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Unlocking the Quantity of *Dioscorea hirtiflora* Harvested in Lindi and Mtwara Regions, Tanzania

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Keywords:

Quantity,
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Stakeholders,
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Tanzania.

This study focused on quantifying the amount of *Dioscorea hirtiflora* harvested in Lindi and Mtwara regions, Tanzania. Specifically, the study aimed at identifying key stakeholders engaged in the *Dioscorea hirtiflora* collection, consumption, and trading in the study area, to quantify the amount of *Dioscorea hirtiflora* collected, consumed, and traded in the study area, and to estimate the income generated through *Dioscorea hirtiflora* marketing in the study area. The study used a sample size of 160 respondents selected randomly from Mnamba, Madangwa, Hingawali, Nachunyu, Mkunwa, Dihimba, Namayanga, and Pachoto B villages. A structured questionnaire was administered for primary data collection. Secondary data were collected from the District Forest and Agricultural Offices. Data were analysed using R software, version 4.5.0. Qualitative and quantitative variables were analysed. The value of *Dioscorea hirtiflora* was obtained by multiplying the average market price of each product by its quantity. The average quantity of 1342.109 kg in Lindi and 1732.667 Kg in Mtwara of *Dioscorea hirtiflora* was collected by the selected households. From the sample of 160, it was estimated that the community earned about (TZS 1,884 275.36) in Mtwara and (TZS1,476,319.9 in Lindi. The study recommends that the government should recognise *Dioscorea hirtiflora* business in the national income statistics.

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INTRODUCTION

Non-wood products are derived from forest resources comprising a broad variety of forest products, collectively described as non-timber forest products (NTFPs). Non-timber forest products (NTFPs) constitute an important source of livelihood for millions of people from forest fringe communities across the world. Generally, NTFPs are biological products from wild species harvested by humans from diverse landscapes for consumptive and non-consumptive uses, with most benefits accruing to local actors (Shackleton et al. 2011 and Nyamoga 2023). The NTFPs also provide many households with a means of income generation, either as supplementary income to other livelihood activities, or as the primary means of cash generation (Areki and Cunningham, 2010; Babulo et al., 2009; Mahapatra et al., 2005; Pannel et al., 2006; Shackleton et al., 2008). Wild edible plants (WEPs) are an important type of NTFPs. Globally, wild foods enhance the quality of diets for those who consume them and provide income for those who sell or trade them, but the exact benefits vary widely. (Powell et al. 2015 and Lalika 2006) reviewed 24 studies on wild food use across the globe and identified a large variation in the importance of wild food use to diets and in the food groups that mattered most. They contribute significantly to household food and support about 300 million people in developing countries (Bharucha and Pretty 2010).

Dioscorea hirtiflora, commonly known as Ming'oko, is a wild yam species indigenous to various regions of Africa, particularly the southern parts of Tanzania. This tuberous climbing plant plays a significant role in the diets and economies of local communities, where it is harvested for both consumption and trade. They also improve food diversity in rural households (Bakkegaard et al. 2017 and Joshi et al 2019). The harvesting of *Dioscorea hirtiflora* is a critical agricultural practice that not only supports food

security but also contributes to the livelihoods of rural households.

Despite its nutritional value and economic importance, there is limited quantitative data available regarding the amounts of *Dioscorea hirtiflora* harvested in various study areas. Understanding the quantity of *Dioscorea hirtiflora* harvested is essential for assessing its sustainability, economic impact, and potential for cultivation improvements. Few studies have assessed the contribution of *Dioscorea hirtiflora* in food security, Nutritional potential, and Antioxidant activity of *Dioscorea* (Majule et al, 2010 and Mwanjala et al, 2024). This study, therefore, aims to quantify the amount of *Dioscorea hirtiflora* collected, consumed, and sold by local communities of Lindi and Mtwara.

Objectives of the Study

Main Study Objective

The study focused on quantifying the amount of *Dioscorea hirtiflora* harvested in *Lindi and Mtwara Regions, Tanzania*.

