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GROWING ORANGE-FLESHED SWEET POTATOES IN MORTHERN MOZAMBIQUE FOR DIETARY DIVERSITY AND PRO-VITAMIN A INTAKE IN RURAL HOUSEHOLDS.

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Abstract. Dietary diversity is a measure to determine food access and consumption in a household, and when triangulated with other information it gives a holistic picture of the state of food security and nutrition in the community or over a wide area. The study aimed to know the sweet potato production level and dietary diversity of the rural populations of Nampula and Zambezia provinces, northern and central Mozambique. In general, data from the study showed that 17% of farmers grow white and orange-fleshed sweet potatoes. From a nutritional perspective, the study revealed that about 65% of rural households in Nampula and Zambezia consume sweet potatoes in their daily meals. Data to assess the knowledge and perception of rural households about the importance of sweet potatoes in the diet indicates that 66% of respondents consider it as a healthier food, especially the orange-fleshed varieties, due to the presence of pro-vitamin A content. Data analysis per district to determine the diet adequacy for children under five years of age indicated that, on average, 68% of children in Alto Molocuè, Gurué and Murrupula have poor dietary diversity.

Key words: dietary diversity, growing, nutrition, orange-fleshed sweetpotato, rural households.

CULTIVO DE BATATA DOCE DE POLPA ALARANJDA NO NORTE DE MOÇAMBIQUE EM PROL DA DIVERSIDADE

ALIMENTAR E INGESTÃO DE PRO-VITAMINA A EM FAMÍLIAS RURAIS

Resumo. Diversidade alimentar é uma medida que determina o consumo e acesso de alimentos em um agregado familiar, podendo esta, ser triangulada com outras informações. Esta, fornece de forma holística, uma imagem de segurança alimentar e nutricional comunitária ou área territorial mais extensa. A pesquisa tinha como objectivo, conhecer os níveis de produção da batata doce e da diversidade alimentar em populações rurais de Nampula e Zambézia, norte e centro de Moçambique. No geral, apenas 17% da população da área de estudo produz batata doce de polpas alaranjada e branca. Em termos de consumo, o estudo encontrou nos seis distritos de Nampula e Zambézia 65% de consumidores de batata doce. Dados de avaliação do conhecimento e a percepção sobre a importância da batata doce na dieta indicam que, 66% de entrevistados consideram-na um alimento saudável, especialmente, variedades de polpa alaranja, pois ela é rica em pró-vitamina A. A análise de dados por distrito para determinar a adequação da dieta em crianças menores de cinco anos indicou que, em média, 68% das crianças de Alto Molocuè, Gurué e Murrupula têm uma diversidade de dieta deficiente.

Palavras-Chave: cultivo, batata-doce de polpa alaranjada, diversidade alimentar, famílias rurais, pro-vitamina A.

Introduction

Dietary diversity is known as an indicator of a household's food consumption and access, which can be triangulated with other information. This provides a holistic picture of food and nutrition security in a community or wider territorial area. In Mozambique, diet quality is still a problem, especially in the central and northern regions of the country, where micronutrient intake is quite poor. The levels of vitamin A and iron deficiency are quite high.

The provinces of Cabo Delgado, Nampula and Zambézia have anemia rates in children above the national average, with the latter having the highest prevalence (79%). The national average for chronic malnutrition in Mozambique has fallen in the last ten years, from 43% to 38%, but the provinces of Nampula and Zambézia still have higher levels, between 46.7% and 44.6% respectively [(3)]. The prevalence of vitamin A deficiency in children under five also remains high in the country, with Nampula being the index province (55%) [(1)].

Food consumption at household level (FA) is poorest in the northern region of Mozambique (Cabo Delgado, Nampula and Niassa and Zambézia) and even better in the central and southern provinces of the country [(3)], which reinforces the need to invest in nutrition in the northern provinces of the country.

Nutrition is a key indicator of an individual's development and refers to how the body processes and uses food [(3)]. It also relates to health, habits, customs and healthy eating practices. The alteration of an individual's nutritional status, whether due to food deprivation or micronutrient deficiency, is generally known as malnutrition. In nutritional terms, pregnant and breastfeeding women and children under the age of five should be the groups that receive the most attention [(4)].

A mother who is not well-nourished during pregnancy may give birth to a child with a low birth weight (<2.5 kg), which could have major repercussions for the newborn, as this will be reflected in infant mortality, since children who are born undernourished have a high risk of morbidity and mortality due to greater exposure to common childhood diseases. Those that survive become ill and may grow poorly.

Children without access to adequate nutrition are not always sick, but they may not reach their potential for physical and mental growth [5]. Climate change contributes to changes in the nutritional status and diet of a population, as it has a negative impact on food security. Generally speaking, the negative impact is limited to the outbreak of diseases, water insecurity, poor environmental sanitation, poor livelihoods, parents' attention to children, handicapping people's ability to adapt or mitigate them [6]. The sweet potato has shown itself to be an appropriate crop in the face of climate change, because in cases of drought, it easily adapts due to its low water demand and this makes it play an important role, acting as a source of subsistence during periods of hunger and food shortages [7].

