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Development and validation of a nutrition training package for rural women farmers in Tanzania: A pilot study

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Abstract
Undernutrition continues to inflict significant social, health and economic consequences in developing countries, Tanzania inclusive. Lack of nutrition knowledge among rural women who are the main caregivers of children and family at large is reflected in the poor nutritional status and compromised health in rural areas. This study aimed to develop and pilot a nutrition training package which is contextually and culturally specific for rural women farmers in Tanzania in order to improve their knowledge, attitudes, skills and practices for positive behaviour change and optimum nutrition practices.
The study was conducted in five villages from the semi-arid Dodoma region in Tanzania. A total sample size of 660 households/ women was involved in the study. The development of nutrition education materials started by conceptualization process, where factors affecting nutrition status were drawn from the baseline information. A set of five target behaviours were prioritized for intervention development. These included: exclusive breastfeeding and complementary feeding, diet diversification, maternal nutrition, food processing at household level and general hygiene. The training materials were in pictorial form to enable even the illiterate ones to be included. Analyses were conducted to compare the baseline with after pilot results.
Results showed that there were statistically significant mean increases in general nutrition knowledge. Dietary diversity and practices improved after the pilot study. There was a clear indication that the training packages were well packed and messages given were getting across and the women could change their practices. All of the participants of the pilot study agreed that the training equipped them with enough information to efficiently incorporate nutrition issues into their future practices. The nutrition education program was found to have improved household nutrition practices in a relatively short time, in particular, nutrition knowledge and food diversity in the piloting group. Future studies may benefit from using this training material to educate rural women farmers. This study is a good starting point for creating a community of women in rural areas that is knowledgeable and with nutrition sensitive practices that will help to prevent undernutrition problems in the future.

Keywords: nutrition knowledge, rural women, farmers, training, pilot

Introduction
In Tanzania, undernutrition is a problem of public health concern. This may be due to poor nutritional practices, low availability of foods rich in micronutrients, poor agricultural practices leading to micronutrient depleted soils and inadequate knowledge about nutrition and food (Burchi, Fanzo, & Frison, 2011) [2]. The consequences of poor nutritional status include reduced work capacity due to growth retardation, impaired cognitive function and immunity, complications in pregnancy leading to poor pregnancy outcome and increased risk of morbidity and mortality mainly in children and women (Caulfield, Richard, Rivera, Musgrove, & Black, 2006). Other problems with respect to the nutrition situation in Tanzania is a big gap between nutritional knowledge and application (Nassanga et al., 2018) [8].
Lack of nutrition knowledge among rural women who are the main caregivers of children and family at large is reflected in the poor nutritional status and compromised health in rural areas (Mbwana et al., 2017; Nassanga et al., 2018) [6, 8]. There is, however, a growing body of literature towards nutrition education interventions to improve dietary intake, nutrition knowledge, attitudes and practices and the methods of nutrition education delivery (Thompson & Amoroso, 2010; Talukder et al., 2010; Schreinemachers, Patalagsa, & Uddin, 2016; Acharya et al., 2017; Nassanga et al., 2018; Khamis et al., 2019) [14, 13, 12, 1, 8, 5]. Nutrition education programmes are usually considered as a good approach for nutrition interventions to improve nutrition knowledge, practices and attitudes, developing nutrition, promoting healthy eating, and improving health and nutritional status.
The aim of this study was to develop and pilot a nutrition training package which is contextually and culturally specific for rural women farmers in Tanzania in order to improve their knowledge, attitudes, skills and practices for positive behaviour change and optimum nutrition practices. The developed training package is in picture form in order to accommodate the rural women who cannot read and write.

Methodology

Description of Study Area

The study was conducted in five villages from the semi-arid Dodoma region in Tanzania.

Food production in Dodoma is predominantly rain fed. Dodoma region receives rainfall in one season with an average of 350-500 mm rainfall per annum. Dodoma is characterized by a prevalence of highly food-insecure areas. Crops produced include cereals (sorghum, pearl millet and maize), roots/tubers (cassava and sweet potato), legumes (cowpea, pigeon pea, bambara nut, groundnut, chickpea, green gram and lablab bean), oil crops (sunflower, sesame, groundnuts) and fruits (pawpaw, guava, mango, grape, lemon and dates). There is also widespread collection of edible wild fruits and vegetables. The food system in Dodoma is mainly based on cereals with pearl millet as the preferred staple. Groundnuts are normally mixed in most relishes that are used with the main dish. Edible wild products, particularly vegetables and fruits, are important in local food menus (Mutabazi, 2013) [7]. The Chamwino district imports food crops from other regions during deficit months. These foods include maize, beans and pigeon pea. During deficit months imported food such as maize and pearl millet is sold at a price more than three times its price during the months of plenty. This is because there are no structured local markets in the study villages, only small grain and pulse traders. The two regions together account for 70–80% of the types of farming system found in Tanzania (Ronner & Giller, 2013) [11].