Specific Objectives of the Study Were to:

- To identify key stakeholders engaged in the *Dioscorea hirtiflora* collection, consumption, and trading in Lindi and Mtwara.
- To quantify the amount of *Dioscorea hirtiflora* collected, consumed, and traded in the study areas.
- To estimate the income generated through *Dioscorea hirtiflora* marketing in the study area.

Research Question

- Who are the key stakeholders involved in the collection, consumption, and trading of *Dioscorea hirtiflora* in Lindi and Mtwara?

- What is the quantity of *Dioscorea hirtiflora* collected, consumed, and traded in the study areas of Lindi and Mtwara?
- How much income is generated from the marketing of *Dioscorea hirtiflora* in the study areas?

METHODOLOGY

Description of the Study Area

Location

The study was conducted at Mnamba, Madangwa, Hingawali, and Nachunyu villages located in Namupa, Sudi, Pangateni, and Nachunyu Wards, in Lindi Region. In Mtwara Region, data were collected in Mtwara Municipal at 2 streets, namely Namayanga and Pachoto B in Naliendele and Mtawanya wards, and Mtwara Rural District at 2 villages, namely Mkunwa and Dihimba in Mkunwa and Dihimba wards (Figure 1).

Vegetation and Topographical Characteristics

The two regions are mostly arid, with a dry season from May to October and a rainy season from November to April. It has higher temperatures ranging from 25 to 35 degrees Celsius. Annual rainfall is about 1100mm. The vegetation of the study area is characterised by four easily

distinguished ecological units, which include coastal, miombo, woodland, and riverine forests.

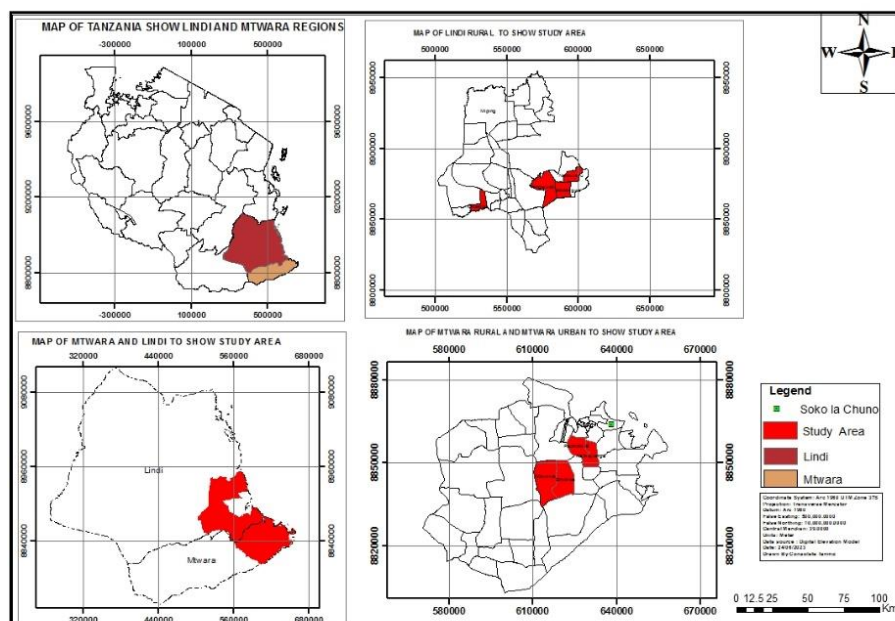
Population and Ethnic Group

The population of Mtwara and Lindi Regions based on the 2022 population census was 1,634,947 and 1, 194,028 respectively (URT, 2022). Lindi Region is located between latitude 7°55' and 10°50' South of the Equator, and longitude 36°51' to 40° East (Milandu and Chove, 2022 and Mtwara is located along the Makonde plateau 900 m above sea level, lying between longitude 38° and 48° and latitude 10° and 12° south of the Equator (Mwanawima,2010). The main ethnic groups are the Mwera as the dominant tribe, Makonde, Machinga, and Matumbi. The Mwera and Makonde are known anecdotally to collect *Dioscorea hirtiflora* for food and income.

