



Food-based nutrition counselling and education intervention for improved diets of pregnant women in rural Malawi: a qualitative study of factors influencing dietary behaviour change

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Abstract

Objective: We wanted to identify factors related to dietary behavioural change among impoverished pregnant women in the face of nutrition education and counselling, describing what creates an enabling environment and barriers for dietary change.

Design: We used qualitative data from a cluster-randomised maternal education trial and conducted a thematic analysis using a social ecological framework to describe the factors that influenced dietary adherence.

Setting: Mangochi district in rural Malawi.

Participants: We interviewed ten pregnant women and conducted four sets of focus group discussions with twenty-two significant family members (husbands and mothers-in-law) and twelve counsellors.

Results: The participants' experiences showed that the main barriers of adherence to the intervention were taste, affordability and poverty. The use of powders and one-pot dishes, inclusion of both women and significant family members and a harmonisation with local food practices enabled adherence to the intervention. We found it crucial to focus the dietary education and counselling intervention on locally available ingredients and food processing methods.

Conclusions: Use of contextualised food-based solutions to combat maternal malnutrition was observed to be relatively cheap and sustainable. However, there is need for more research on local foods used as nutrition supplements. We suggest that investments need to be directed not only to nutrition education and counselling but also to the enabling factors that enhance adherence. The original cluster-randomised controlled trial was registered with Clinical trials.gov ID: NCT03136393.

Keywords
Barriers
Behaviour change
Enablers
Malawi
Nutrition
Pregnant women

Maternal nutrition is crucial for pregnancy and infant health. However, high prevalence of undernutrition during pregnancy persists in low- and middle-income countries due to nutrient requirements being unmet, exacerbated by poor dietary quality and household food insecurity⁽¹⁾. Notably, low dietary quality in micronutrients contributes to poor fetal development, increased risk of complications in pregnancy and impaired child development⁽²⁾. One systematic review reported that more than 50 % of dietary studies conducted among women in resource-poor settings in sub-Saharan Africa found dietary inadequacy in multiple

micronutrients⁽³⁾, of which Fe deficiency anaemia and deficiencies of I, folate, vitamin A and Zn were the most common^(2,4,5). Similarly, in Malawi, the Demographic Health Survey published in 2017 indicated that 45 % of pregnant women were anaemic, compared with 33 % of women who were neither pregnant nor breast-feeding⁽⁶⁾. In the rural Mangochi area, we found that the prevalence of micronutrient deficiencies among pregnant women was particularly high, between 90–100 % for vitamin A, folate, riboflavin, Ca and Fe, and 50–80 % for vitamins B₁₂, B₆ and niacin⁽⁷⁾.

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Nutritional education and counselling interventions are strategies often used to improve diets and birth outcomes^(8–10). Nutrition education interventions targeting undernourished populations aim to improve both energy and micronutrient deficiencies, either through use of micronutrient supplements and fortifications^(1,11–13) or through food-based solutions, such as dietary diversification^(14–16). Food-based solutions have a potential of being more sustainable and can prevent micronutrient deficiencies without the risk of adverse micronutrient interactions⁽¹⁷⁾. At the same time, this approach enhances the dietary adequacy of micronutrient intakes for the entire household⁽¹⁸⁾. In Malawi, pregnant women are encouraged to use the national food-based Six Food Group (SFG) dietary guideline, which is the basis for the construction of a food group diversity index/score to assess dietary quality⁽¹⁹⁾. The SFG guideline promotes the consumption of meals that consists of staple (grains and tubers), vegetables, animal/fish food, legumes, fruits and fats⁽¹⁹⁾. This nutrition education package is promoted to pregnant women through the public antenatal care programme, as well as through public radio. Both these platforms convey general nutrition information but entail limited possibilities to guide the women on how they can effectively apply the dietary guidelines. In contrast, community-based approaches to nutrition education can both convey information and guide application.

Most dietary interventions struggle to produce evidence of impact and often encounter implementation difficulties, including poor adherence^(20–24). Previous studies on the efficacies of the various nutrition education interventions implemented in recent years have concentrated primarily on investigating the success of the intervention in relation to how they were implemented, as systematically reviewed by Murimi *et al.*⁽²⁵⁾. Other studies have identified critical factors influencing adherence, ranging from limited availability and accessibility of nutrient dense foods (often due to high cost), unwillingness to consume recommended quantities, distaste for the recommended foods and limited nutritional knowledge and skills in self-management of the proposed diet^(26,27). Dietary behaviours are thus complex and addressing them require critical and holistic approaches, which takes into account socio-cultural factors as well as structural and environmental factors⁽²⁸⁾. A socio-ecological framework enables an analysis of these multiple and interdependent factors⁽²⁹⁾.