This crop is one of the staple foods in Mozambique, and can be found in practically every farming system in the country. Along with cereals and legumes (peanuts and beans), sweet potatoes are among the main products that make up the basic diet of Mozambicans [8]. In addition to its greater acceptance due to its taste, it is used almost in its entirety, boiled, roasted, stewed, fried, in puree, porridge or even desserts. [9].

Its leaves are rich in folic acid and iron (non-heme) and are used as a curry. A daily intake of 400g of greens combined with fruit and vegetables can help alleviate micronutrient deficiencies and prevent chronic diseases associated with unhealthy food consumption and lifestyle [10]. Sweet potatoes belong to the group of foods that can alleviate micronutrient deficiencies and prevent chronic diseases associated with dietary deficiencies, as they are very rich in nutrients such as high levels of carbohydrates, high concentrations of vitamin A (especially orange-fleshed cultivars), B-complex and some minerals such as calcium, iron, phosphorus, potassium, sulphur and magnesium.

Its nutritional richness makes it great for regulating blood pressure and preventing certain types of cancer. It is especially valuable because it is a food security crop for vulnerable people and can provide the population with a significant portion of dietary carbohydrates [11].

The importance of sweet potatoes goes beyond food, often serving as a means of generating income for rural and urban families in Mozambique. In 1997, the Instituto de Investigação Agrária de Moçambique (IIAM) introduced varieties of orange-fleshed sweet potato (BDPA), but its cultivation and consumption is still very insignificant in the country. Weekly rates of BDPA consumption in AFs stand at 17 percent. Analysis by province shows that consumption is highest in Maputo province and Maputo City, followed by Sofala, Tete and Zambézia. On a weekly basis, families in the provinces of Cabo Delgado and Nampula consume the least BDPA [3].

The inclusion of sweet potatoes, especially orange-fleshed ones, in the family diet can help diversify food consumption and therefore increase nutrient intake. Diet diversification is a change and choice of dietary patterns and families' traditional methods of preparing and processing local foods [12].

For some, dietary diversification means dietary diversity, and this refers to a substitute for a qualitative measurement of food consumption by assessing families' access to different food groups, called the family dietary diversity index. For others, food diversification is a snapshot of the economic well-being of a PA in relation to access to a variety of foods and serves as a reference for the adequacy of nutrient intake at an individual level [13, 14]. Whether or not the diet is appropriate is based on *scores,* adding up the number of food groups consumed at home or by the interviewee over a 24-hour period [13].

Family and individual dietary diversity is measured by establishing scores for the adequacy of intake. A score of less than four (<4) represents poor dietary diversity, a score of 4-5 represents average dietary diversity, and a score of six (6) or more indicates adequate nutrient intake [(15)].

The increase in family food diversity is associated with the family's socio-economic status and food security. At an individual level, an increase in the dietary diversity score is associated with nutritional adequacy, i.e. food security [(16)]. Food security is defined as ensuring that everyone has access to quality basic food, in sufficient quantity, on a permanent basis and without compromising access to other basic needs, based on dietary practices that allow the human body to reproduce properly, thus contributing to a dignified existence [(17).]

In Mozambique, food security is still a challenge and the adequacy of the diet varies from region to region, with better quality in families in the south of the country and part of the central region. However, in the northern region, dietary adequacy is still poor [(3)]. As is well known, a poor to moderate diet results in high rates of chronic malnutrition (short stature for age), with chronic malnutrition in Mozambique affecting around 43% of the country's children. The prevalence of chronic malnutrition is highest in the central and northern provinces, ranging from 41% to 52% respectively, and is lowest in the south; Inhambane, Gaza, Maputo Province and Maputo City, at between 26% and 39%. In rural areas of Mozambique, more children suffer from chronic malnutrition (45%) than in urban areas (39%). The prevalence of acute malnutrition (low weight for height) is 7%, but there are significant differences between the country's provinces [(3)].

Around 14% to 16% of FAs in Zambézia and Nampula, respectively, have a poor diet. These families have a low frequency of consumption of foods with a high protein content, such as meat, poultry, eggs, rats, offal, varying from 2 to 3 days a week. People in these provinces usually consume cereals, vegetables, milk, fruit, sugar and oil an average of 4 days a week [(3)].

The Mozambican government has public policies aimed at improving the food and nutritional security of its population. These policies comprise two government instruments: (i) food and nutrition security strategy and (ii) multisectoral action plan to reduce chronic malnutrition (PAMRDC). The Ministry of Agriculture and Rural Development (MADER) guarantees the availability of and access to food for families. This sector has been promoting the production of more nutritious food through the implementation of several key national programs. MADER promotes the cultivation of food crops such as corn, rice, cassava, peanuts, potatoes, soybeans and beans, as well as poultry and fish farming.

