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Food habits and beliefs about *Moringa oleifera* among South African student mothers: a qualitative study

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Abstract – The problems of malnutrition constitute a major challenge in South Africa, particularly affecting the underprivileged populations of the Eastern Cape and Limpopo provinces. The present study aimed to gain an understanding of how to improve the nutritional intake of South African university student mothers and their children by the introduction of *Moringa oleifera* in their food. Focus Group Discussion was implemented at two previously historically disadvantaged universities with predominantly black student populations, namely the University of Fort Hare and the University of Limpopo. Findings from the participants' discussion about food habits and barriers to healthy eating show that there is a gap between healthy eating knowledge and eating habits. Despite the high level of awareness of the importance of nutritional intake, most of the study participants and their children consume less healthy foods. Due to the high cost of healthy food and their limited income, student mothers face substantial financial constraints when trying to make healthy changes in their food habits. Moreover, student mothers' positive beliefs about the nutritional benefits of Moringa are insufficient to encourage its consumption. Finally, student mothers agree about using Moringa as a nutritional supplement. Maize porridge (*pap*) appears to be the preferred staple food for Moringa supplementation because of its palatability, satiating power, availability, affordability, and ease of preparation.

Keywords: *Moringa oleifera* / South Africa / focus group / food habits / student mothers

Résumé – Habitudes alimentaires et croyances sur le *Moringa oleifera* chez les étudiantes-mères sud-africaines : une étude qualitative. Les problèmes de malnutrition constituent un défi majeur en Afrique du Sud, touchant particulièrement les populations défavorisées des provinces du Cap-oriental et du Limpopo. La présente étude vise à comprendre comment améliorer l'apport nutritionnel des étudiantes-mères sud-africaines et de leurs enfants par l'introduction de *Moringa oleifera* dans leur alimentation. Des groupes de discussion ont été mis en place dans deux universités historiquement défavorisées, avec une population étudiante noire prédominante, l'Université de Fort Hare et l'Université du Limpopo. Les résultats des discussions des participantes sur les habitudes alimentaires et les obstacles à une alimentation saine ont montré qu'il existe un décalage entre les connaissances en matière d'alimentation saine et leurs habitudes alimentaires. Malgré un niveau élevé de sensibilisation à l'importance des apports nutritionnels, la plupart des participantes et leurs enfants consomment des aliments peu sains. Le coût élevé des aliments bons pour la santé, comparé au faible revenu de la plupart des participantes, montre que les moyens financiers sont l'un des facteurs les plus importants qui empêchent les mères de changer leurs habitudes alimentaires. En outre, les croyances positives exprimées par les participantes sur les avantages nutritionnels du Moringa ne sont pas suffisantes pour promouvoir sa consommation. Enfin, les étudiantes-mères sont d'accord pour ajouter le Moringa comme complément nutritionnel. La bouillie de maïs (*pap*) semble être l'aliment de base préféré pour la supplémentation en Moringa en raison de sa palatabilité, de son pouvoir rassasiant, de sa disponibilité, de son prix abordable et de sa facilité de préparation.

Mots clés : *Moringa oleifera* / Afrique du Sud / groupes de discussion / habitudes alimentaires / étudiantes-mères

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1 Introduction

South Africa faces the double burden of malnutrition: undernutrition and overweight among children and mothers. Specifically, 27% of children under five years are stunted and 13% are overweight (UNICEF, 2019). Many women are also exposed to what has become known as "hidden hunger" which is the lack, or inadequate intake, of micronutrients, resulting in different deficiencies, such as iron, vitamin A and zinc (FAO, 2018).

The relatively high prevalence of malnutrition among children and their mothers indicates that despite the country being food and nutrition secure at a national level, food insecurity still exists, especially in the poorest provinces such as the Eastern Cape and Limpopo Province (STATS SA, 2017). The coexistence of child undernutrition and mother overnutrition in the same households was documented by Bradshaw *et al.* (2007). Factors such as accessibility, affordability, and quality of available foods are part of the reasons behind this phenomenon. According to Modjadji and Madiba (2019), the consumption of energy-dense foods might explain child undernutrition and mother overnutrition as this type of food leads to overweight/obesity among the mothers but does not provide adequate nutriments to children, thus leading to undernutrition.