We previously conducted a randomised controlled trial (RCT) among pregnant women in rural Malawi to investigate whether dietary counselling and education to increase nutrition knowledge and skills by applying the Malawian SFG dietary guideline could reduce the prevalence of low birth weight infants (primary outcome) and increase dietary diversity score and pregnancy weight gain (secondary outcomes). This study is one of the few nutrition intervention targeting pregnant women as previous research in Malawi has concentrated on dietary practices for young children without any description of implementation effects

regarding adherence^(18,30,31). We here describe the experiences that the pregnant women and their caregivers who participated in the RCT, as well as the counsellors who conducted the nutrition education, had regarding the intervention. The main aim was to identify factors that influenced adherence to the nutritional advice and recommendations given through the intervention. To address this aim, we used a qualitative approach to investigate the experiences with and the perceptions of the participants in this nutritional intervention and to give voices to the women. Their voices would provide valuable insight into the factors influencing food choices in this particular setting, including the barriers and enablers to adhere to dietary advices.

Methods

Study area and recruitment of study participants in the original randomised controlled trial

The original cluster RCT was carried out from January to December 2016 in the Nankumba area in Mangochi, Southern Malawi, an area with a population of about 150 000 whose livelihood is mostly fishing and farming. Mangochi district was chosen as study area due to its many challenges in maternal and child undernutrition. Twenty clusters, defined as villages that did not share common borders with other villages in the study, were eligible for inclusion. The villages were assigned STATA-generated random numbers to allocate them to either the intervention or the control group, generating ten clusters in each study group. The pregnant women from these clusters were identified by the study team in their communities and referred to the nearest designated local health centre where their pregnancy and the gestational age were confirmed.

Consenting pregnant women, being between their 9th and 16th gestational week, both primi- and multiparous, were eligible for inclusion. Moreover, they had to be available during the study period and had to intend to give birth at the health facilities within the study area. Women carrying multiple fetuses and those with severe illnesses were excluded from the study. A more detailed description of the design of the RCT and participant recruitment has recently been published⁽³²⁾.

Components of the nutrition education intervention

Our nutrition intervention was informed by a socio-ecological model described by Contento⁽²⁸⁾, which identifies and systematises complex and interdependent factors (Fig. 1). We specifically focussed on person-related (intra- and interpersonal) and social environmental influence on dietary habits. The intervention activities were nutrition education, cooking demonstrations and home-based counselling. For intrapersonal factors, the interventions aimed at enhancing personal motivation



Fig. 1 Socio-ecological factors that influence food choices and dietary behaviour. Adapted from Contento⁽²⁸⁾. Highlighted in red is the factors we specifically focussed on in our study

and nutrition skills. Counsellors educated the pregnant women about benefits of good nutrition for mother and child health and demonstrated how to make diversified meals according to the SFG guideline. The women were also encouraged to adhere to scheduled antenatal care and take Fe tablets. For interpersonal factors, the intervention also targeted significant family members (husbands and mothers-in-law). As no food subsidies were provided, the home-based nutrition counselling and follow-ups aimed to motivate the women and their families to adhere to the recommended dietary guidelines on their own initiatives. Addressing social and environmental factors, the intervention aimed to use recipes with ingredient and methods that enhanced accessibility and affordability.

We performed linear programming development analyses of dietary intakes of pregnant women in the area to identify dietary deficiencies and propose recipe formulation and combinations of affordable and accessible local foods that yield optimum dietary quality of micronutrients⁽³³⁾. The routine dietary intake in this setting included a thick porridge (*Nsima*), made from maize (the main staple), and eaten with relish from one or two food groups. This meal would comprise only two to three food groups of the required six. The most common main meal combination from the upland area of Mangochi was *Nsima* taken with only vegetables, whereas in the lakeshore area it was taken with fish. Legumes, such as beans and peas, were rarely consumed. Their diet thus lacked mainly vegetables, animal foods, legumes and fat, which informed our choice of the main ingredients of the recipes, namely powder supplements made from dried anchovies (*Bonyia*), groundnuts (*Nsinjiro*) and vegetables (particularly dried *moringa* tree leaves). We utilised the Maternal, Infant, and Young Child recipe book with some