The use of improved production technologies such as animal traction, irrigation, fertilizers, certified seeds, agricultural extension and animal health monitoring guarantees the production of these crops. With regard to the promotion of nutritious food, MADER is implementing the extension program known as SUSTENTA, which aims to educate small farmers to produce crops with a high nutritional value, such as orange-fleshed sweet potatoes.

BDPA is seen as an essential food for combating malnutrition, as it is a good source of energy and pro-vitamin A. It is a food security crop, as it is less labor-intensive than other crops and is even considered suitable for women to manage. It requires less water and can be grown over a long period of time without any loss of yield [(18)].

In the country, the introduction of BDPA into the production system has brought evidence of improved levels of pro-vitamin A intake in pregnant and lactating women and children under five [(19)]. Vitamin A levels in this target group were determined on the basis of laboratory analyses of consumers' serum retinol.

The results of the laboratory analysis showed that there was an increase in vitamin A in the blood of around 89% of children, pregnant and breastfeeding women who frequently consumed BDPA over a certain period. Therefore, expanding the cultivation and consumption of BDPA by children under five, pregnant and lactating women could significantly improve vitamin A intake in Mozambique in general, and in the provinces of Nampula and Zambézia, the geographical areas with the most deficient populations [(19)].

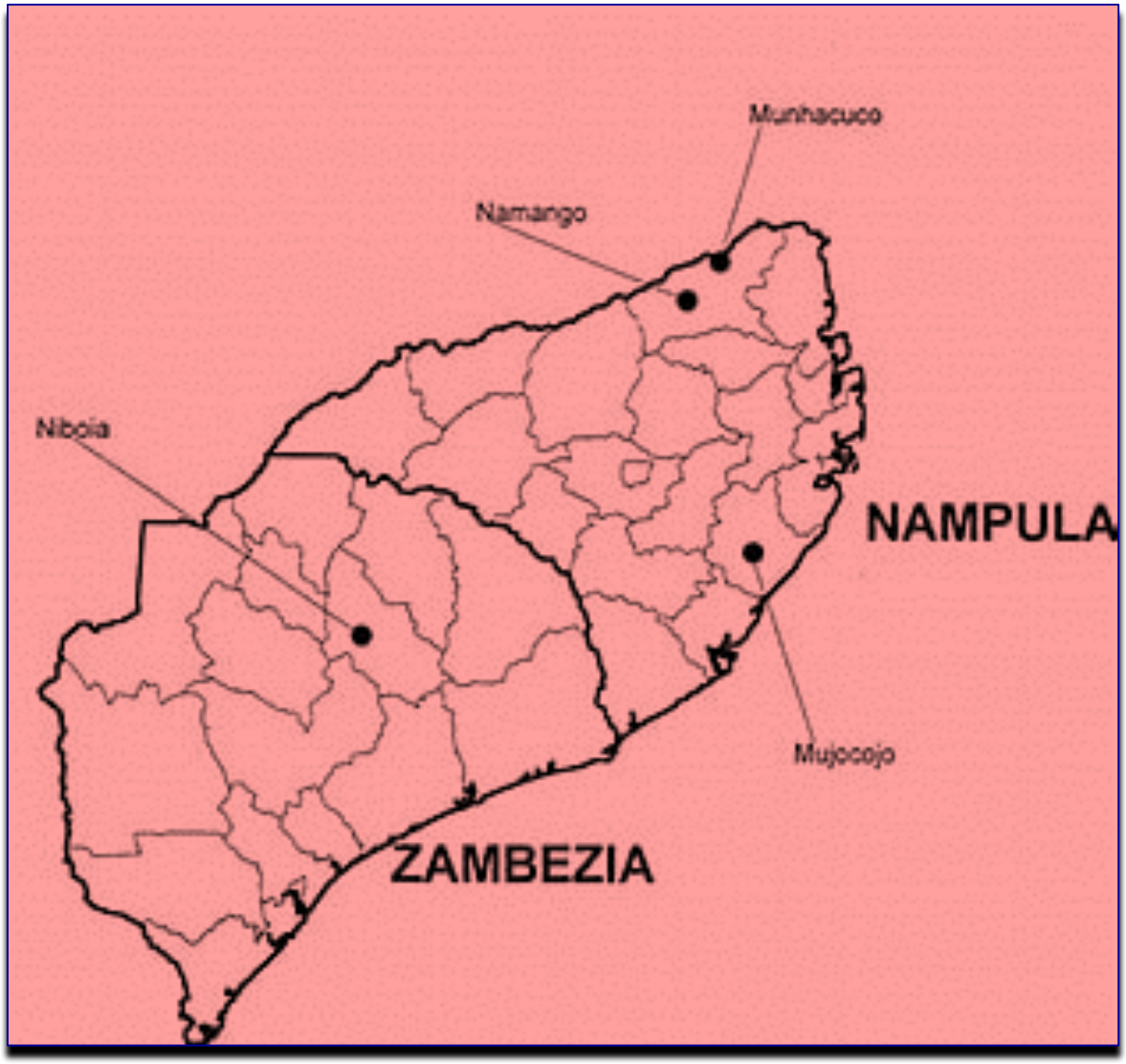
In Mozambique, around 41% of farmers grow white-fleshed sweet potatoes (BDPB) and this is an opportunity for them to make a marginal change and start growing BDPA as well, thus contributing to a higher intake of provitamin A [(20)].