Improving the nutritional status of a particular group requires an understanding of the factors that determine their food choices. Much research has been conducted on food choice determinants in western countries. The classical models proposed in the literature (Gains, 1994; Shepherd and Raats, 1996; Sijtsema *et al.*, 2002) highlight three classes of factors: factors linked to the food product (sensory attributes and anticipated physiological consequences), factors linked to the individual (personality trait, mood, sensitivity), and factors linked to the economic and social environment (costs, availability, social pressure). However, the extent to which these factors affect children and mothers' food choices in South Africa has not received much attention (Modjadji and Madiba, 2019).

Mothers of young children have a primary influence and control over the food their children eat and have access to. Their role is fundamental in promoting a healthy lifestyle and behavior in children (Scaglioni *et al.*, 2011). Ideally, health, food security, nutrition, and sensory preferences mostly guide mothers' food choices for children (Russell *et al.*, 2015; Jeong and Kim, 2020), but in reality, many other factors can influence these choices such as parents' level of education, socio-economic position, accessibility to healthy foods (Swinburn *et al.*, 2011; Machín *et al.*, 2016).

The objective of this study was to understand, *via* Focus Group Discussion (FGD), the link between food choice criteria and healthy eating behavior to gain an understanding of how to improve the nutritional intake of South African university student mothers and their children. We were also interested in the mothers' opinion on and belief in the potential of the introduction of *Moringa oleifera* (MO) into their diet. MO is a plant known for its powerful nutritional qualities (Fahey, 2005; Moyo *et al.*, 2011; Saini *et al.*, 2016). The leaves are a good protein source, containing between 22% and 34% of proteins (Sánchez-Machado *et al.*, 2010; Mune *et al.*, 2016) and present a high percentage of proteins digestibility, between 64% and 75% (Benhammouche *et al.*, 2020; Hedhili *et al.*, 2021). Previous studies on African food such as maize porridge, *mahewu*, supplemented with MO leaves have shown an increase in the number of proteins and minerals such as calcium and iron (Olusanya *et al.*, 2020; Ntila *et al.*, 2020). Moreover, since its introduction as a cultivated crop in the Limpopo province, MO has been a growing interest from farmers, researchers and government on various aspects such as its morphology, chemistry, growing conditions, production, processing and utilization (Mabapa *et al.*, 2017; Mashamaite *et al.*, 2021). In addition, interest in MO consumption in food among South Africans is expected to rise (Mashamaite *et al.*, 2021).

2 Materials and methods

2.1 Participants

A total of 19 black South-African student mothers participated in the study. Eleven of the participants were from the University of Fort Hare (UFH) while 8 were from the University of Limpopo (UL). Recruitment was carried out through a screening questionnaire. The conditions for participation were to be a registered female student in the 2019 academic year, to have given birth to at least one child, and to be above 18 years old.

Most participants were enrolled in a bachelor program in the field of Agriculture. The monthly income of most participants was above 1000 Rand/month (USD 64 in 2019) (Tab. 1). Eleven participants were in the 20–25 age range and the majority of them had a single child. From the screening questionnaire, all participants declared being interested (7) or trying (12) to move toward a healthier diet; 12 declared to know *Moringa oleifera*, and 9 to have already used it. The main difference between the two universities was in terms of knowledge of MO: more participants declared knowing and using MO in UL than in UFH. Participants' incomes were higher in UL than in UFH. Participants in UL were also younger and in higher grades than those in UFH.