Sampling and Sample Size for Baseline Study

Multistage stratified sampling procedure was used to select respondents. First, purposive sampling was used to select Dodoma region as one of the regions with highest prevalence of malnutrition in Tanzania (36.9%) while national prevalence is 32% (TDHS, 2018). Due to homogeneity in the number of households between villages, five villages were selected, namely: Mzula, Ilolo, Ndebwe, Mvumi-Makulu and Chalula. Second and third stages were stratified based on the information obtained from village record offices. The third stage involved selection of households that met the study criteria.

The total sample size of 660 households was computed using fisher's formula, with the prevalence of anaemia in rural areas used as a basis for the determination of sample size (Fisher, 1973; Fisher et al., 2002). In the fourth stage, due to less variation in the number of population sizes between the villages, the obtained sample size was equally divided into five villages, which gave an average of 132 households for each village where simple random sampling method was applied to select the required equal number of households in all the villages. The inclusion criteria to participate in the study were; a rural household with a mother or a caregiver and a child aged 24 to 59 months. Households excluded in the study were those which did not have a mother or caregiver or a child of that age. All the eligible households were listed from the village registry and subjected to ENA for SMART software for randomization. This led to the selection of the 660 households from five villages that participated in the study.

Protocol

Permission to conduct the study was obtained from the Sokoine University of Agriculture and from Chamwino District Commissioner's Office. Household heads and spouses were informed of the purpose, objectives and activities of the study by reading to them the information sheet. The participants were required to sign the consent form or apply a thumb print (in ink), marking their consent to participate in the study.

The Baseline Questionnaire

The questionnaire encompassed issues related to norms and values and the general nutrition and dietary practices in the community. Topics covered included the demographic structure, the general living conditions in the community, home gardening, water, sanitation and hygiene, the nutritional and health situation, nutrition knowledge, attitudes and practices, food production, consumption and distribution and local problem perception & community drivers. The questionnaire was administered by face to face to collect the above information.

Anthropometric Measurements

Height and weight were measured and nutritional status of mothers/caregivers and their children was determined. Body Mass Index (BMI) was calculated for adults while weight for age and weight for height were calculated for children. The WHO (2006) guidelines and standards were used to define stunting, underweight, wasting and BMI. Standard methods of taking anthropometric measurements were followed according to Gibson (2005).

Development of Training Materials

The development of nutrition education materials started by conceptualization process, where a network of factors affecting nutrition status was drawn from the baseline information and clear strategic actions were gathered to improve or modify the identified nutrition situations.

A preliminary set of five target behaviours were prioritized for intervention development. These included: exclusive breastfeeding and complementary feeding, diet diversification, maternal nutrition, food processing at household level and general hygiene. Criteria that informed this selection were: the behavior was not widely practiced, there was probability or indication of the relationship between the behavior and child malnutrition based on scientific research, and the potential for changing the behaviour was probable given available local resources. The training materials were in pictorial form to enable even the illiterate ones to be included.

Piloting of the Training Materials

Pilot- testing was conducted to allow for refinement and revision of behavior change strategies and theories of change so as to adjust the training materials developed. Training materials were tested using community participation. After testing and modification of materials, piloting was done using appropriate channels and media of communication of nutrition messages.

Pilot training used a variety of interactive and participatory methods to support learners to explore new concepts, reflect on their confidence with them and explore their real life application. These included: group works; presentations, plenary discussions, case studies. The delivery methods, focus and content were applied based on the experience level of the group and or particular needs in a delivery context with greater emphasis placed on any element as needed. The mode used was participatory approach which included a range of activities enabling farmers to play an active and influential part in decisions of what to include in training manuals.

Five groups from the project villages, total N= 50 were evenly distributed to all the intervention training packages. Training was implemented over three weeks. The principal investigator, three research assistants and village health care workers conducted the training. Fathers and other community members were allowed to participate in the sessions. Two months after the training sessions, a mini survey and focus group discussions were conducted among the participants to grasp the effectiveness of the training materials. A total of 5 pictorial modules covering various aspects of nutrition as a means to overcome the barriers of nutrition literacy were piloted.