Methodology

A descriptive methodology was used, covering four districts in the province of Nampula (Meconta, Monapo, Murrupula and Rapale) and two in the province of Zambézia (Alto Molocue and Gurué). Figure 1 shows the map of the two provinces in the study.

Figure 1.

Map of the provinces of Nampula and Zambézia [21].



The localities were considered primary sampling units and, for each district, 7 localities were selected from the North, Center and South. Groups of three villages were randomly selected from the northern, central and southern parts of the towns. In total, 42 towns and 168 villages made up the research area.

The sample design was based on sweet potato producers, as this was a baseline study of a project to promote the cultivation and consumption of orange-fleshed sweet potatoes. In Mozambique, there are around 3,5000,000 sweet potato growers, of which 5.3% are in Nampula, and 29% in Zambézia. It is estimated that there are around 1,200,500 potential sweet potato producers in Nampula and Zambézia [3]. On average, each AF in Mozambique is made up of 5 people, and around 240,100 Mozambicans grow sweet potatoes [22]. A minimum overall sample size of 526 beneficiaries is considered ideal for the study [23].

Thus, using a general principle of 0.7 standard deviations, a margin of error of 10% and setting the critical value of the normal probability distribution (z) at 1.96, corresponding to a 95% confidence level, data was collected from 640 heads of PAs living in 168 villages of the 42 previously selected localities in the six districts.

A household is a group of people, whether they are related or not, who usually live under the same roof and maintain the same budget to meet essential needs. Head of household is the person responsible for the household, considered as such by the other members, who normally supports the family budget and lives with the household, and may or may not be present at the time of the survey, as long as their absence is less than two months [(24)]. The formula used to calculate the sample was as follows:

Initial sampling size: n= (N2*z2*s2/MDE2)

Where:

N = total number of respondents

z=critical value of the normal probability distribution

s=standard deviation of the distribution of beneficiary data

MDE = margin of error

Based on this formula, the initial sample was 138 FAs, but it had to be adjusted for three levels of randomization, which allowed it to be increased to 564 (3*188). A non-response rate of 10% was then adjusted to reach a final size of 627 AF. However, due to a probable loss (handling error), there was a final adjustment to 640 AFs. Each FA head answered questions in a semi-structured interview based on the standard questionnaire to find out about food consumption and the agricultural situation. The food consumption frequency questionnaire (24-hour recall) was used to collect data on food consumption.

A 24-hour recall is a method used in dietary surveys to obtain complete information on an individual's food intake over a 24-hour period, corresponding to the previous day. This is carried out by a trained interviewer who asks questions about the food and drink consumed in the 24 hours prior to the interview. The 24-hour recall also makes it possible to collect information on intake over 48 hours [(25)].

Once collected, the data was checked and cleaned before being tabulated. Using the CSPro software, previously trained typists tabulated the data and during this process also checked for consistency.

Dietary diversity was determined based on the FAO criteria and its classification (scores) to determine dietary adequacy, based on the sum of the number of food groups consumed in the last 24 hours in that household or by the interviewee [(15)]. Thus, food groups were formed that corresponded to the basic needs of the PA and individual dietary diversity scores.

There are different criteria for establishing food groups, depending on the author and the country. Foods can be grouped or classified according to their origin, nutritional composition and state of processing, but the most practical classification from a dietary point of view may be the one that uses the nutritional composition criterion, i.e. according to their significant nutrients [(15)].

The estimation of the individual dietary diversity score considers nine food groups and these include (1) roots and tubers, cereals; (2) legumes and nuts; (3) dairy products; (4) meat-

based foods; (5) eggs; (6) vitamin A; (7) fruits and vegetables rich in vitamin A; (8) and other fruits and (9) vegetables [15].

In this study, the scores, whether at PA or individual level, were determined by grouping foods into nine categories, according to the nutritional needs that each one covers, and then the interviewees listed the foods consumed in the last 24 hours. To determine nutritional adequacy, each interviewer recorded the corresponding scores.