2.2 Procedure

The Focus Group Discussion procedure followed Morgan (1998) recommendations. The FGD were held in September 2019 with two FGD in each university following the same procedures and moderator guide. Each session lasted for about 90 minutes. The discussions were moderated by an experienced moderator and two assistants in English language. Before starting the discussion, participants were informed that the FGD would be audio recorded and that pictures would be taken. It was however emphasized that the information collected would be used only within the framework of academic research and that the participants would remain anonymous. They were asked to complete an informed consent form. The ethical approval for this study was obtained from the University of Fort Hare.

Table 1. Characteristics of the 19 participants (in percentage).
Tableau . *Caractéristiques des 19 participantes (en pourcentage).*

Age	%	**Education level**	%
18–24	37	College/Secondary school	42,
25–35	47	Graduate	16
36–45	16	Post-graduate	42
Heard about Moringa	%	**Used Moringa**	%
Yes	63	Yes	47
No	37	No	53
Number of children	%	**Student monthly income level**	%
1	79	R 500–R 1000 (USD 32–64)	26
2	16	R 1001–R 2000 (USD 64–127)	42
3	05	> R 2000 (> USD 127)	32

2.3 Moderator guide

A first version of the moderator guide was written and pre-tested at the UFH with a first FGD including five participants from the same population as for the final FGD. After a rapid analysis of this first FGD, the moderator guide was simplified to allow a better understanding and more interactive discussions. The final moderator guide (see in Supplementary Material) included six sections:

2.3.1 Section1: Background and introduction

Participants were encouraged to participate actively in the discussion. They were told that the discussion concerned their own ideas and that there were neither right nor wrong answers. Participants briefly introduced themselves by mentioning their course and year of study, number and age of children and then talked about their favorite food to break the ice.

2.3.2 Section 2: Food choice criteria

To understand food drivers, we first asked participants to write on post-it papers the reasons why they choose the foods they eat frequently and the reasons behind the foods they feed their children frequently. The moderator collected the post-it notes and pasted them on a whiteboard by themes. The different themes that emerged from the exercise were then discussed separately for mother and child.

2.3.3 Section 3: Staple foods

Participants were then asked to mention at least three staple foods that they and their children eat frequently. A discussion was carried out on what they think of the nutritional benefits of these staple foods.

2.3.4 Section 4: Food habits and health

To access the link between food habits and health, participants were first asked to explain how they think the way they eat is related to their health. Then, they were later asked to indicate the food they think can be mixed with their favorite food to make it a nutritious meal. The discussion was then focused on leafy vegetables.

2.3.5 Section 5: Healthy eating habits

To focus on participants' healthy eating habits, a free association task in which participants were asked to indicate what comes to their mind when they were prompted with the term eating healthy was used. After discussing the terms that came to their minds, participants were asked to list the things that: 1) keeps them and their children from making changes in their eating habits, 2) could help them change their and their children's eating habits, 3) they would need to learn to eat healthier.

2.3.6 Section 6: Moringa benefits

To initiate discussion on MO benefits, participants were given a message aiming at encouraging people to eat MO (Supplementary Material, Sect. 6). They were asked what they think about this message, what are the values of the different nutritional benefits of MO to them. After that, participants were asked to list things that can keep them from, and things that can help them and their children eating MO supplemented food products.

2.4 Data analysis

The audio-recorded discussions of all FGDs were fully transcribed. Three researchers independently analyzed each transcription using notes taken by the assistants to supplement the tape recordings. The results were then compared and adjusted after consensus had been reached.

3 Results and discussion

3.1 Food choice criteria

We performed a thematic analysis of the reasons given by the participants to explain their own food choices and the food choices they make for their children. For mothers' reasons, six meta-themes were identified while only three were identified for children. Among the meta-themes, two were common to mothers and children: *health issues* and *hedonic dimension*. The meta-themes health issue was further divided into three themes: *health*, *energy* and *nutrition* which were all discussed for both mothers and children. The other meta-themes were either specific of

mother (weight issues, purchase constraint, food preparation and satisfaction) or children (growth and weight).

