

Non-Wood Forest Products (NWFPs) and Their Role in Rural Development and Poverty Reduction in North Darfur State, Sudan

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Abstract

This study was conducted in North Darfur State (El Fasher Locality), which is located in the western part of the Republic of the Sudan, it is one of the largest States in Sudan. The area is characterized by semiarid climatic conditions (the annual rainfall between 75-600 per year; the average temperature varies between a mean minimum of 17.7° C in winter and a mean maximum of 34.7° C in summer). The study was conducted during the period of November 2015 to August 2016 aiming to assess the contribution of Non Wood Forest Products (NWFPs) some fruits to income generation and food security. The primary data for the study was collected through field visits, observations, questionnaires and group discussions. The secondary data was collected from reports, books and scientific journals. The data was analyzed using the program of Statistical Package for Social Sciences (SPSS), descriptive statistics including frequencies and the percentages was used. Results showed that the average profits per person per year in El Fasher markets from fruits of (*Adansonia digitata*, *Balanites aegyptiaca*, *Grewia tenax*, *Hyphene thebaica*, *Tamarindus indica* and *Zizyphus spina Christi*) are (15218.2SDG), (497.3SDG), (9125.0SDG), (4280.0SDG), (2556.4SDG), (1656.0SDG), respectively, while the average profits per person per year in El Fasher rural markets from fruits of (*Balanites aegyptiaca*, *Grewia tenax* and *Zizyphus spina Christi*) are (46.5 SDG, 108.5 SDG, , 68.6 SDG) respectively. The study concluded that the forest fruits are playing an important role in the household food security, and income generation. However, by collecting and selling forest fruits, people can raise their income and enhance their livelihoods. Hence, NWFPs plays an important role in the livelihoods of rural people in North Darfur State. The study recommended encouraging the farmers to grow trees of forest fruits in their farms, like *Grewia tenax* which is fast growing species and has the highest market value.

Keywords: non wood, farmers, market, rural development, poverty reduction

INTRODUCTION

Forests and trees out-side the reserved forests contribute to the livelihoods of more than 1.6 billion people (FAO, 2010). With a new understanding of the value of indigenous fruit trees in providing food security and meeting nutritional needs, trees and shrubs are providing a multitude of useful products, such plants will receive more attention, because they are found naturally and traditionally managed in Africa forests and woodlands. Also they perform a good sources of nutrients, protein and fiber than common fruits and vegetables for rural population (Abdel-Rahman et al., 2014).

The positive contribution of NWFPs to rural livelihoods is broadly acknowledged (FAO 1995). Trading on Non-timber forest products (NTFPs) for income generation is not new, tree fruits are examples of some available NTFPs that may be found for sale in the vast majority of the rural markets and nearby Towns and Cities. The importance of NWFPs in contributing to rural livelihoods and alleviating rural poverty is well known (FTP, 2000). It is estimated that about 60 million people are highly forest dependent in Latin America, West Africa and South east Asia, with an

additional 400 to 500 million people especially communities living inside and on the fringes of forest areas depend on NWFPs for food, shelter, medicine, and cash income. Apart from meeting subsistence and cash income needs of the dependent communities, NWFPs also support large number of small to large-scale enterprises engaged in processing and/or trading of NWFP based products (Ibrahim et al., 2015). Indeed, in many countries little national level information, based on empirical study, exists that quantifies the contribution of local trade in tree fruits to household income and employment, reliably assesses their role or examines their potential for rural economic development. (Adam and Pretzsch, 2010). The majority of harvested NWFPs are used for meeting food, nutrition and health care requirements. Some fill a part of seasonal income gaps and others are integrated into the market economy, forming an important source of household income (Hansda, 2009, Eltom, 2006, Abdualrahman et al, 2011, Gebauera et al, 2002, Agustino et al, 2011, Aboshora et al, 2014, Bukar et al, 2015, Idrees et al, 2015, Maruod et al, 2015, Tesfaye, 2015, Sharma and Patni, 2012).

North Darfur State is affected by the rain shortage and drought since the beginning of the seventies to mid-eighties of the last century and successively thereafter, until 2000. Where people mostly depend on agriculture for food and income, but the situation have been more aggravated by the recent conflicts and displacement, which led to the loss of agricultural production. These large scale movements created serious problems in the form of, shortage in food, fodder, environmental services and the sources of income. Therefore people start to seek for other alternatives, such as collection and trade of NWFPs (fruits) (Siam et al, 2014, and Khalil 2014).

The emergence of humanitarian crisis in Darfur in 2003 between the Government of Sudan and the armed movements and due to attack and counter attack between them put the area under serious conflicts. This conflict created the world's most desperate humanitarian situation as an estimated 3.6 million out of the 6.8 million people in Darfur are affected by the crisis particularly the rural farmers. There are more than two million internally displaced peoples (IDPs) and approximately 200,000 refugees have fled to the neighboring countries. Due to these reasons majority of the rural farmers are now living IDPs in camps depending on food aid provided by the UN agencies and NGOs organizations. Even those who remain at their homelands were affected by these conflicts and they have ceased farming because their lands are not accessible due to security situation, so they are also depend on the provided food aid.