Social Economic Activities

The livelihoods of people in the two Regions depend mainly on mixed fishing and farming, especially maize, groundnuts, cowpea, sweet potato, cassava, sunflower, soya beans, and rice, supplemented by natural resources. The rural household survey sites were the Lindi (Mtama), Mtwara DC, and Mtwara municipal districts of Tanzania's Southern zone (Figure 1).

Figure 2: A Map Showing the Geographical Location of the Study Area



Source: Own Construct Using GIS (2024).

Research Design, Sampling Procedure and Techniques

Sampling Techniques and Sample Size

Cross-sectional research designs were employed where data were collected once in each selected village in Mtwara and Lindi regions. The cross-sectional design was adopted because it is cost-effective, less time-consuming, and allows a lot of information to be obtained in a relatively short time, and allows data to be collected at one point in time from different individuals or groups of respondents (Hemed *et al*, 2015; Mohajan, 2020). Random selection was used to obtain households from eight villages of the study area. In each selected village, 5% of the total households were

randomly sampled. According to Boyd and Musig (1981), in order for a random sample to be representative of that population should at least constitute 5% of the total population. A household was chosen because it is a social and economic unit in the sampled villages (Aleign *et al*, 2011). In rural areas, a household is a primary unit of production, distribution, consumption, and a point of decision-making. The study involved a total of 160 households, which were randomly selected from 8 villages of Hingawali, Madangwa, Mnamba, and Nachunyu (Lindi); Dihimba, Mkunwa, Namayanga, and Pachoto B (Mtwara). Women were most involved by 64.37% and men were represented by 35.6.

Table 1: Showing Regions' Samples in Mtwara and Lindi

S/N	Gender	Lindi %	Mtwara %	Average (%)
1	Male	36.25 (n = 29)	35 (n = 28)	35.62(n = 57)
2	Female	63.75 (n = 51)	65 (n = 52)	64.37 (n = 103)

Hingawali, Madangwa, and Pachoto B villages are relatively close to the main road, where they sell directly to the passengers, while Mnamba, Namayanga, Dihimba, Mkunwa, and Nachunyu villages are relatively far from the main road and markets.

Data Collection Methods

For better insight, validity, and reliability of the research findings, this study used mixed methods of qualitative and quantitative approaches for data collection to assess income generation from *Dioscorea hirtiflora* products in Lindi and Mtwara regions. Questionnaires, focus group discussions (FGDs), and key informant interviews were used in collecting data. The information collected on the socio-economic characteristics of the respondents included age, gender, marital status, education, and primary occupation. A total of six Key Informants' Interviews (KII) were organised with District Forest officers, District Natural Resources officers, and agriculture officials were selected purposively for discussion. A grey literature search was also used to examine the contribution of ming'oko to the household income and livelihoods. Four FGDS were used as a valuable method for collecting data to identify

key stakeholders (Village Executive officer, Village chairperson, 2 sellers, 2 collectors, 2 buyers, 2 youth representatives based on gender) engaged in the *Dioscorea hirtiflora* value chain and traditional practice in communities.

Market Survey

During the market survey, information on market price, how prices change across seasons, market capacity, and quantities of *Dioscorea hirtiflora* that are available in the market was collected. Prices and amounts of *Dioscorea hirtiflora* supplied and sold at the market were recorded. Total sales per year were also determined so as to obtain the total income. This was done at Markets and households located in the study area. Sellers and buyers of *Dioscorea hirtiflora* were interviewed to give the average amount of the products sold/purchased per day. The amount of these products was determined by converting the local measuring units to conventional units like kilograms. The market chain information was also collected, linked to markets, and actors in the trade were identified through a questionnaire.

Data Analysis

Data collected through the household's survey were coded and analysed using R software, version 4.5.0. where qualitative and quantitative variables were analysed.

Qualitative Data

Content analysis method was used to analyse in detail the components of verbal discussions which were held with different respondents through focused group discussion and key informants.

Quantitative Data

Data collected from semi-structured questionnaires was summarised, edited, coded, and analysed using the R software, version 4.5.0. and then used a computer program to generate quantitative statistics. Descriptive statistics, for example, frequencies, percentages, and means, were computed to determine the proportion of households collecting, consuming, and trading Ming'oko tubers.

