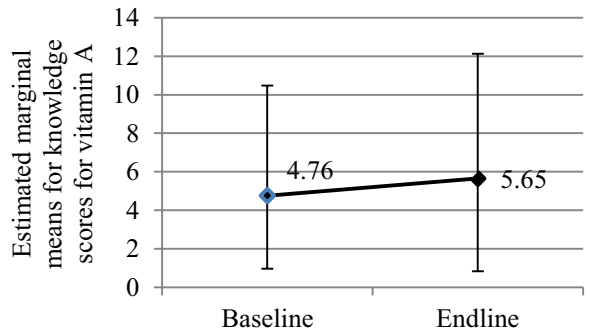

Fig. 1 Estimated marginal means for 5th and 95th confidence interval for knowledge on vitamin A

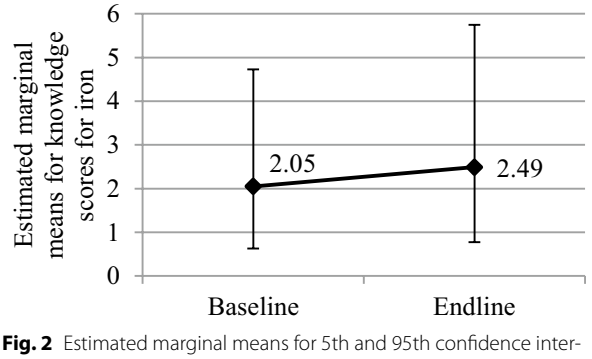

Fig. 2 Estimated marginal means for 5th and 95th confidence interval for knowledge on iron

eta squared = 0.065) and iron ($p = 0.403$ and partial eta squared = 0.022).

When the knowledge scores for each nutrient were observed individually, it was seen that for vitamin A, seventeen respondents improved their scores, sixteen reduced their scores at endline and three respondents did not change their scores. For iron, eleven respondents improved their scores, seven decreased and eighteen respondents scored the same as at baseline. Looking at the components of the scores for each of the nutrients individually, for vitamin A, we see that the number of respondents who had heard about or who knew about vitamin A increased from 29 respondents to 32 respondents. For iron, the number of respondents who had heard about iron was 14 at baseline and this increased to 25 at endline.

Respondents were asked the reason for the importance for both the nutrients, and these were randomly answered, both correct and incorrect, at baseline and at endline. The same was observed for the question related to foods rich in vitamin A and iron.

The knowledge scores were grouped into categories: low, including those respondents with a score of 0–2; medium, those respondents with a score of 3–6 and high, those respondents with a score of 7–8 (Figs. 3, 4). For vitamin A, we see that participants in the middle category showed better improvement as compared with the other two categories. For iron, number of respondents in the low category went down and those in the middle category improved while the high category showed small changes only.

Discussion

The current study assessed the influence of a short nutrition education on the knowledge of women residing in households with home gardens. Most home garden studies have been done in Asia and Africa and among households with low socio-economic status, low education

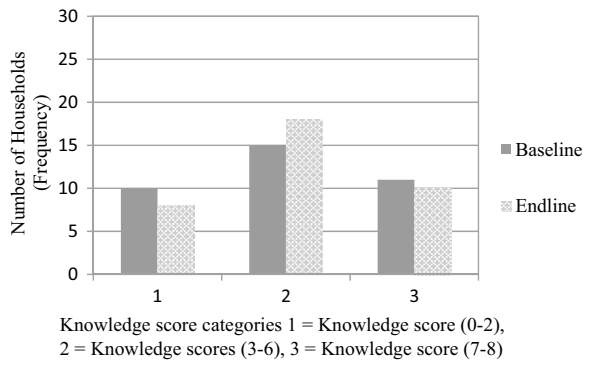

Fig. 3 Knowledge scores of respondents grouped in categories for vitamin A ($N = 36$)