Data Analysis

Various software were used to analyze the data collected. The Statistical Product and Service Solution (SPSS) software (IBM SPSS Statistics for windows, Version 21) was used to analyze the collected data. Emergency Nutrition Assessment (ENA) for Standardized Monitoring and Assessment of Relief and Transitions (SMART) 2011 (www.nutrisurvey.de/ena2011/) was used to classify the study children into categories of nutritional status by converting the anthropometric measurements into z-scores. Quantitative data are presented by frequency, percentages, means and standard deviations. Further statistics will be conducted.

Results

Baseline results

A total of 660 women-child pairs were reached during the baseline survey. Mean household size was (5.7 ±1.8). Only 31% of the interviewed women/caregivers could exactly read and write. Other household and women characteristics are presented in Table 1 and Table 2.

Table 1: Household Characteristics

Characteristics	n	%
Status of Interviewee		
Mother	560	84.8
Caregiver	100	15.2
Interviewee position in the HH		
Household head	149	22.6
Wife of HH head	497	75.3
Relative	14	2.1
Household Head sex		
Male	504	76.5
Female	156	23.5
Marital Status of the mother/caregiver		
Married Monogamous	425	64.6
Married Polygamous	63	9.5
Widowed	58	8.7
Divorced	72	10.9
Single	20	3
Co-habitating	22	3.3

Table 2: Women/Caregivers' level of literacy and source of livelihood

Level of literacy of mother/caregiver	n	%
Not able to read or write	285	43
Can read and write to some extent	172	25.9
Can read and write	203	31.1
Education level of respondents		
No formal education	280	42.4
Adult education	14	2.2

Primary school	341	51.6
Some primary school	20	3
Secondary school	4	0.6
Diploma/certificate	1	0.2
Source of livelihood		
Farmer	654	99.1
Employed in informal sector (casual labour)	1	0.2
Business	3	0.4
Self employed	2	0.3

On nutrition knowledge attitudes, perceptions & practices the results indicated that 86% all the surveyed women, had never received nutrition education, and of those 14% who had received nutrition education they got it from RCH clinics. Furthermore about 89% did not know the meaning of balanced diet, and 71% were not aware of food combinations to be taken in order to increase iron absorption and 49.5% did not know the causes of anemia. In addition, 63.8% of households did not use iodized salt for cooking food in their households; the major cited reasons were availability and affordability. On the other hand, about 30% of the caregivers were not aware whether the salt used for daily cooking was iodized or not.

Breastfeeding was a common practice. The majority of the surveyed mothers had ever breastfed (97%) their children and a good proportion of mothers (85%) fed their newborns colostrum, and about 59% of mothers initiated breastfeeding within an hour after giving birth. However, exclusive breastfeeding was minimally practiced; the majority of mothers (79%) reported to not exclusively breastfed their children. About 59% of mothers perceived that breast milk alone was not sufficient for their baby during their first six moth of life. Mothers (41%) reported that they had received support from health workers to initiate breastfeeding.

On food production, consumption and distribution, results indicated that 51% of household heads decided on what crops to be produced in the fields, on the other hand 50% of women reported to have control on what is to be cooked within the household. Availability of food was cited as an important factor for consumption of different food groups in the households, accounting for 70% of the interviewed respondents. In addition about 40% of caregivers reported that adult men are given priority in intra-household food distribution and consumption, followed by children (23%).

Regarding local problem perception & community drivers, results indicated that at household level, 47% of women in all villages reported that access to food was the major challenge, followed by money (26%), water (11%), diseases (10%), land (4%) and conflicts (3%). The magnitude of these challenges differed from one village to another. At community level water was reported as the major problem by 29% followed by conflicts 16%.

Overall, Household Dietary Diversity Scores (HDDS) value for the entire sample was 4.8 (±1.8), indicating that, on average households included 5 food groups in their meal. The lower mean HDDS was found in Ndebwe village 3(±1.1) and the highest HDDS mean was found in Ilolo village 6(± 1.5) and Mvumi-Makulu village 5.7(±1.3). Nearly all (100 percent) households ate cereals during the reference period of 24 hours. The intake of food rich in animal protein (e.g., meat, eggs, milk and milk products) was generally lower for the entire sample, only 4% consumed milk and its products and only 10% consumed meat. Furthermore, consumption of fruits was low in all of the surveyed households, only 22% reported to consume fruits. Vegetables, mostly green leaves, were also widely consumed, with an average of 86% percent of households reporting consumption of leafy vegetables.