Economic Value of *Dioscorea hirtiflora*

Data on quantities (Q) of *Dioscorea hirtiflora* collected, consumed, and traded through market

survey were converted to conventional units (kilograms). The value of *Dioscorea hirtiflora* was obtained by multiplying the average market price of each product by its quantity using the formula below.

$$V = \frac{Q}{P} \times \dots \quad (1)$$

Where;

V = Economic Value,

Q = Quantity of *Dioscorea hirtiflora*,

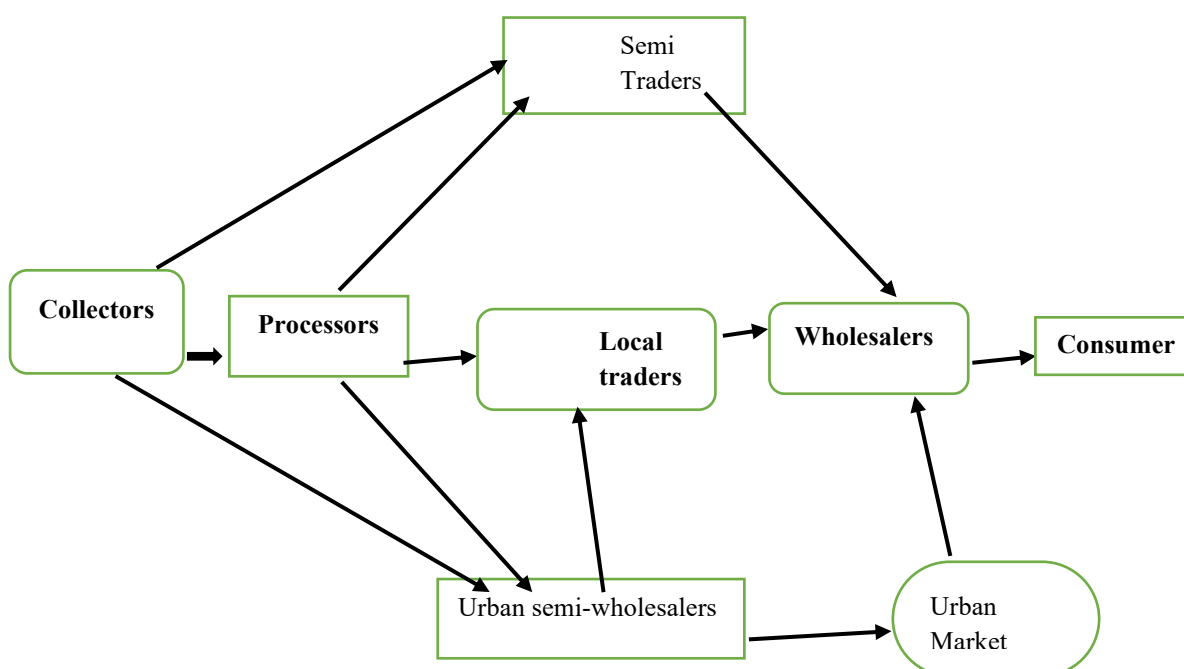
P = Average Price of *Dioscorea hirtiflora*.

RESULTS AND DISCUSSION

Key Stakeholders Engaged in the *Dioscorea hirtiflora* Collection, Utilisation, and Sales in Lindi and Mtwara.

According to the focus group discussion, the key stakeholders are collectors, processors, local traders, semi-traders, wholesalers, and consumers. The result shows that stakeholders involved in Ming'oko collection, consumption, and sales are mainly categorised into two groups, those using Ming'oko for food (43.87%) and those using Ming'oko for business (56.13%) Figure 2).

Figure 2: *Dioscorea hirtiflora* Stakeholders' Value Chain



Amount Collected, Consumed, and Sold per Household (Overall average, per region average)

Table 1 shows that the average of 1342.109 kg in Lindi and 1732.667 Kg in Mtwara of *Dioscorea hirtiflora* was collected by the selected

households. An average of 415.976 kg in Lindi and 674.849 kg in Mtwara of *Dioscorea hirtiflora* were consumed by the sampled households from the total quantity collected, and the rest of the quantity, 926.133 kg in Lindi and 1057.818 was sold in the market.