adaptations, to develop recipes that would include up to five food groups in one meal⁽³⁴⁾. The sixth group was from seasonal and indigenous fruits (mangoes, *Masuku* (wild loquat), bananas). Importantly, the recipes were prepared as a one-pot dish, also called multi-mix methods of cooking. We had recipes for main meals and snacks or breakfast. For the main meal, the recipes suggested *Nsima* taken with either multi-mix vegetables, beans or fish as relish. Powder seasoning to the relish ensured consumption of adequate nutrients and was as follows: (i) multi-mix vegetables were prepared by adding four tablespoons of *Nsinjiro* (groundnuts) and two tablespoons of fish powders to be added to a pot of vegetables (enough for five people); (ii) multi-mix fish, a teaspoon of *Moringa* powder was added to a pot of fresh fish and *Moringa* powder together with *Nsinjiro* was added to dried fish (enough for five people); and (iii) multi-mix beans were prepared by adding a teaspoon of *Moringa* and two tablespoons of fish or some pieces of meat (enough for five people). The porridge recipe constituted a cup of maize meal plus two tablespoons of *Nsinjiro*, one tablespoon of anchovy powder and one teaspoon of *Moringa* powder. For all the recipes, the amounts of *Nsinjiro* and fish powders added were more than the recommendation of 15 g, while vegetable powder (from *Moringa* leaves) was less due to its bitter taste. However, dried *Moringa* leaves have a greater concentration of nutrients⁽³⁵⁾. Anchovies are a good source of Ca, Fe and Zn, while groundnuts are a good source of proteins and fats. *Moringa* leaves are a good source of protein, vitamin B₂, vitamin B₆, vitamin C, Fe, vitamin A, Mg, fibre, antioxidants and β -carotene⁽³⁵⁾.

The food preparation practices that we promoted, such as use of powder supplements and food processing that maintained bioavailability of nutrients, were harmonised



with cultural practices (local food practices, food beliefs and preferences). For example, in Mangochi, the use of *Nsinjiro* to flavour vegetables, porridge and fish was a common practice and we used this as a starting point when building the new recipes that included fish and vegetable powders. Some strategies to maintain bioavailability of nutrients were adapted from local practice. Whole maize grains were soaked and allowed to sprout before making maize meal, which was slightly different from the local practice which entailed that the maize is de-hauled, soaked and milled. We introduced new methods for processing of *Moringa* powder and preparation of beans to ensure bioavailability of the nutrients: *Moringa* leaves were dried under shade and pounded to powder, while beans were soaked in water over night before cooking. To facilitate adherence to these practices, we conducted Trials of Improved Practices, which is a methodology utilised to test the acceptability of the proposed practices among a comparable group of pregnant women in a non-study area before rolling out the intervention⁽³⁶⁾. Well-trained female counsellors from the same community utilised standard intervention guidelines to facilitate the implementation of the intervention.

Study participants in the qualitative study

This qualitative study employed a descriptive design, aiming to maintain flexibility and local sensibility in the data collection process⁽³⁷⁾. We included forty-four participants. Ten pregnant women from the intervention arm of the original RCT from three of the ten villages were purposively selected and aimed to attain maximum variation in the sample (age, number of births and marital status), as well as geographical differences and levels of adherence to the intervention guidelines (as reported by the counsellors). Twenty-two of the most significant family members to the women (husbands and mothers-in-law) were recruited from the same three intervention communities. Moreover, we included twelve female counsellors who had conducted the educational trainings and who had some influence in their local communities.

Data collection

We collected data for 2 months before the intervention ended. The main data collection strategies were structured, individual in-depth interviews (IDI) and focus group discussions (FGD). In addition, we included observational data recorded by the local team members during the intervention. Two separate, structured interview guides were prepared by the research team to facilitate the IDI and the FGD. These guides were developed using findings from a literature review, advice from the first author (who is a trained Malawian nurse/midwife) and information obtained through informal discussions with pregnant mothers in neighbouring communities. The IDI guides were piloted

on five pregnant women (not participating in this study) and adjusted for relevance and clarity. We used IDI as the main data collection strategy among the ten pregnant women participating, given the study's focus on the women's experiences. The FGD comprised six to twelve people and were utilised to gather data among the caregivers and counsellors. Both the IDI and FGD lasted 30–60 min and were carried out in the participants' homes or in local primary schools in close proximity. We used the field notes recorded during the weekly home visits by the counsellors to assess each participant's level of adherence. The IDI/FGD thematic guides are shown in Table 1.