Results of the nutrition and health status were as follows:

Height, weight and mid-upper arm circumference (MUAC) were measured and nutritional status of mother-child pairs determined. Body Mass Indexes (BMIs) were calculated for 620 non-pregnant women. Anthropometric indexes for 660 children (24-59 months) were computed using WHO AnthroPlus software to assess their nutrition status. Such indexes include Weight for height (WHZ), Height-for-age (HAZ) and Weight-for-age (WAZ) that indicates wasting, stunting and underweight, respectively.

The overall prevalence of stunting was 33%. Mzula and Ndebwe villages had the highest prevalence of underweight at 13.8% and 13.4% respectively. Mzula village had the highest prevalence of severely underweight children at 3.6%. There were no significant differences in weight and height among children between villages. The prevalence of stunting and severe stunting was highest in Ndebwe at 29% and 8.9% respectively. The overall prevalence of underweight in women was 7%. The prevalence of overweight was 14% and that of obesity was 11.2%.

After pilot results

Results of the Mini Survey and Focus Group Discussions

Table 3 shows an overview of nutrition knowledge. Results showed that there was a statistically significant mean increase in general nutrition knowledge from baseline survey (48.7%±8.74) to post survey (66.3%± 11.27). Therefore, there was a mean increase in knowledge by 17.6% correct answers. Some of the frequently missed questions for the post-pilot were related to the food combinations to be taken to decrease anaemia and alternatives for the animal protein.

Table 3: Nutrition knowledge before and after pilot training

N=50	Correct Score Pre-Training Mean ± SD	Correct Score Post-Training Mean ± SD	Change in Mean Score Mean	t-value
Raw	12.62 ± 2.32	21.44 ± 2.68	8.82	-2.46*
Knowledge Score				
Percent	48.7%±8.74	66.3%± 11.27	17.6%	
Knowledge				

Knowledge on balanced diet increased by 28% during the two periods as more respondents could provide right responses to questions on balanced diet. However, the proportion of participants who did not know about balanced diet was still high at 44% (a decline of 38%). There was a significant increase by 80% in the proportion of participants who could define food groups at the endline survey. McNemar and marginal homogeneity tests indicated that there were significant differences in aspects: receiving nutrition education before, knowledge of foods that increase intake of fibre and knowledge of food groups between the baseline and endline time points ($p<0.05$).

A scale of twelve food groups was used in assessing household dietary diversity (similar foods were combined to form one group). Using information collected from the household dietary diversity questionnaire, the household dietary diversity scores were derived using the FAO guidelines for measuring household and individual dietary diversity (FAO, 2008). Furthermore, household dietary diversity scores were classified into three categories namely; low (<3 food groups), medium (4-5 food groups) and high dietary (≥6 food groups) diversity. At baseline only 31% of households had a high HDDS as compared to 45% at endline (Figure 1). Nutrition status was not assessed due to a short period after the pilot training.