Figure 3: Mean Quantity Collected

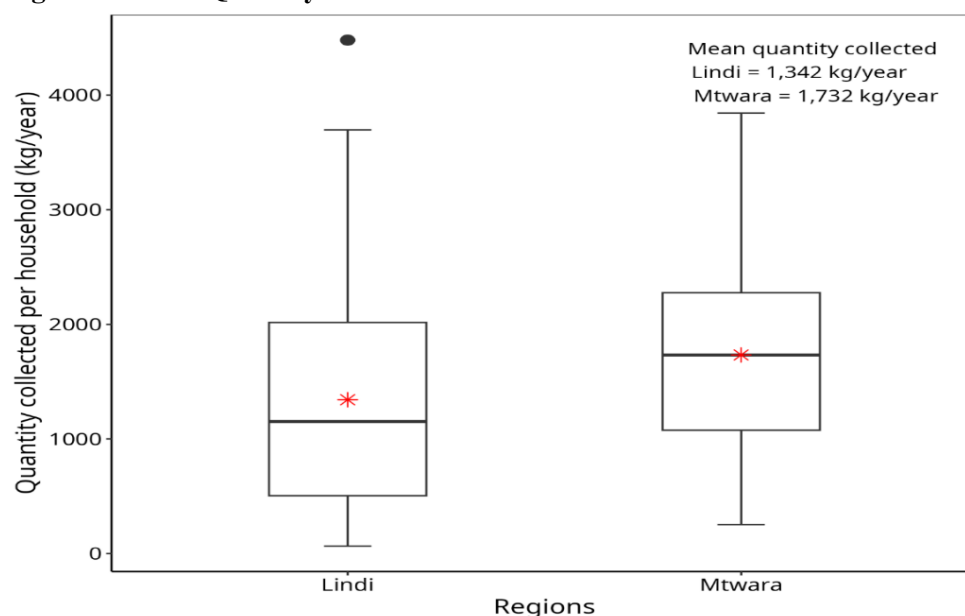


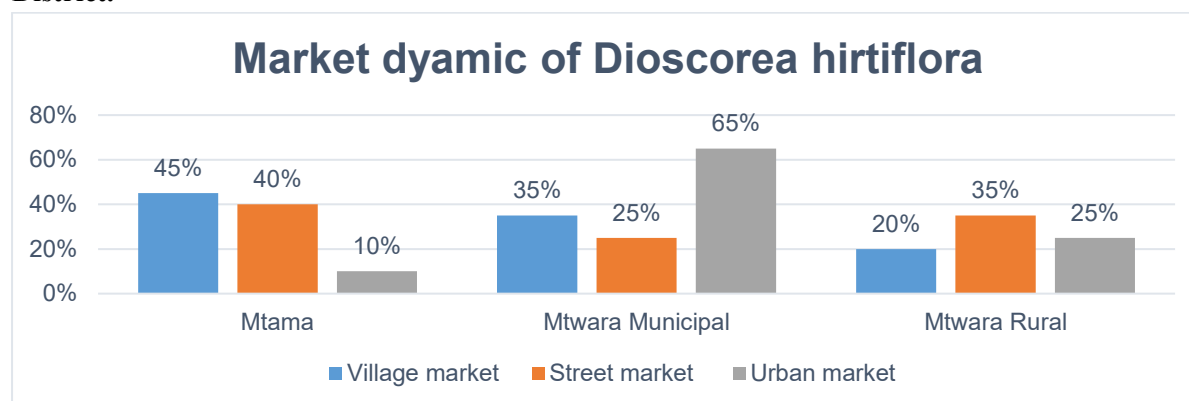
Table 2: Quantity of *Dioscorea hirtiflora* Collected, Consumed and Sold.