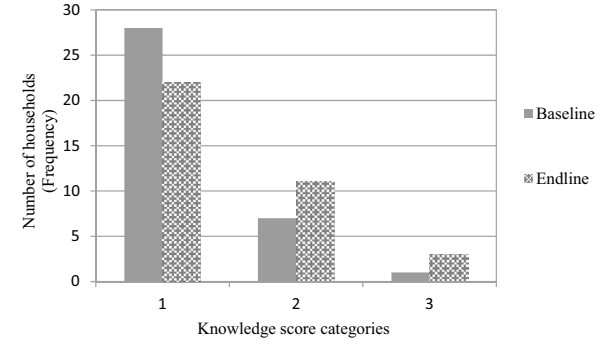

Fig. 4 Knowledge scores of respondents grouped in categories for iron ($N = 36$)

level and living in rural areas [8, 18–22]. Most studies have been done in rural areas, and this study intended to understand whether families with similar characteristics in urban areas could improve their nutrition knowledge via nutrition education sessions. In the long run, an improvement in nutrition knowledge is expected to lead to better nutrition outcomes [8, 23–25].

Home gardens are a crucial part of the household, especially in populations with a high risk of food insecurity. It provides the family with an easy access to fresh vegetables and fruits [17, 26]. The "need to provide vegetables for the household" was the primary motivation for cultivation of a home garden by 55 % of the participants in this study, an observation which is in agreement with other studies [21, 27].

Under poverty conditions in developing countries, the role of women is usually limited to taking care of the household, children and farm; they do not wield much power in purchase decisions. If the home garden contributes to the household's income by selling of the excess produce it can help in alleviating the women's role in the household by enabling them to make decisions on how this income is spent. Research has shown that when women have some control or are able to take part in the decision-making process they tend to use the money to purchase other foods and/or fulfil other household needs and in general invest better in the nutrition, health and well-being of the household as compared to men [1, 22, 23, 28]. A study in Bangladesh showed that home gardens are a source of empowerment for women and the extra income generated by selling the excess produce adds to the household income [24]. Empowering the women with nutrition knowledge will lead them to make better choices and eventually would lead to better nutrition outcomes for household members [1, 23, 29].

Apart from selling the excess produce from the home garden we observed that in some cases the women bartered the home garden produce with other women for vegetables or fruits they did not produce themselves. The basis of this exchange was a preference for greater food diversity. This approach was a cost-effective and resourceful way of increasing variety in the diet and therefore commendable.

In this study, the number of respondents who indicated that vegetable consumption was important increased from four at baseline to eleven at endline, while for fruits this number went from six respondents to ten respondents. When women participate in training programmes and gain better nutrition knowledge, there is an improvement in the nutrition of the household [21, 23, 30–32]. Though the nutrition education in our study did not result in a statistically significant effect on the overall nutrition knowledge scores, there was a tendency towards improvement in some respondents, as observed by the estimated marginal means (Figs. 1, 2). Education level of the respondent and number of nutrition sessions attended did not have any effect on the nutrition knowledge scores. This observation is contrary to the findings of Faber [21] and Osei [33], but the nutrition education in their studies was conducted over a longer period of time. In another study demonstration plots were used which focused mainly on vitamin A-rich plants [32].

The composite nutrition knowledge scores were grouped into categories to understand the changes in scores, and respondents in the medium category, with knowledge scores of 3–6, showed an improvement for both the nutrients (Figs. 3, 4). The knowledge scores, for vitamin A and iron, for each respondent at baseline and endline were compared to ascertain whether a pattern could be detected. There was no clear trend except that the number of respondents with positive scores at endline was higher as compared to baseline. The individual components of the knowledge score for each of the nutrients were further examined detecting an increase in the number of respondents who knew of vitamin A and iron. This increase was more pronounced for iron than for vitamin A, indicating that even at baseline, there was greater awareness of vitamin A as compared to iron. Eventually, this could be attributed to previous programmes and studies focused on vitamin A [6, 21, 32, 34].

Some respondents in the low and high categories for knowledge about vitamin A and iron were found with lower scores at endline. Reasons for that could be "not attending the nutrition education session" or lack of attention. At endline, some respondents were in a hurry to complete the interview as they had either to look after their child or elders at home, or to go to work in a factory or fields. All of these factors could lead to reduction in scores at endline.