In the assessment of dietary diversity, a high score (≥6) is related to increased nutritional adequacy. A score below four (<4) represents low dietary diversity and a score of 4-5 represents medium dietary diversity [13]. The PA's dietary diversity score indicates their economic access to food, since items that require resources from the PA, such as condiments, sugar and sugary foods and drinks, are included in the score. The individual results reflect the nutritional quality of the diet [15].

It's worth noting that family food consumption doesn't always give the best interpretation of the nutritional situation of the PA or the malnutrition of children, as consumption data is often inaccurate. Nutritional outcomes are caused by meal frequency, waste, dietary diversity, feeding practices, childcare, intra-household food distribution and access to health services. One of the indicators with a strong correlation with malnutrition has been *per capita* consumption.

Therefore, individual dietary diversity was determined using children under five years of age (6-59 months) as a reference. Thus, children with an individual dietary diversity index lower than four (0-3) were associated with low dietary diversity, and those with an individual dietary diversity index greater than or equal to four (≥4) were associated with high dietary diversity. For statistical analysis, the survey used the *Census and Survey Processing System* (CSPro 7.7.2)

The aim of the baseline study was to learn about the contribution of sweet potatoes to the dietary diversity of rural populations in Nampula and Zambézia, northern and central Mozambique, through the introduction of this crop into their production system.

Ethical considerations

The study protocol was designed and reviewed by the donor to capture relevant information on agriculture and food use.

Results and discussion

Household characteristics

Rural families in Nampula and Zambézia have an average of five members. Women accounted for around 51% of the entire sample, and all the FAs in the sample had at least one child under the age of five. Among children under five, around 54% were female. Table 1 provides detailed information on the characteristics of the PAs in the area studied**.**

Table 1.

Characteristics of households in the districts of Nampula and Zambézia, north and center of Mozambique. Own elaboration.

District	AF size					No. Children <5 years		
	% women	No.	Average	95 % CI	Median	% women	Average	Median
Gurué	51,4	106	5.1	4,7-5,6	5.0	59.6	1.5	1.0
Alto Alto Molocuè	50.0	101	5.4	5,0-5,7	5.0	52.1	1.3	1.0
Murrupula	48.8	107	5.0	4,6-5,3	5.0	51.4	1.5	1.0
Monapo	52.4	107	5.5	5,1-5,8	5.0	53.2	1.4	1.0
Meconta	51.2	108	5.1	4,8-5,5	5.0	48.8	1.2	1.0
Rapale	49.8	111	5.4	5,1-5,8	5.0	58.7	1.3	1.0
Total	50.6	640	5.3	5,1-5,4	5.0	53.9	1.4	1.0

Production system

Sweet potatoes are the fifth most important crop in Nampula and Zambézia, after maize (34.9%), peanuts (16.3%), cassava (19.7%) and beans (12.9%). It represents 8.9% of all respondents, ahead of rice (7.3%). This confirms the information that MADER promotes the cultivation of food crops such as corn, rice, cassava, peanuts, potatoes, soybeans and beans [(3)]. Table 2 illustrates the classification of food crops according to their order of importance.

Table 2.

The most important food crops in the districts of Nampula and Zambézia, north and central Mozambique. Own elaboration.

Cultures	No. of respondents (n=640)	Percentage (%)	Classification
Corn	223	34.9	1ª
Cassava	126	19.7	2 ª
Peanuts	104	16.3	3 ª
Beans	83	12.9	4 ª
Sweet potatoes	57	8.9	5 ª
Rice	47	7.3	6 ª
Total	640	100.0	

The proportion of sweet potatoes in the production system

The analysis to determine the proportion of plots planted with sweet potatoes showed that the districts of Meconta and Nampula, in Nampula province, and Gurué, in Zambézia, grow the sweetest potatoes. In the Meconta district, sweet potatoes occupy around 19.2% of the cultivated area and in Murrupula, the crop represents 17.6% of the cultivated area. In Gurué, Zambezia, the area occupied by sweet potatoes is 18 percent. On average, sweet potatoes occupy 17% of smallholder farms in Nampula and Zambézia.

Overall, the average size of these farms varies between 0.5 hectares and 1.5 hectares [(26)]. Based on this data and translating the proportions found in the study into hectares, it can be seen that farmers in Gurué, Meconta and Murrupula have plots ranging from 0.09-0.29 hectares, while farmers in Alto Alto Molocuè, Monapo and Rapale have plots averaging less than 0.09 hectares each. Table 3 shows the proportion of plots with sweet potatoes in each study district.

Table 3.

Number of plots with sweet potatoes and other crops at household level in the districts of Nampula and Zambézia, northern and central Mozambique. Own elaboration.