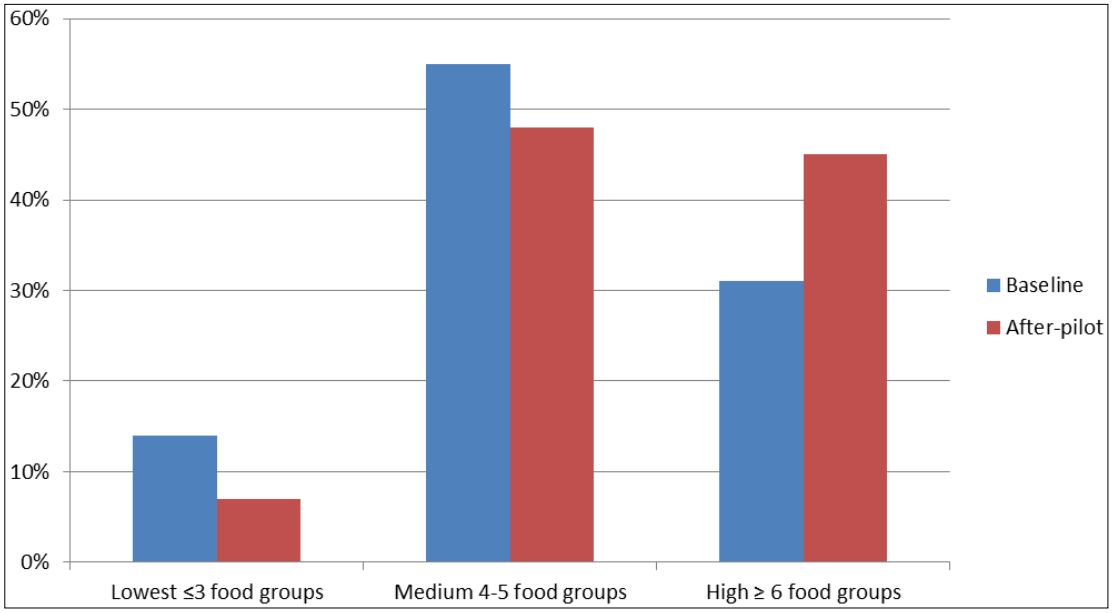

Fig 1: Dietary diversity classification

Discussion

This study aimed to develop a nutrition training package for rural women farmers and pilot testing the initial feasibility and efficacy to increase participants' knowledge and practices about nutrition.

There was a clear indication that the training packages were well packed and messages given were getting across and the women could change their practices. All of the participants of the pilot study agreed that the training equipped them with enough information to efficiently incorporate nutrition issues into their future practices. The nutrition education programme was found to have improved household nutrition practices in a relatively short time, in particular, nutrition knowledge and food diversity in the piloting group.

Results indicated that is feasible to implement a short time training to rural women farmers, and participants were generally satisfied with the training. The pilot succeeded in improving knowledge and self-efficacy related to knowledge and practices on exclusive breastfeeding and complementary feeding, dietary diversity for the whole family, maternal nutrition, food processing at household level and general hygiene.

The increase in knowledge from pre to post pilot measurements supports the hypothesis that the training will help to increase rural women's knowledge and practices on the said aspects. The participants also reported positive satisfaction with the pilot. It is possible that the pilot was shown to be effective at increasing knowledge and practices because the training was concentrated on topics that the participants had little exposure to in their lives thus far.

Reported practices of nutrition were better during the after pilot period as compared to the baseline period. This may indicate that the information supplied during the trainings was maintained by the participants for the whole period until after the pilot time and probably they will implement throughout their lives. Significant improvements in knowledge and practices were found in various aspects of exclusive breastfeeding and complementary feeding, dietary diversity for the whole family, maternal nutrition, food processing at household level and general hygiene. Other studies also reported improvements in knowledge and practices after the implementation of nutrition education and (Cannoosamy, Pem, Bhagwant, and Jeewon, 2016; Pillai, Kinabo, and Krawinkel, 2016) [3, 9]. Comparable results were also reported by Powers, Struempler and Parmer (2005) [10] where people in the nutrition education intervention group revealed significantly better improvement in nutrition knowledge.

Results of the after pilot testing will not be discussed further because it involved few representatives as this study was aimed only to pilot the training packages and adjust them according the interest of the target group.

When asked what changes they would make to the training package, some women participants responded that they think more time is needed to be spent on specific modules and less time on the others. There were others who thought the training should have been focused on other household members as well such as fathers and grandmothers.

Other participants believed that no changes needed to be made to the training package. All participants agreed that the package could be useful for improving nutrition knowledge, attitudes and practices of rural women from the farming communities. They also liked and commanded the interactive activities that were incorporated into each module. On the other hand, the majority of participants believed that there was too much time spent on the training package overall.

Revision of the Training Packages after the Pilot Test

The trainers collected the self-feedback and that from participants regarding the training package and materials including methods of delivery, materials, strengths, and weaknesses; we recorded participant uptake of key messages, addressed knowledge gaps and documented observable and reported behavior change.

Four focus group discussions with mothers (N = 24) assessed participant acceptability of messages and materials, and family participation and engagement in the promoted practices.

The following were recommended and done: Condensed time frame for training, removal of some information from the training package, addition of reflection activities for each topic and re-ordering of the topics.

Conclusion

The pilot succeeded in improving knowledge and practices of the targeted aspects, but some few changes are required to improve the training material for future use. Future studies may benefit from using this training material to educate rural women farmers. This study is a good starting point for creating a community of women in rural areas that is knowledgeable and with nutrition sensitive practices that will help to prevent undernutrition problems in the future.

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Conflict of interest

The authors declare that they have no conflict of interest.

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