Data analysis

Interviews were done and transcriptions written in Chichewa, the local language in the area, and translated to English. We conducted a thematic analysis with strong emphasis on a contextual understanding, inspired by a socio-ecological model illustrated in Fig. 1, exploring intra-personal, interpersonal and socio-environmental factors levels and depicting how the intervention addressed these overarching factors that influence food choices and dietary behaviour^(37,38). Each transcript was read several times to obtain an overall sense of its content, paying specific attention to patterns that occurred. Data extracts, which are concepts collected from all the data sources, were coded in order to create categories for more efficient analysis. We used semantic themes, that is, the initial themes on insight into participants' experiences, and also latent themes, that is, interpretive, assumptions and conceptualisation expanding the semantic presentations. The essential themes of each interview were combined, condensed and refined into main categories and final themes. These themes were further consistently interrogated with specific purpose of the study which were to identify barriers and enablers to adherence to the intervention.

Results

Characteristics of the study participants

Most of the ten pregnant women (aged 20–36 years) were married, had completed primary school and were poor. The period of exposure to the intervention ranged from 10 to 18 weeks, but a majority had received individualised counselling for a longer time. Group nutrition education and cooking demonstrations were conducted every month, targeting newly recruited participants, but also to mentor those already recruited. The significant family members were mostly elderly mothers-in-law living in the same compound as their daughter-in-law and son, and less often husbands. The husbands participating were young (aged 25–28 years) and expecting their first child. The counsellors (35 years and above) were mostly married women with

Table 1 The individual in-depth interviews' and focus group discussions' guides

Data collection strategy	Research question	Theme from the interview guide	Main interview questions
IDI (pregnant women)	To what extent, was the nutrition education, understood and acted upon? What are the challenges being encountered and to what extent were you able to navigate them?	General understanding regarding experiences with the proposed nutrition recommendations, dietary practices, perceptions and behaviour To pin down enablers and facilitators for behaviour change processes	<ul style="list-style-type: none"> • What have been your experiences with the proposed dietary recommendations? • Describe your usual dietary habits/recommendations • What do you think of the recommendation promoted? • What was your experience with sustenance of the dietary guidelines
FGD (caregivers/counsellors)	What factors influenced the women's adherence to the recommended dietary guidelines?	Experience with maintaining the new dietary practices	<ul style="list-style-type: none"> • What kind of support did you offer to enable the woman/women, adopt the recommended dietary practices? • How did the women sustain the practices? • What made it easier or difficult to apply the recommendations? • Are there any other ways we could make the recommendations easier to apply?

IDI, in-depth interview; FGD, focus group discussion.

children and had a background as volunteers in health care provision in the community.

Participants' experiences, perceptions and behaviour change (processes)

The intervention promoted consumption of dietary diversity, either through the more traditional approach, which includes preparation of single foods, or as 'one-pot meals' including five of the six food groups in the SFG guideline, except fruit, were included. Six of the ten women changed their eating and cooking practices in accordance with 'one-pot meals' approach, while the remaining four continued to utilise the traditional approach. We found that efforts to consume a diverse diet, to alter food choices and methods of preparation, changed with a stronger awareness of the importance of good nutrition during pregnancy. The woman's reflections about her learning process show that the intervention was influential in enhancing food choices:

'Before this exposure I was just eating as I wished when pregnant – the times that I didn't feel like eating, I would spend the whole day without eating a proper meal. But after learning, I eat with caution nutritious foods and more frequently. In times when I don't feel like eating, I still force myself to eat'. (Woman 9)

These changes also applied to situations with economic constraints:

'Before we were exposed to the intervention, when we had money we only aimed at buying any type of food, but after exposure we started buying the required nutritious food'. (Woman 8)

The intervention also enhanced skills in preparation of nutritious foods:

'Before being exposed to the intervention I was preparing my food using the traditional ways, but now I apply multi-mix food preparation methods to ensure that the food is more nutritious'. (Woman 4)

The intervention enabled the women to consume five servings of diversified diet (according to SFG guideline) in a day and utilised SFG guideline also to plan and assess their daily consumption in detail:

'To ensure that I take six food groups in a day I would make sure I consume different food groups from morning to evening. In the morning I would go for multi-mix porridge, I could add fish powder – that means I have made two groups. I would then take a fruit – then that's three groups in the morning. That means I have three food groups which are staple, animal food and fruits. Having done this, I would then plan to ensure that I got the remaining three which are legumes, vegetables, and fats. I would add beans at lunch - that's legumes, and take vegetables at dinner, and the cooking oil used in preparing the relish makes the sixth group'. (Woman 8)

Through observation, we found that daily consumption according to the SFG guideline and extra servings of food was more feasible if the women used powder supplements in a one-pot dish. The women who opted for the traditional food preparation methods had diets that were less diversified and they consumed fewer servings of food per day. One of these women described her daily food intake as follows:



'In the morning porridge I added ground nut powder. At lunch and dinner I would take *Nsima* which was usually served with soya meat, but most of the time it was served with vegetables only. I usually eat, like three times a day. I would very rarely eat five servings per day, I also managed to eat fruits as they were in season and also snacks like scones and sweet potatoes'. (Woman 2)

The preferred recipes were those that included the local porridge, beans and vegetables. Porridge was mostly consumed for breakfast or as a morning and/or evening snack. The seasonal indigenous fruits were easily available most of the time. Information from the field notes showed that adherence to the intervention recommendations was more likely among the educated women, those who were exposed to the intervention for more than 12 weeks and those who took part in more than one cooking demonstration session and individualised counselling.