Provinces	Districts (N=509)	Total number of plots with crops			No. of plots with sweet potatoes		% of plots with sweet potatoes
		Average	95% CI	Median	Average	Median	
Zambezia	Gurué (n=91)	3.3	3,1-3,6	3	0.6	0.0	18.0
	Upper Molocuè (n=80)	2.8	2,5-3,0	3	0.4	0.0	14.5
	Murrupula (n=77)	2.8	2,6-3,1	3	0.5	0.0	17.6
	Monapo (n=90)	3.1	2,7-3,4	3	0.4	0.0	13.1
Nampula	Meconta (n=81)	2.6	2,3-2,9	2	0.5	0.0	19.2
	Rapale (n=90)	2.6	2,4-2,8	2	0.4	0.0	15.5
Total		2.9	2,7-3,0	3.0	0.5	0.0	17.4

Sweet potatoes are one of Mozambique's main food crops and can be found in almost all of the country's production systems. [(7)]. Betting on sweet potatoes in the production system has multiple advantages because it is a food that is very rich in carbohydrates, pro-vitamin A (especially orange-fleshed varieties), B-complex and some minerals such as calcium, iron, phosphorus, potassium, sulphur and magnesium. Its nutritional richness makes it a blood pressure regulator as well as preventing certain types of cancer. It is also a culture of food security and

income generation for vulnerable families [11]. For consumption, sweet potatoes can be used almost in their entirety: the roots are eaten boiled, roasted, stewed, fried, pureed, as porridge, or even as dessert. The leaves are used to make curry [9].

Household food diversity

The overall average score for dietary diversity at the PA level was four (4), but the classification by district showed scores below four in Alto Molocuè (3.6) and Murrupula (3.7), which translates as families with an inadequate diet. The districts of Rapale and Meconta scored 5.1 and 4.7 respectively, which is above the average of four (4) and shows that these families have an adequate diet. Table 4 shows the results of the dietary diversity score for rural families in six districts in the provinces of Nampula and Zambézia, northern Mozambique.

Table 4.

Estimated mean, confidence interval and median of the dietary diversity index in families from the districts of Nampula and Zambézia, northern and central Mozambique. Own elaboration

Province	Districts	N	Average	95% CI	Median
Zambezia	Gurué	106	4.0	3,6-4,4	4.0
	Alto Molocuè	101	3.6	3,3-3,9	4.0
	Murrupula	107	3.7	3,4-4,1	4.0
Nampula	Monapo	107	4.3	3,9-4,6	4.0
	Meconta	108	4.7	4,3-5,2	4.0
	Rapale	111	5.1	4,5-5,6	5.0
Total		640	4.2	4,1-4,4	4.0

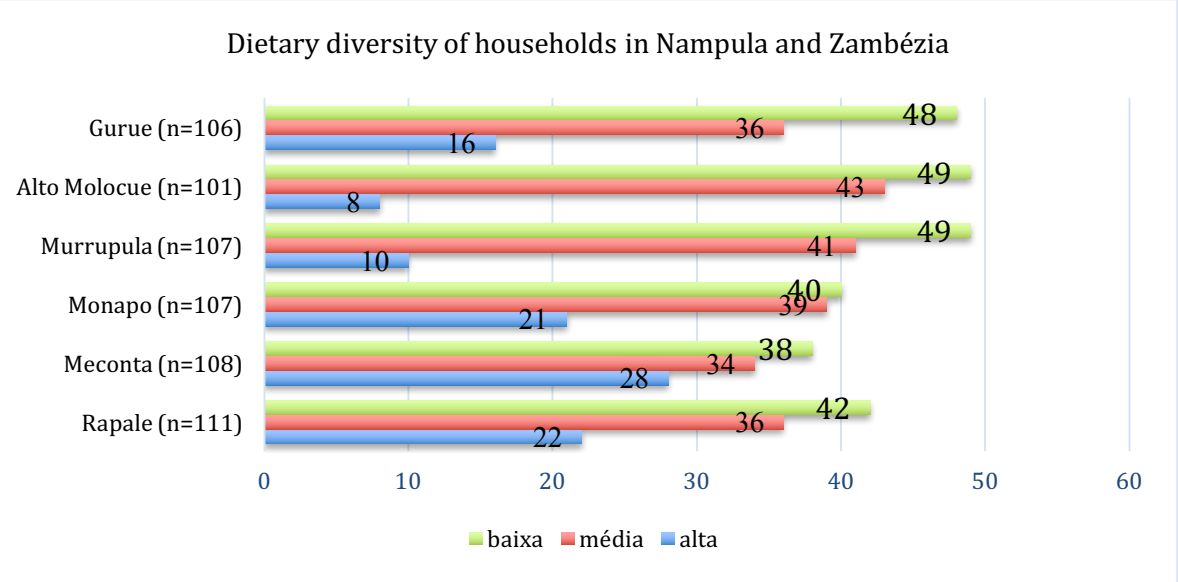
Dietary diversity is a measure that determines food consumption and access in a household, which can be triangulated with other information. This provides a holistic picture of food and nutrition security in a community or wider territorial area. The study made an additional analysis of the family situation to determine its dietary diversity. The results of the analysis showed that around 43% of families are in the poor dietary diversity category (<4) and nearly 35% are in the medium category (4) and only 22% have adequate dietary diversity (≥4).