3.1.1 Food choice criteria common to mothers and children

3.1.1.1 Health

Participants consistently mentioned that health is the most important reason that determines their food choices and the food choices of their children. A majority of participants referred to vegetable as an important representative of healthy food: "*I have to have vegetables in my house for me and for the children's health*"; "*I like cooking healthy food for my children like vegetables.*" Exceptionally, some participants were not very concerned about health: "*I can eat vegetables for the fun of it not because I am considering my health. So, food is not a big deal for me.*"

Nevertheless, these student mothers consider "health" more important for their children than for themselves: "*my child's health is priority.*" All mothers confirmed that ensuring a healthy life for their children is their responsibility. They explained that they try to anchor healthy eating habits in their children: "*My son, when he was 2–3 years, started to have cognitive memory [...] I decided to look at a healthy way to change what he was eating [...] I had to make him understand why his lunch was not the same with other kids.*"

In this discussion, participants also mentioned some consequences of unhealthy eating habits like consuming "junk foods". There was a consensus that "*diseases are the results of what we consume daily*". A participant said: "*I prefer to eat healthy so that I don't want to get sick.*" Children also can suffer from diseases when foods are not healthy and this can lead to problems of "*malnutrition*", "*obesity*" and "*constipation*". This link between unhealthy food habit and diseases confirms that malnutrition is still a serious problem and eating habits the most important cause.

3.1.1.2 Energy

Another frequently mentioned reason for food choices of mothers and children was energy. For mothers "*it is important to eat foods that give energy*" because energy affects "*mood*" and it is necessary "*when you want to do something like study*". Mothers said: "*Some of the foods contain minerals, proteins, carbohydrates and all those things they go back to energy.*" Eating energetic food is also important for children where they find "*energy to play and to do other things*". In addition, energetic behavior of kids indicates their health status: "*When your child is not playing or not active [...] you are able to identify [...] that your child is sick.*"

3.1.1.3 Nutrition and nutrients

Participants recognized that nutrition is an important reason determining food choices of mothers and children. A mother said: "*when you are consuming food you have to know what you are going to gain as nutrition.*" Some foods have benefits such as "*anti-oxidant*", "*vitamins*" and "*minerals*" and provide less risk to get certain diseases. Participants also underlined that what you eat should be "*balanced*" which is defined by certain participants by "*a good combination of both protein and starch in one meal.*" Negative effects of some nutrients like fat were also evoked in this discussion. Fatty food, oils and junk foods were described as unhealthy food.

3.1.1.4 Hedonic dimension

Pleasure was an important reason that influenced food choices of both mothers and children. Participants indicated that sometimes they wanted to buy food "*not because they are hungry*" but just simply because they "*just feel like feeding their craving*". Some participants "*feel comfortable to eat things that they like which leads to satisfaction.*" For children, pleasure is a very important reason that guides their appetite and mothers try to provide foods they like to their kids. One mother said: "*I also feed him food that he prefers because if he does not like it, he will just go outside and throw it away.*"

3.1.2 Food choice criteria specific to mothers

3.1.2.1 Weight

For some mothers, weight is a serious driver of food choices and two opposite profiles were observed: some mothers want to gain weight and others on the contrary want to lose weight. For mothers who want to gain weight, it is complicated to find healthy foods, which at the same time are high in calories. A participant explained: "*I want to gain weight and the food that helps gain weight is junk food which is not healthy; so I don't really know how to juggle between eating healthy and gaining weight.*" For mothers who want to lose weight, the food that they eat does not help them to achieve their objective. A participant explained: "*I made a decision that I'm going to eat the right foods [...] but when I start eating them I become so hungry that I end not focusing on my decision*"; "*I want to be slim but when I eat vegetables I don't like the taste, I'm not full and I don't get the energy so that is why I end up eating food that is not healthy.*"

3.1.2.2 Purchase constraint

The three reasons given by mothers to explain purchase constraints were affordability, availability and price, as in most low-income population (Burns *et al.*, 2013). To find foods with good quality and affordable price is not easy. Checking and comparing prices is a common habit among our participants. A mother said: "*Affordability is also something I consider [...] I like buying things when they are on special and sale.*" Availability of food is also mentioned as one of the reasons influencing participants' daily food choices. Some mothers explained that they "*do not buy something that they will not get in the market next time*".