Barriers and enablers to adherence

The counsellors expressed that levels of adherence among the women varied; while some women followed the SFG guideline from the beginning to the end of the intervention, others only changed behaviour after multiple follow-ups. Some of the women simply refrained from tasting the food prepared through the multi-mix method, while others reported to have tried but did not sustain the practice. The major themes from our analysis were grouped into intrapersonal, interpersonal and socio-environmental factors, as indicated in Table 2.

Intrapersonal factors

The experiences shared with us and the observation we made indicate that personal motivation and capabilities (nutrition skills and affordability) influenced adoption of the proposed dietary habits. The women's replies during the interviews show that the nutrition education using visual aids was effective in communicating that the proposed dietary guidelines would ensure birth of a healthy baby. These visual aids also served to strengthen the awareness of the importance of good nutrition during pregnancy and motivated behaviour change, for both women and significant family members:

'The health worker showed us a picture of a malnourished baby. When I saw the picture I was scared and opted to improve my diet'. (Woman 10)

'I had to support her to ensure that she would give birth to a healthy child'. (Family member 3)

The use of powder as seasoning and one-pot dishes was presumed to be more economical, as each meal used only small amounts of anchovies, groundnuts and vegetables compared with taking individual pieces of each of these food items:

'I thought you needed all the six food groups in one meal, and also I thought that animal food group were only meat products, hence that it was expensive'. (Woman 3)

'The multi-mix preparation of meals was very welcome as it really made the eating of six food groups easy, but sourcing each group in one meal would be expensive'. (Counsellor 6)

We observed poor skills in processing maize which implied weak adherences to the recommendation of consuming maize meal made from sprouted maize for *Nsima*. The counsellors expressed that maize was usually over-fermented and this altered both flavour and smell of the flour:

'Most women were oversoaking the maize hence the fermenting smell was strong, and that is what put off other family members from sharing the food'. (Counsellor 3)

It was thus imperative that women were able to prepare the meals in a way that could preserve good flavour. This counsellor's statement indicates that the intervention process was sufficiently flexible to accommodate the participants' varied learning capabilities and interests:

'Some of the women could not master food processing and needed more home visits and even more individualized demonstration at home'. (Counsellor 5)

A close follow-up was also used to motivate the women who were reluctant to sustain the practices, referred to by the counsellors as 'difficult' women:

"I had three difficult women, I continued following them up. However, their levels of adherences was fluctuating – sometimes doing well – sometimes backsliding. Finally, two of them improved, but one did not'. (Counsellor 12)

Interpersonal factors

Internal household dynamics, including economy and interpersonal relations, were important factors for adherence. The levels of income in the household were crucial for food availability. The few women who had a stable income because their husbands had a secure business or employment experienced less pressure on mobilising the required food ingredients. The women who were not married and those whose husbands were involved in temporary, precarious, often day-to-day labour ('piece work') struggled to sustain a diverse diet:

'My husband did not engage much in piece work and we had problems in sourcing all food stuffs, in a week we could skip the main meal for two days'. (Woman 5)

Being able to sustain the practices depended upon support from a husband and mother-in-law. It was clear that some husbands needed persuasion often offered by the mothers-in-law:

**Table 2** Barriers and enablers for following the nutrition guidelines for pregnant women in Malawi

Level of influence	Themes	Codes	Related quotations	
			Barriers	Enablers
Intrapersonal	Personal motivation	Health benefits		<p>'The women were taking the food regardless of the smell'. (Counsellor 3)</p> <p>'I had to maintain my diet so that I can have a healthy child; even my baby was born healthy'. (Woman 4)</p> <p>'As for me I did not like her food but, I just kept encouraging her to be eating it'. (Family member 3)</p>
		Palatability of the food	<p>'The other family members were put off from sharing her food other because of the fermentation smell'. (Counsellor 8)</p> <p>'At first the whole family was taking but with time, the husband and children did not like the smell of the food'. (Counsellor 11)</p>	
		Close follow-up	<p>'Sometimes the women were just lazy to cook even when food was available'. (Care giver 1)</p> <p>'Yes, I had one whom I even gave up, before I gave up I kept visiting her even giving her the ingredients, when they run out she never made any effort to attempt to make it on her own. I even tried to involve the husband and her grandmother but to no avail'. (Counsellor 8)</p>	<p>'I had three difficult women, I continued following them up, I also was giving them the ingredients like fish and vegetables powder where possible, however, their levels of adherences was fluctuating sometimes doing well sometimes backsliding, finally two of them improved but one did not'. (Counsellor 12)</p>
	Personal capability	Nutrition skills	<p>'Most women were oversoaking the maize hence the fermenting smell was strong'. (Counsellor 3)</p>	<p>'Just hearing about these recommendations, was not enough to make you able follow the eating practice. But knowing how to prepare it is very important as you can easily practice at home'. (Participant 10)</p> <p>'Some of the women would master food processing following the initial cooking demonstration'. (Counsellor 2)</p> <p>'They needed more home visits and cooking demonstration to help them perfect processing of the ingredients and recipes'. (Counsellor 3)</p> <p>'The multi-mix preparation of meals was very welcome as it really made the eating of six food groups easy, sourcing each group differently would be expensive'. (Counsellor 11)</p> <p>'I thought you needed all the six food groups in one meal, and also I thought animal food group was only meat products, hence that was expensive'. (Woman 3)</p>
		Affordability	<p>'We have heard about diverse foods but it was not easy for us to afford the 6 food groups'. (Caregiver 1)</p> <p>'The local health worker was teaching about how to eat a diverse diet but I was eating what was available'. (Woman 7)</p>	
Intrapersonal	Availability of food resources	Access to financial resources	<p>'My husband did not engage much in piece work and we had problems in sourcing all food stuffs, in a week we could skip the main meal for two days'. (Woman 5)</p>	<p>'My husband had a job, hence his salary was supporting us that I had no problems with sourcing foodstuff'. (Woman 6)</p> <p>'Food situation was not a challenge because my husband has a stable business'. (Woman 9)</p> <p>'We moulded bricks after the sales we budgeted the money hence we had money to buy all our requirements, we work together and agree in how to spend the money'. (Woman 9).</p> <p>'We used to do day-to-day, labour together to get money for her nutrition requirements'. (Family member 2)</p>
		Women involvement in resource mobilisation		<p>'When he gets the money we would prioritize buying the required foods'. (Woman 4)</p> <p>'My wife was also helping, when we hardly found resources, she could use the food wisely not wasting. She was also buying some things when she had some money'. (Family member 1)</p>
		Women ensured prioritisation of money on healthier diet	<p>'When my husband had money we could only buy resources for tea, rice and sugar, when I have money I would buy Maize, beans and vegetables'. (Woman 2)</p>	

Table 2 *Continued*

Level of influence	Themes	Codes	Related quotations	
			Barriers	Enablers
	Family support	Advocacy for nutrition needs of the pregnant women Direct support	'When our household food situation was critical; there was nothing even for me as a pregnant woman'. (Woman 5) 'My husband and my mother-in-law were not really ensuring that I ate healthy rather they were just providing for the whole family'. (Woman 6) 'We strive to just have family meals not necessarily what I need as a pregnant woman'. (Woman 2)	'We were making sure that the pregnant women is served and the whole family would understand'. (Family member 2) 'My son thought his wife was taking advantage of her pregnancy state to make unnecessary demands. Before, were not sensitized about these guidelines and we really thought the wife was making it up'. (Family member 3) 'Sometimes her husband was reluctant to provide for their needs so I would advocate for them'. (Family member 1) 'I would make porridge in the morning, and encourage her to be eating'. (Family member 1) 'She was eating little so we were encouraging her to eat more'. (Family member 3) 'I used to cook porridge for them, was also asking their husband to buy fruits for them'. (Family member 2)
Sociocultural determinants	Local practices and food culture	Harmonisation of dietary practices and food processing	'The traditional way was to use shelled maize. But soaking un shelled maize is old fashion'. (Family member 3)	'Porridge recipe was applicable to me as it was already my routine food in the morning'. (Woman 8) 'As for the vegetables and beans recipes, the whole family was taking very well'. (Counsellor 1)

'My son thought his wife was taking advantage of her pregnancy to make unnecessary demands. Before, we were not sensitized about these guidelines and we really thought the wife was making it up'. (Family member 2)

In addition, the mothers-in-law were also often engaged in practical support and encouragement:

'We were making sure that the pregnant woman is served and the whole family would understand'. (Family member 1)

'I would make porridge in the morning, and encourage her to be eating'. (Family member 1)

Engaging significant family members with intervention activities enhanced the overall household nutrition knowledge and improved food choice during shopping. The limited financial resources were thus mostly used on buying the required nutritious foods:

'When he gets money we would prioritize buying the required nutritious foods'. (Woman 4)

Women used the limited financial resources on less costly but more nutritious food:

'When my husband have money we could only buy tea, rice and sugar, when I have money I would buy maize, beans and vegetables'. (Woman 2)

Furthermore, we observed that participation in financial resource mobilisation empowered women to participate

in allocation of household finances, including prioritise purchasing of the recommended food resources:

'We moulded bricks for sale, after the sales we budgeted the money so that we had money to buy all our requirements. We work together and agree in how to spend the money'. (Woman 9)

Socio-environmental level factors

We found that the harmonisation and adaptation of the interventions to local food practices and culture clearly was an important factor for adoption. The use of powder supplements in the recipe for beans and fish was an extension of the local practice of using groundnut powder as single food seasoning in porridge, vegetables or fish. We observed that the recipe for porridge was the most convenient and yielded high adoption, due to its resonance to already existing practices:

'The porridge recipe was acceptable as it is already a routine food in the morning'. (Counsellor 10)

The participating women observed that use of powder supplements was very convenient as they addressed the prevailing dietary inadequacies:

'Families do not normally combine many food groups in one meal, like having Nsima with beans alone. As such, adding vegetable and fish powders to the beans would represent the vegetable and animal food groups, and thus optimizing the meal from two food groups to five food groups'. (Counsellor 7)



Processing of maize flour required about 3 d. In these poor households, where people lived on daily incomes from piece work, they could only afford to purchase maize in small amounts (5 kg) at a time. The participants expressed that processing maize flour was not sustained as it required more time to process and this could not conveniently fit in the local food procurement culture:

'Many people were buying maize only when the flour was readymade, hence there was no time to wait for soaking. Besides, it was the men who were buying this maize. After they have done their piece work they could buy the maize and just get it milled since the maize was sold next to the maize mill'. (Counsellor 9)

We also observed that utilisation of processed maize flour in multiple dishes (Nsima, porridge and snacks) created demand for frequent processing which was observed to be labourious and inconvenient for households. Thus, its use was restricted to porridge recipe, this consequently enhanced its sustainable utilisation:

'When I started promoting one-pot dish of porridge only as a supplementary meal for pregnant women – many women sustained taking porridge made from processed maize flour'. (Counsellor 7)

The families adopted preparation of maize flour for use in porridge and maintained their usual practices for family meals:

'We used to buy two tins (10 kg) of maize and she could take half of one tin to make soaked maize'. (Family member 1)

Sustainability of the proposed dietary practices was also influenced by poverty. We utilised the tradition of communal work to mobilise processing of the ingredients. Women contributed money and labour to procure and process powders of groundnuts, fish and vegetable for the purpose of cooking demonstrations and shared the leftovers. The counsellors expressed that this approach promoted the spirit of sharing:

'All had utilised the ingredients, but most of them did not sustain production, so we started sharing leftover ingredients from the cooking demonstration'. (Counsellor 3)

'Some women would not manage to make the ingredients timely, hence I would make the ingredients for them'. (Counsellor 5)

Discussion

This qualitative study provided valuable information regarding the study participants' experiences of the dietary counselling and education intervention which used local food-based solutions to provide adequate energy, protein,

vitamins and minerals requirements for the pregnant women. Primarily, we aimed to describe the process of dietary change occurring as a result of the intervention⁽³²⁾, and the barriers and enablers for such changes, as expressed by the participants. This endeavour was also an attempt to bring the women's voices more to the fore of nutritional intervention studies.

In our RCT, we utilised nutrition education, dietary counselling and cooking demonstrations to promote recipes that were guided by the Malawian Six Food Group dietary guideline. These recipes provided the women with the opportunity to consume foods from a broad range of foods available in the local context. Our intervention targeted complex socio-ecological factors that influence dietary habits through initiatives that enhanced intrapersonal, interpersonal and socio-environmental factors for adoption of the proposed diet⁽²⁸⁾.