The percentage analysis of dietary diversity by district shows a significant proportion of PAs in Alto Molocuè with poor dietary diversity (49%), followed by Murrupula (48%). The districts of Meconta and Rapale are in the lowest position (38%).

Figure 2 shows the levels of dietary diversity in the six study districts.

Figure 2.

Proportion of households with low, medium or high dietary diversity in each district of Nampula and Zambézia, northern and central Mozambique. Own elaboration.



Individual dietary diversity

At the household level, consumption is not always related to malnutrition in children, because data on consumption is often inaccurate and because nutritional outcomes have causes related to food frequency, waste, diversified diet, feeding practices, childcare, intra-household food distribution and access to health services. In this case, only *per capita* food consumption can be correlated with malnutrition. The determination of individual dietary diversity was only carried out with children under the age of five. To do this, the nine categories of food products were grouped together and the number of food items consumed by children in both provinces was determined [(15)].

Overall, individual scores ranged from 3.3 to 3.6 points, with an average of 3.5 points, which translates into poor dietary intake among children under five years of age. The median individual consumption was 3, suggesting a prevalence of inadequate dietary diversity among children under five at the family level.

This result contrasts with the SETSAN findings, which indicate that there are better infant feeding practices in the northern region of Mozambique, even though there is still a high prevalence of chronic malnutrition in this region [(3)]. The causes of this discrepancy are unclear, but it may have to do with poor access to food, or poor hygiene conditions (water and sanitation), which could contribute significantly to the high levels of malnourished children currently observed. Malnutrition doesn't just affect children under the age of five; pregnant women are another group most affected by the disease [(4)]. Etiologically, malnutrition can be associated with acute illnesses or injuries, chronic conditions or starvation. Malnutrition can also be caused by food deprivation, either isolated or associated, and can be acute (low weight for height, bilateral oedema or chronic (low height for age) or due to a lack of micronutrients such as iron, iodine, vitamin A and B vitamins.

Malnourished children are at greater risk of dying from common childhood diseases, and those who survive become ill and may have poor growth. Around a third of children under the age of five die from malnutrition worldwide. Proper infant nutrition prevents children from being exposed to frequent illnesses, allowing them to reach their physical and mental growth

potential [5]. Table 5 shows the average values of the individual dietary diversity of the rural population of Nampula and Zambézia, in northern and central Mozambique.

Table 5.

Estimation of the mean, confidence interval and median of individual dietary diversity scores in the districts of Nampula and Zambézia, northern and central Mozambique. Own elaboration.

Province	Districts	N	Average	95% CI	Median
Zambezia	Gurué	106	3.2	3,0-3,5	3.0
	Alto Molocuè	101	3.1	2,8-3,3	3.0
	Murrupula	107	3.1	2,9-3,4	3.0
Nampula	Monapo	107	3.5	3,2-3,7	3.0
	Meconta	108	3.8	3,5-4,2	4.0
	Rapale	111	3.9	3,5-4,3	4.0
Total		64(	3.5	3,3-3,6	3,0

In all districts, there is a prevalence of inadequate dietary diversity among children under five years of age. However, the scenario was more severe in Alto Molocuè (3.1), Murrupula (3.1) and Gurué (3.2) compared to Rapale (3.9) and Meconta (3.8), as illustrated in Table 5. Overall, around 58% of children consume less than three food groups a day, a clear indication of the prevalence of poor dietary intake. In Molocue, more than two thirds of children under the age of five had a low dietary diversity.

The study aimed to learn about the contribution of sweet potatoes to the dietary diversity of PA. The interviewees were asked if they usually incorporated sweet potatoes into their diet. The results indicate that all the FAs interviewed consume sweet potatoes. Table 6 shows the frequency of sweet potato consumption at household level.

Table 6.

Number of days per week that households in the districts of Nampula and Zambézia, north and central Mozambique, consumed sweet potatoes during the high and low peaks of the harvest. Own elaboration.

Province	District	No.	No. of days per week on which the FA consumed BD at the peak of collection			No. of days per week on which the FA consumed BD outside the harvest season		
			Average	95% CI	Median	Average	95 % CI	Median
Zambezia	Gurué	106	3.1	2,7-3,4	2	2.1	1,8-2,5	1
	Alto Molocuè	101	2.7	2,4-3,0	2	1.6	1,3-1,9	1
	Murrupula	107	3.1	2,8-3,5	2	1.8	1,6-2,1	1
Nampula	Monapo	107	2.3	2,0.2,5	2	1.3	1,1-1,4	1
	Meconta	108	2.5	2,2-2,8	2	1.5	1,3-1,6	1

	Rapale	11	2.2	2,0-2,5	2	1.6	1,3-1,8	1
Total		640	2.7	2,5-2,8	2	1.7	1,5-1,8	1

Respondents were asked if they would continue to eat sweet potatoes even if their family income increased one day. Data from the study revealed a downward trend in the number of consumers associated with rising incomes (36%). However, around 26% said they could increase their consumption and around 33% said they would not change their consumption pattern.