3.1.2.3 Food preparation

Because our participants are student mothers, they prefer foods that are easy to prepare and do not take a lot of time to be ready. A participant said: "*I do not want to spend my time preparing food hence I do not like food because it takes time to prepare.*"

3.1.2.4 Satisfaction

Some participants mentioned other reasons linked to satisfaction such as "to be full" and "to be satisfied". The satiating power is an important element determining the food

choices in low-income population (Burns *et al.*, 2013). Stress was also mentioned as a driver of food choice: "*Sometimes, I just consume food to avoid stress. Whenever I am stressed, I consume more food.*"

3.1.3 Criteria specific to children: growth and weight

Almost all participants agreed that growth and weight are important reasons determining the food they feed to their children. For children, "*growth is measured by weight*" and for mothers, weight of their children is a critical point. A participant explained: "*when I took him (the child) to the clinic for check-ups, his weight, this was a big challenge because he was struggling to pick up weight.*" In addition, some children needed "*supplemented food*" if they had a developmental delay. A mother said: "S*ome foods that we give to small kids are Purity and Cerelac, and some of these foods have folic acid and iron [...] that can help the child to grow healthy.*"

3.2 Staple foods eaten by mothers and their children

The main South African staple foods mentioned by participants are *pap* (porridge made from coarsely ground maize), rice, *samp* (made with corn kernels and beans), and maize meal. Almost all staple foods are the same for mothers and children, except for some infants that are fed with Cerelac and infant formula. According to the participants, the most important nutritional components of these staple foods were "*the high amount of starch and carbohydrates*", so these foods "*give energy*" and help children to "*grow*". However, there was a consensus that the South African staple foods were "*very low in nutrients*", they just "*contain starch and are usually cooked with salt and oil*". To sum up, student mothers are conscious that the local staple foods are not very balanced and do not contain all nutritional compounds. They just eat them to "*find energy*" and "*get satisfaction*".

Mushaphi *et al.* (2015) report that maize porridge contributes significantly to the dietary intake of 81 percent of the households in Limpopo province. One explanation is that these foods are affordable for this population (between *R 7 (USD 0.5) and R 12 (USD 0.8/kg*) and available in large amounts in the market.

3.2.1 What is the link between food habits and health?

There is a consensus between participants about the existence of a link between food habits and health. Participants said: "*your body is the mirror of what you eat*"; "*you are the result of what you eat because your body reacts.*" The most important point discussed on health was disease. Participants confirmed that the principal cause of diseases and illness was food habits: "*I get sick when I eat a lot of oil and fatty food*"; "*a lot of sugar causes diabetes.*" In addition, they mentioned that the quantity of food eaten could affect health: "*eating everyday carbohydrates food or* samp *or meat, this worries me because too much of everything causes problems.*"

Almost all participants underlined a link between weight and food habits whereby local meals were one of the causes of overweight: "*The food we eat also impacts our bodies by adding body mass*"; "*Since my goal is to lose weight but I don't eat food that will help me lose weight, I end up being fat.*"

Participants recognized that eating healthy foods like fruits and vegetables, eating a balanced meal, and avoiding junk food is a good way of preventing illness.

3.2.2 What foods could be mixed with favorite foods to make them nutritious?

When asked about ingredients that can be added to favorite foods to make them more nutritious, participants mentioned fruits (apple, banana), vegetables (carrot, cabbage, green peas, green beans, broccoli, ginger), and some herbs like parsley and rosemary. Some participants agreed that preference should be considered when adding ingredients to make healthy foods. For example, for children, foods should be "*sweety, smoothie and crunchy*" to be accepted by children because children just "*eat what they prefer*".