Person-related determinants were our key intervention targets (Fig. 1). We aimed to empower the women with nutrition knowledge and skills as they are responsible for processing and preparing food for their households. Consistent with other studies, adequate nutrition skills and perceptions that the intervention was affordable were key determinants for one's conception of sense of control over dietary intake^(28,36). Use of powder supplements made from nutrient-rich local foods offered a cheap alternative for attaining a diversified diet and ensured efficient utilisation of small, available household financial resources. Home-based interventions also targeted women's social relationships' network that included their husbands who supported through provision of financial resources and mothers-in-law who provided advocacy and direct support. Targeting the immediate family was essential as food choices and eating patterns are influenced by the need to negotiate with others in the family about what to buy or eat^(28,39). Consequently, improved nutrition perception, knowledge and skills among the women together with their social network influenced household healthy food choice and availability. However, adherence to family meals was limited due to poor flavours and taste associated with inadequate skills in food processing and cooking. Increase in nutrition awareness motivated the pregnant women to focus more on the healthy benefits of the diet so that distaste seemed not to affect their adherence⁽²⁰⁾. Frequent follow-up and repeated demonstrations (more than the planned scheduled) were required to have competencies in food processing and cooking. Our findings show increased awareness among the households and that pregnant women's nutrition needs were important. Most families prioritised to provide nutritious food for the pregnant women, as opposed to the common inequalities in household food distribution with men enjoying preferential food treatment⁽⁴⁰⁾. Changing priorities was particularly clear in the cases where women contributed to financial resource mobilisation.

Our results show that the intervention's success was a result of effectively harmonisation to local food culture.



A solid socio-cultural analysis of the proposed dietary practices to understand its acceptability and desirability was enabled by the strong Malawian research team. This local expertise ensured a more ethical and citizen-oriented approach⁽⁴¹⁾. The Trials of Improved Practices' methodology worked well to enable a close engagement with available local foods and preferences⁽³⁶⁾. This process allowed for an effective harmonisation of interventions with local practices in a way that could create minimum social pressure for adoption to accept inclusion of new food elements. This strong anchoring of interventions to local foods and eating habits aligned to the evidence that the intervention's sensitivity to these social and cultural context was crucial for adherence^(26,27).

Evidence has shown the value of using food-based solutions to correct micronutrient deficiencies if the proposed food combinations can be consumed sustainably and in adequate amounts^(7,16,20). The process of developing the recipes for this intervention was informed by linear programming based on local foods which ensured the right nutrient combination theoretically. However, like in other nutrition solutions based on local foods, we experienced inconsistency in selection and consumption of the proposed food combinations due to stock outs of the ingredients (processed maize flour and powder supplements)^(20,42). Learning and executing new skills promoted in this intervention, which included use of processed maize flour and powder supplements as ingredients in multiple dishes (porridge, snack and main meal), would require both additional time and costs, thus adding to their capacity as barriers, especially among food insecure household^(28,36). Promoting multiple recipes coupled with the relative financial and time constraints associated with production of ingredients corresponds to commonly reported barriers that are related to ease of access and availability of healthier diets⁽²⁷⁾. Of these ingredients, only *Nsinjiro* was available on the local market and was sustainably utilised. Having the rest of the ingredients on the local market at a reasonable price could address both financial and time constraints. Bava *et al.* and others argue that intervention activities should ensure a trade-off between preferred practices and the related constraints to ensure convenience to minimise time and cognitive effort^(28,43). Implying that few and focused interventions are usually effective, utilisation of the porridge recipe as a single intervention was observed to be attainable and provided adequate diversity of supplementary foods. The porridge recipe was the most convenient and diversified meal, as it accommodated five food groups and was consumed as breakfast as well as a morning or afternoon snack. Sustainability of the practices was also enforced with use of social mobilisation, like communal sourcing and production of the ingredients as opposed to giving out subsidies⁽⁴²⁾. This approach motivated also the women who initially were resistant to process their own foods but also shielded the poor households.

A strength of our study is that the data are obtained from a robustly designed RCT. The current qualitative study provides insights on how local factors, including social-cultural and economic factors, can influence adherence. Limitations of the study include lack of detailed data on religious and cultural beliefs that could impact on dietary intakes. We also lack data on biomarkers of nutrient intakes.

Conclusion

In conclusion, this dietary counselling and education intervention influenced household healthy food choices and availability amidst compelling economic challenges. Utilisation of powder supplements demonstrated the intervention's sensitivity to the local setting and the realities of life for the participants and their communities. We noted that targeting socio-ecological factors including direct efforts towards motivation to learn and change and also support from direct family members created an enabling environment for dietary changes to take place. We suggest that investments need to be directed not only to interventions but also to the creation of enabling factors that enhance adherence. There is a need for more research on potential use of the locally produced powder mixes as micronutrient supplements in Malawi specifically, and in low- and middle-income countries more broadly.

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