The hypothesis that sweet potatoes are the crop of vulnerable people is not proven in this study, as the percentage of respondents who will continue to eat sweet potatoes, even if their wealth status improves, was even higher (59%). A very fascinating finding of this study is the fact that, even though BDPA varieties have not yet been introduced in those areas, all the respondents declared that they had already consumed BDPA bought at the local market and other BDPA offered by friends and family. Table 7 below shows the number of days that families consumed BDPA during the week.

Table 7

Number of days per week throughout the year that households in the districts of Nampula and Zambézia, north and central Mozambique consumed BDPA. Own elaboration

Province	District	No.	No. of days per week throughout the year that the PA consumed BD		
			Average	95% CI	Median
Zambezia	Gurué	106	2.1	1,6-2,5	2
	Alto Molocuè	101	1.3	1,0-1,5	1
	Murrupula	107	2.1	1,7-2,4	2
Nampula	Monapo	107	1.5	1,3-1,8	1
	Meconta	108	1.4	1,2-1,6	1
	Rapale	111	1.9	1,6-1,2	1
Total		640	1.7	1,6-1,9	1

The consumption of BDPA is still insignificant in the country. On average, rural families consume BDPA twice a year, unlike BDPB, which is consumed twice a week (Table 6). The integration of BDPA into the production system of rural families in Zambezia improved the intake of pro-vitamin A in 89% of children aged 6-59 months and their mothers, while another group in the control area did not register this increase. Sweet potatoes can be eaten boiled, fried or mixed with wheat (known as golden bread). A loaf of bread made from BDPA puree, weighing around 250g, can provide 45% of pro-vitamin A in children under five [(19)].

The study also assessed the knowledge of heads of FAs about the nutritional importance of sweet potatoes (orange and white flesh). In this approach, 34% of respondents mentioned that they had heard of pro-vitamin A in BDPA and 58% said that BDPB also contains pro-vitamin A. Around 8% of respondents said that not all sweet potato cultivars are rich in provitamin A. The main sources of this knowledge were health facilities (79%) and local health activists (46%).

Regarding the nutritional benefits of BDPA, more than two thirds of those surveyed pointed to it as a healthier food than wheat bread. However, it is relevant to note that, although there is a notion

about the benefits of BDPA, in Murrupula and Rapale there is still a significant number of people who prefer bread to BDPA, 30% and 28% respectively.

This finding confirms the results of other studies which indicate that BDPA consumption is still low in the country, accounting for only 17% of PAs. The consumption rate is highest in Maputo, Sofala, Tete, Zambézia and Maputo City. The provinces of Cabo Delgado and Nampula have lower proportions of households incorporating BDPA into their diet [(3)] and this low consumption is due to low production. In two study areas (Nampula and Zambézia), an average of 22% of respondents declared BDPA.

Conclusions

In Mozambique, sweet potatoes are one of the main food crops and can be found in all the country's production systems. In Nampula and Zambézia, around 17% of the production area is occupied by sweet potatoes. The districts of Meconta and Murrupula, in Nampula, have larger production areas than Rapale with 19.2 percent and 17.6 percent, respectively, and in Zambézia, the two districts (Gurué surpasses Alto Molocuè) have production areas of 18 percent. Around 20% of families in Nampula and Zambézia produce sweet potatoes (white and orange flesh) and this crop ranks fifth in the entire production system, after maize, peanuts, cassava, beans and rice.

More than 2/3 of households prefer to eat sweet potatoes because they consider them healthier than wheat bread, but studies indicate that BDPA consumption is still poor in the country, accounting for only 17% of FAs. The consumption rate is highest in Maputo, Sofala, Tete, Zambézia and Maputo City. The provinces of Cabo Delgado and Nampula have the lowest proportion of FAs who incorporate BDPA into their diet.

In Nampula and Zambezia, 27% of families consume BDPA only twice, but even so, they consider it to be a low-income food. 36% of current consumers have shown a tendency to reduce consumption as their income rises. An important fact is that a significant proportion of the families interviewed said they knew about the importance of the BDPA through the health units and community health agents.

It's important to note that although there is some awareness of the benefits of BDPA in Murrupula and Rapale, there are still a significant number of people who prefer bread to orange-fleshed sweet potatoes for breakfast. Overall, BDPA consumption is still insignificant in Mozambique. This is due to low production, as these varieties were first introduced to Mozambique in 1997, but have experienced serious adaptability problems.

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