The taste was also an important dimension that was discussed by participants. Two profiles of participants emerged from the discussion. Some mothers weighed more nutritional value than taste and indicated they could eat healthy foods even when the food is not palatable: "*You can add herbs like parsley, I think maybe* Moringa *to your* samp *so that it will give it more nutrients, not because it tastes nice.*" Other participants explained that taste is very important in order to accept food: "*They say that* Moringa *is good for your health, I have tasted it, and that thing tastes... ah ah ah ah... horrible.*"

Some participants again used the term affordability when speaking about the ingredients that could be added to improve the nutritional quality of their foods. A participant said: "*because of affordability: there are things that I would love to eat such as almonds and pecan nuts, so if I have money I would add those to my diet.*"

Leafy vegetables were not mentioned spontaneously by participants as ingredients to add to their food to make it more nutritious. When prompted by the moderator, participants suggested many leafy vegetables like "*spinach, lettuce, cabbage, carrot leaves, mustard leaves, parsley, celery, mint*". However, none of the participants mentioned Moringa as a leafy vegetable.

3.3 Respondents' healthy eating habits

"Balanced diet" was the most frequently cited term when participants were asked "*When I say eating healthy what comes to your mind?*". Participants described a balanced meal as a diversity of foods with a variety of nutrients: "*in your plate, you have healthy fat, protein, carbohydrates, and healthy spices.*" In addition, they added that it could be useful to follow a periodic table to balance meals: "*I think vegetables take the biggest part, then came protein, and the least think is carbohydrates.*" To sum up, the common understanding of eating healthy is "*eating the right amount of food at a right time*".

Participants also underlined that eating fruits and vegetables constitutes a healthy eating habit: "*most cancer articles say that you should eat a lot of vegetables to be in good health.*" The term "*healthy diet*" was also frequently evoked. Participants agreed that it is necessary to avoid foods that have a negative impact on health: "*before I eat I do my own research. I go to the internet and search the health benefits of the food I want to eat, why do I have to eat it.*" Most of the participants mentioned that eating healthy is equal to "*being*

away from junk food, limiting fat intake and drinking a lot of water." For some participants, healthy food also means food with bad taste.

3.3.1 What are the barriers that prevent mothers and their children from changing their eating habits?

The most important factor that prevents mothers from changing their food habits and the food habits of their children is "finances". The same word was expressed similarly by "*money*", "*lack of money*", "*cost*", "*low-income*" and "*prices*". The expensive prices of some healthy foods like vegetables make it difficult to buy them. Participants said: "*I eat a lot of vegetables, veggies don't last and are expensive.*"

In addition to the high cost of vegetables, especially fresh ones, participants also mention that the "perishability" of fresh vegetables and fruits can cause a barrier to consuming healthy foods. Along with perishability, availability was also discussed. Participants gave the example of some fruits or vegetables like cauliflower, which are not available in shops, and "*to find them, you have to travel to towns*". The same barriers along with poor fruit and vegetable quality (taste/freshness) were discussed in a focus group study in four US states (Rolnick *et al.*, 2009).

For children, preference sometimes can be a barrier. Participants mentioned that it is important to give children what they like to eat even if it is not healthy. They explained: "*The other thing could be that the child doesn't like vegetables and that means you will have to opt for what they eat as opposed to what you would prefer them to eat*"; "*if you know that your kid likes this you should just go stick to it so that it can be easy for you to feed them and they will consume it without giving you trouble.*"

Finally, habits appear to be one of the main barriers to switching to healthy eating like "*having bad habits*" (eating late at night), being "*lazy*" to prepare food, and "*eating junk food*". Despite the knowledge of the harmful effects of consuming junk food (high in fat, causing gaining weight), some participants cannot avoid eating it because of craving for its taste and its capacity to satisfy hunger. A focus group study of healthy eating knowledge, practices, and barriers among adult and adolescent immigrants in the United States confirmed that the most important barriers were taste and cravings, easy access to junk food, cultural foods, and traditions, time, and finances (Tiedje *et al.*, 2014).