Region	Quantity Collected(kg)	Quantity Consumed(kg)	Quantity sold (kg)	% Consumed	% Sold
Lindi	1342.11	415.98	926.13	30.99	69.00
Mtwara	1732.67	674.83	1057.82	38.94	61.05
Total	3074.78	1090.825	1983.95	35.47	64.52

Market Dynamics of *Dioscorea hirtiflora* in Lindi and Mtwara Region

The findings indicate that in Lindi, 45% of *Dioscorea hirtiflora* is sold in street markets, 40% in local markets, and 10% in urban markets. In

Mtwara Municipal, 35% is sold in village markets, 25% in street markets, and 65% in urban markets. Meanwhile, in Mtwara Rural, 20% is sold in village markets, 35% in street markets, and 25% in urban markets. (Figure 4 below).

Figure 4: Sales Outlets Used by Rural Households Who Sold *Dioscorea hirtiflora* Tubers in Each District.

a) The average Income per household yearly is Lindi = $1342.109 \times 1100 = 1,476,319.9$ Tsh collected:

Mtwara = $1732.667 \times 1087.5 =$

Average income = Average quantity collected x 1,884,275.3625 Tsh

Average price

Table 4: Average Income from *Dioscorea hirtiflora* Collected by Region

Region	Average quantity collected (kg)	Average price	Average income (Tsh)
Lindi	1342.109	1100	1,476,319.9
Mtwara	1732.667	1087.5	1,884,275.4

On average, the amount contributed to the income of the people in Mtwara per household due to their involvement in the value chain of Ming'oko is almost 1,476,319.9 Tsh per household per year,

while in Lindi, the contribution of Ming'oko to the household income per year is almost 1,884,275.4 Tsh per year.

	count	mean	std	min	25%	50%	75%	max
region								
Lindi	50.000	1100.000	156.492	700.000	1000.000	1000.000	1200.000	1500.000
Mtwara	48.000	1087.500	178.200	600.000	1000.000	1000.000	1200.000	1500.000

The average income per household per year was estimated by multiplying the average quantity collected by the average prevailing market prices. Therefore, in Lindi Region, the total average amount harvested per household was about 1342.109 kilogram, which, when you multiply by the average price of TZS 1100, YOU GET about TZS 1,476,320. On the other hand, in Mtwara Region, the average amount collected per year was about 1733 Kilograms, which is much higher than in Lindi. So, multiplying it by the average

market price of TZS 1087.5 per kilogram, you get an income of about TZS 1,884,275 per year.

DISCUSSION

Key Stakeholders Engaged in the *Dioscorea hirtiflora* Collection, Utilisation, and Sales in Lindi and Mtwara.

Dioscorea hirtiflora, locally known as Ming'oko, is a wild yam species widely utilised by rural households in Lindi and Mtwara. Local people in these regions tend to collect *Dioscorea hirtiflora* for both domestic- consumption and for sales.

According to the key informants, the main stakeholders include collectors, processors, local traders, middlemen, and consumers. Increasing access to NTFP-selling outlets may be achieved through information dissemination, empowerment of collectors, and establishment of linkages between collectors and traders. (Bista and Webb, 2006). Ming'oko are being harvested from farms. Some of the harvesters (collectors) process them, while others do not. The collected Ming'oko end at the family level for food consumption (subsistence). Others are selling them to buyers either in processed or unprocessed form. Buyers are further taking these Ming'oko to the Local Market and Regional Market to sell them to consumers for food at a reasonably high price compared to the buying price. Moreover, some of these buyers are buying *Dioscorea hirtiflora* for food at their families. Middlemen traders are seen as important stabilisers of prices as long as fair trading practices are followed. One of the most powerful actors of the value chain is intermediaries who have a strong influence in NTFP marketing, because they are mandated by the wholesalers who give them money and, most of the time, some materials, and they go to the forest to get products from the collectors (Ngansop T.M et al., 2019).