The reasons why the respective nutrients are important were inconsistently mentioned, correctly and incorrectly, at baseline and at endline: no clear pattern could be identified. The answers given for foods rich in vitamin A as well as iron were answered more correctly at endline. These results are similar to results from an earlier study in Tanzania [35]. Another study in Tanzania indicated that the mothers considered vegetable and fruit consumption important and the participants could better name foods rich in vitamin A as compared to iron-rich foods (Ludwig C., unpublished data, 2009). Here, the respondents improved their practical knowledge, in terms of being better able to name foods rich in the respective nutrients. This is in accordance with studies which showed that practical nutrition knowledge played a greater role in the nutrition outcomes as compared to the education level of the mother [36, 37].

Along with positive scores, it is also necessary to acknowledge that some respondents decreased their scores while some remained in the same group. Those who answered in negative of knowing vitamin A and iron were given a score of zero, answering the reasons or foods rich in the respective nutrients wrong resulted in negative marking, all of which could have reduced the scores. Some respondents were in a hurry to complete the interview, while some answered randomly or could not remember, all of which could have been factors resulting in negative marking and a decrease in the scores (Additional file 1).

Constraints and recommendations

For several reasons, this study could not apply some of the strengths contributing to the success of nutrition education like the combination of a demonstration home garden plot, monthly nutrition education sessions and child growth monitoring for a longer period of time as done by others [20, 32, 38]. They also employed local nutrition monitors whom the mothers could ask for advice. Studies, by Faber [32] and Laurie [38], focused only on vitamin A-rich vegetables which could also be another factor adding to their strength. In a similar study in Nepal, nutrition education sessions were held monthly but the nutrition education monitors provided additional training to smaller groups of women emphasizing the same information. The reiteration of the same messages helped in retention of knowledge [8]. The review by Berti and colleagues showed that the home gardening components which did not include a nutrition education component were not as successful as those with a nutrition education component [4].

As compared to other studies, a small sample size resulted in reduced power in knowledge scores. Another shortcoming was the lack of a control group. Little is known about the number of nutrition education sessions required to achieve sustained improvements. In our study, we conducted three interactive nutrition education sessions still; we found a tendency towards a positive change of the nutrition knowledge scores. Based on the design of this study the required number of participants would be 300 [39] for showing a statistically significant improvement. For further studies, an adequately calculated sample size and a control group are recommended to overcome the challenges of interpreting our data, as has also been suggested by Webb [29]. Appointing "nutrition monitors" could be a way in which women help to correct and boost each other's nutrition knowledge. These nutrition monitors could be those respondents who have improved their knowledge scores over time and are active in the community. The study also suggests focusing on using locally available foods, especially those from the home garden to enhance understanding and eventually improve nutritional intake and thus nutritional outcomes.

Conclusion

The study assessed the influence of a small-scale and short nutrition education programme on families living in an urban area and having home gardens. We found more positive scores at endline as compared to baseline. The improvement in scores could be due to the interactive learning sessions and the small group size which allowed for more active involvement of participants during the sessions as well as the focus on locally grown vegetables from home gardens. Due to small numbers, the change in the knowledge scores could not be demonstrated as statistically significant.

With all its limitations, this study contributed to a better understanding of facilitating and impeding factors in the improvement of nutrition knowledge. In conclusion, more research on nutrition education with larger groups, more sessions, and a longer intervention and observation period could help to prove its effect on knowledge scores and nutrition outcomes. Ultimately, nutrition education on the benefits from home gardens and their improved vegetable supply should be integrated into continuous programmes of health and nutrition promotion.

Additional file

Additional file 1. Dataset.

Authors' contributions
AP was responsible for the study design, data collection and preparing the manuscript. JK provided field support and assistance in Tanzania during data collection and feedback on the manuscript. MK was the principal investigator and responsible for the overall study design and provided critical feedback on the manuscript. All authors read and approved the final manuscript.

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Competing interests
The authors declare that they have no competing interests.

Availability of supporting data
Please refer Additional file.

Consent for publication
All authors agree and consent for the article to be published.

Ethical approval and consent to participate
Oral informed consent was obtained from each respondent from each of the participating households. Approval to interview the respondents was obtained from the Morogoro Municipality Office, not by an institutional review board, as the study was done in collaboration with Sokoine University of Agriculture and did not include any invasive techniques.

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