3.3.2 What are things that could help mothers and their children change their eating habits?

Almost all participants agreed that getting "*more income*" and being "*financially independent*" were the most important factors that will help them to change their eating habits and eat healthy. Participants explained: "*If I get more income I would change the way I am eating because I would be able to afford to buy the kind of food that seems to be expensive for me.*"

The second most important factor discussed by participants was to "*get more knowledge*". Participants explained that there is a "*lack of knowledge*" about the nutritional benefits of some foods and about how to prepare some foods: "*We don't understand the nutritional benefits, we just buy*"; "*some foods lose their nutrients when they are overcooked.*" Therefore, it is interesting "*to take time to learn about health and the food you eat.*" In line with this idea, some participants draw attention to the nutritional benefits of some foods and the ability to trust this. They explained: "*We have been scammed so many times that we no longer trust people when they tell us certain things work.*"

To have the encouragement to change their eating habits, some participants mentioned that they need help from other people. This help can be from, a "*person with whom you live*", or a "*professional*" or "*awareness campaign*". For professionals, participants spoke about dietitians and we found two opposing points of view. Some participants thought that eating guidelines can help a lot: "*I go to a dietitian and they give me eating plan according to my blood group so I know what is right and not right for my body.*" Other participants related professional dietitians to expensive costs: "*Going to professional dietitians is expensive so it takes us back to finances. Using dietitians from campus does not help much because they give a general diet plan.*" One of the main issues linked to this idea of encouragement is the lack of motivation. For some participants the motivation to change eating habits should come from outside: "*I need a partner to keep me in check with what I eat.*" For some other participants: "*Motivation should come from the inside because when that person is not around, then it's not going to work for you.*"

3.4 Opinions towards Moringa benefits

The message provided to the participants to understand their attitude towards Moringa benefits yielded an interesting discussion. Some participants mentioned that they have never heard of MO benefits at all: "*to be honest, this is the first time I recognize the benefits of Moringa*"; "*I do not know about the benefits of Moringa so for what has been read, I think it is important that we use it*". Almost all participants agreed to use MO in order to derive these benefits: "*if what they say about Moringa is true, then we should definitely use it.*"

The link between eating MO and solving health problems was also discussed. Participants confirmed that there are many diseases for which MO can be a solution and consider using it as a food supplement. Participants said: "*As for me I would use it as a food supplement because I am really afraid of cancer and other diseases and the food that we eat contributes to diseases.*" Some participants felt concerned as they could relate to the diseases mentioned in the message: "*I think this Moringa is good because it can prevent the disease I have which is asthma.*"

This discussion led participants to speak about the uses of MO. For participants from UFH, just one mother had tasted MO previously, but she stopped eating it because of its unpalatable taste. On the other hand, some participants from UL mentioned that MO was cultivated in their homes and specifically consumed by parents and grandparents. Participants gave examples of a real experience of consumption of MO and its impact on health: "*My mother suffers from high blood pressure [...]. She started using Moringa and now she is fine.*" This discussion suggests that in Limpopo province where MO is better known, it is perceived more as a medicine than a food, especially by the older generation. Participants prefer to eat it as a food supplement than to incorporate it into their meals.

3.4.1 What are the barriers to eating Moringa and Moringa supplemented food products?

The most important thing that keeps participants from eating MO and MO supplemented foods is the lack of knowledge about this plant and its benefits: "*for me, it's a lack of knowledge, I did not know about it*"; "*We need more knowledge about Moringa, we do not know is it a powder, or is it a tree, or is it a pill.*" In addition, MO was not suggested as an example of a leafy vegetable by participants because of a lack of knowledge. Participants said: "*Moringa is new*"; "*I do not know it*"; "*I have a bit of idea about Moringa I heard that it cures arthritis, cancer*"; "*I do not even know if they consume it as a powder but that's what I have heard.*"

The taste was also often mentioned. Participants who already tasted MO did not like its taste: "*It does not taste nice*"; "*I tried to use it as anti-asthma and I did not like it so I stopped using it*"; "*it's bitter*". However, after knowing about the nutritional benefits of MO through this FGD, some participants wanted to try to use it in another way in order to improve the taste. Their problem, however, was the lack of information on "*how to prepare it*".