Amount Collected, Consumed, and Sold per Household (Overall average, per region average)

The average amount of *Dioscorea hirtiflora* collected per household in Lindi and Mtwara is approximately differs, with Mtwara collecting a higher quantity of *Dioscorea hirtiflora* compared to those in Lindi, with Mtwara collecting about 390.558 kg more (Table 2). According to Ruffo et al. (2002), edible wild plants have multiple uses; that is to say, one plant can be used as a fruit, medicine, or firewood. From the total *Dioscorea hirtiflora* collected, households consumed almost a quarter of the harvest in both regions. Lindi consumed approximately 415.98kg, which is about 30.99% of the total amount collected, while Mtwara consumed approximately 674.85kg, which is about 38.94% of the total amount collected. This suggests that *Dioscorea hirtiflora*

is an important food source for these households, providing a substantial portion of their dietary needs. The remaining quantities were sold in the market, where Lindi sold about 926.13kg of their harvest, which is equal to 69% and Mtwara sold about 1057.82kg of their annual harvest, which is equivalent to 61.05%. A high proportion of rural households across all four districts collected and consumed wild *Dioscorea hirtiflora* tubers, with over half also selling tubers (Zulu et al, 2019). This indicates that a significant portion of the crop is marketed and sold commercially, hence contributing to the household income. The high consumption rates in both regions highlight the role of *Dioscorea hirtiflora* as a staple food, contributing to household food security, and more than half of the harvest is sold, indicating that *Dioscorea hirtiflora* also serves as a vital source of income for these households.

The market distribution is broken down by three distinct market types, each with a specific percentage representing its contribution to the total market activity for this particular crop. The local market operates within the local area of Mtama, where *Dioscorea hirtiflora* is sold in smaller quantities or to a community that directly consumes the crop. The 45% refers to the portion of total *Dioscorea hirtiflora* sales or trading occurring in this market. Local markets are crucial for rural economies. On the other hand, the urban market is located in the urban area of Chuno, in Mtwara Municipality, and is the largest market in terms of *Dioscorea hirtiflora* sales, accounting for about 65% of the market activity (Figure 3). Urban markets often have more buyers and sellers, making it a dominant market for *Dioscorea hirtiflora*. The street markets in the wider Mtwara District represent the informal or open-air market spaces where *Dioscorea hirtiflora* is sold directly to consumers. These markets typically account for about 35% of the total market share for the crop. These results are similar to those of Zulu D. et al. (2012), Kasulo et al (2009) and El Tahir, B. A and Vishwanath, A. (2015). who reported on market availability. In their findings, they state that markets provide the opportunity to generate income and also drive

production to meet consumer demand in terms of quantity and quality.

Income Generated from the Collected or/Harvested *Dioscorea hirtiflora*

The data shows that the average annual income from *Dioscorea hirtiflora* for surveyed households is TZS 1680297.65, representing a substantial 50% of their total income. This highlights the species' critical economic role for these households. When comparing the two regions, Mtwara has a slightly higher average income from *Dioscorea hirtiflora*, totalling about (TZS 1,884,274), than Lindi, with a total of (TZS 1,476,320) (Table 4). Wild tubers, including *Dioscorea hirtiflora*, play a crucial role in the livelihood of communities, contributing to food security and income generation (Zulu et al., 2019 and Dovie, 2003). However, Lindi households derive a larger share of their total income from this yam, with an average contribution of 92.01%, compared to 74.95% in Mtwara. Incomes from NTFPs complement other means of income and serve as a means of livelihood to poor families (Maiguru, 2023).

CONCLUSION AND RECOMMENDATIONS

Conclusion:

Dioscorea hirtiflora collected, consumed, and sold were quantified from the study area. These products are useful in the day-to-day life of the local communities surrounding the study area. The *Dioscorea hirtiflora* stakeholders' value chain is complex in collection, consumption, and sales, with multiple actors involved. Profit margin of the main collectors is very low; the market structure is very complex, hence reducing profitability to the rural communities involved in the business.

Recommendations:

Therefore, it is recommended that the government and NGOs should recognise *Dioscorea hirtiflora* business in the national income statistics and set good strategies and properly implement them by involving all stakeholders involved in the collection, consumption, and sales of *Dioscorea hirtiflora* in Lindi and Mtwara regions, Tanzania.

Conflict of Interest

None declared

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