Finally, some participants discussed their lack of trust in MO benefits and they linked this information to marketing. Participants said: "*The benefits of Moringa are the same as the medicines and this information is used to do marketing [...] so I'm not really wowed by what they are saying.*" Participants also mentioned that MO can be expensive and this makes it difficult to afford: "*The price tag on it might also make people not want to try it because some people sell a cup-size leaves at R 100 (USD 6.5).*" Availability was also a problem: "*Where do I get those products, are they sold around*?"

3.4.2 What are the things that help eating Moringa and Moringa supplemented food products?

Participants mentioned that getting more knowledge about MO specifically "*where to find it, the cost, how much to take a per dose, how to prepare it*" was necessary to help them eat it. Another important dimension was the necessity to be confronted with concrete cases and "*visual results*" about the positive effects of MO: "*If I get some people that said I eat Moringa and this happens to me [...] I will consider it, but right now, I have a lot of questions about it.*" This idea was more discussed among participants from UFH because of the lack of experience with MO consumption. In addition, participants suggested that the taste should be improved: "*I think if it is added to yoghurt and not overshadow the taste of yoghurt it will be fine.*" Furthermore, participants underlined the importance of developing "*an educational program or awareness campaign or seminars*" in order to ensure that people know more about MO benefits. However, these methods can be inaccessible to all South-African social categories: "*It's easy to share the information amongst academics but then how do we take the information to the villages? People in the health sector may be of help with the awareness.*"

3.4.3 Which arguments could be used to convince people to eat Moringa and Moringa supplemented food products?

In order to convince people to eat MO and MO supplemented foods, participants suggested telling people about the health benefits of MO. Another way to convince people was to explain that by eating MO they could possibly save money: "*If you buy just Moringa you can minimize spending money for buying a lot of things like anti-bacterial products [...] and supplemented products.*"

Some participants mentioned that to convince someone to consume MO you need to have a good background about MO including its uses and benefits. On the contrary, some participants agreed that it is not achievable to convince people about something if you do not use it. Therefore, only MO consumers can play this role.

4 Conclusion

In this study, we gained an understanding of how to improve the consumption of nutritional food among low-income university student mothers and their children in South Africa. First, the understanding of the food choices criteria of our target population confirms that factors such as health, food price, affordability, satiating power, and income have an important impact on their food behavior. Secondly, after understanding the eating habit of participants, as well as the barriers to their healthy eating habits, the evolving discussion among participants showed that there exists a gap between healthy eating knowledge and eating habits. Although they are fully aware of the importance of eating healthy food and the problems associated with malnutrition, most of the student mothers prefer to give their children the food they like even if these foods are not healthy. Low income and expensive cost of healthy foods also explain the difficulty of these mothers to change their food habits and food habits of their children's. Finally, our findings show that the beliefs on the nutritional benefits of *Moringa oleifera* are not a sufficient factor for ensuring MO consumption. Student mothers are not opposed to adding MO as a nutritional supplement to their diet as long as the supplemented foods are palatable, available in the market, and easy to prepare. Maize porridge (*pap*) appeared as an ideal staple food to be enriched because of its palatability, satiating power, availability, affordability, and ease of preparation.

5 Limitations of the study

It is important to note that this study has some limitations. This study sets to understand the food habits and beliefs about MO among black African students with children. Hence, findings from this study reflect this specific population and may not be generalizable to other women/mothers in Eastern Cape and Limpopo provinces and other provinces in South Africa. Moreover, the focus group discussion methodology adopted for the study is a qualitative methodology that allows understanding of food habits and beliefs based on group interactions among participants. Our participants being students, their nutritional knowledge may be higher than that of other low-income populations and thus our results cannot be extrapolated to all low-income populations.

Supplementary Material

Supplementary Material. Moderator's topic guide.
The Supplementary Material is available at http://www.bsgf.fr/10.1051/cagri/2022020/olm.

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