In Darfur the consumption of wild-food plants seems to be one of the important local survival strategies and appears to have intensified due to the repeated climatic shocks hampering agricultural production and leading to food shortages. Increased consumption of wild-foods enables people to cope better with erratic, untimely rains and drought for several consecutive years without facing severe food shortages, famine and general asset depletion. The key to this strategy for survival is the collection, storage and consumption of wild plants in uncultivated lowland areas such as bush, forest and pastoral land as well as the domestication of a great variety of these indigenous plants and trees for home consumption.

Non wood forest products in North Darfur include gums and fruits like 'Aradaib' (*Tamarindus indica*), 'Dom' (*Hyphaene thebaica*), 'Gungulaze' (*Adansoniadigitata*), 'Lalob' (*Balanites aegyptiaca*), 'Nabak' (*Ziziphus spina-christi*) and *Gidame* (*Grewia tenax*) are available over the whole year in El Fasher markets, because of a high demand and their excellent storage capacity and they are very important as food and sources of income for the rural population (Abdalla 2016, Siam et al, 2011, Salih and Yahya, 2015, Seleem, 2015 and Ahmed et al, 2012).

However, this study was mainly emphasized on the socioeconomic of the Non wood forest product with the aim of providing sufficient information concerning the contribution in increasing income, they pay a role in the daily life apart from meeting food subsistence, cash income needs of the dependent communities and source of additional food.

MATERIALS AND METHODS

El Fasher is located in Northern Dar Fur State, western part of the Republic of the Sudan between latitude 12° 20' N and longitude 24° 27' E. North Darfur is one of the largest States in Sudan, with total area of about 296 420 km², most of its parts in the north, east and central are desert and semi-desert lands, extended in the hills of mountainous volcanic chains of Jebel Marra series.

The Prevailing climate in the State is arid and semi-arid, hot in summer and cold in winter, the mean minimum and maximum temperatures are 17.7 C° and 34.7C° respectively. Average rainfall ranges between 75-300 mm/year, rain falls between July and September (Meteorological Station, El Fasher, 2015).

The study area is characterized by fluctuating rainfall from season to another and multiple types of vegetation prevail, including trees, shrubs, herbs and grasses. The main types of trees and shrubs include *Balanites aegyptiaca*, *Ziziphus spina-Christi*, *Boscia senegalensis*, *Grewia tenax*, *Prosopis juliflora*, *Boscia angustifolia*, *Acacia tortilis*, *Acacia ehrenbergian*, *Salvadora presica*, *Acacia raddiana* and *Commiphora africana*, while herbs and grasses are *Cenchrus sp.*, *Eragrostis sp.*, *Aristida mutabilis* and *Aristida funiculata*.

Population of North Darfur State Consist of different tribes such Barti, Mima, Zaghawa, Arab and other tribes. The population estimated to be about 2,113668 persons (Office of Statistics and information, North Darfur, 2015).

The main activities in North Darfur State are agriculture, grazing, trading and handcrafts and employment in government jobs. Farmers practice cultivation of millet, sorghum, sesame and groundnuts during the rainy season besides keeping livestock.

Data for this study was collected throughfield visits, observations, questionnaires and group discussions. Market survey through interviews using a structured questionnaires, where 40 merchants were interviewed in five markets in EL Fasher locality (Nivasha, El Fasher main market, Almwashi, Umdofoso and Zamzam)and 30 collectors were interviewed in four villages around El Fasher rural areas, namely; Hilaila, Karkar, Adwa, and Um Mraheek villages.

Also group discussions were held out in these villages to collect information from the collectors at the local level through checklist about the uses, benefits, consumption and importance of forest fruits, income generation and food security for households in the study area.

Secondary data for the study was obtained through the review of literature including text books, journals, reports and previous studies. The collected data was analyzed using the Statistical Package for Social Sciences (SPSS) software (Ver. 11.5) by computing descriptive statistics including frequencies and the percentages was used, further Analysis of Variance (ANOVA) was carried out.

RESULTS AND DISCUSSION

Table (1) shows the socio-economic characteristics of the respondents in the study area. The family size ranges between 1-11 persons as indicated by the majority of the respondents (100%). Generally the female respondents are higher than the males, 65.0% female and 35.0% males in El Fasher markets and 83.3% females and 16.7% males in El Fasher rural markets. Concerning the education level of the respondents in El Fasher markets, majority of them are attained Khalwa level 45.0%, illiterate 25.5%, Primary School 22.5%, Intermediate School 5.0% and University and above 2.5%, respectively. Where for El Fasher rural markets, 40.0% Khalwa, 23.3% illiterate, 26.7% Primary School, 6.7% Secondary School and 3.3% University and above. In comparison between El Fasher markets and El Fasher rural markets, for most of the respondents the education level is Khalwa, but there is only one respondent has attained University level. In comparison between the merchants and collectors, Trading is the main occupation for the all merchant respondents but farming is the main occupation for most of the collector respondents. Nearly all the respondents in the study area use forest fruits to increase income, all the merchants obtaining forest fruits through purchasing but all the collectors obtaining them through direct collection, the Standard of living after collection or trading fruits for most respondents is better.

Type of fruits, method and season of collection, markets and uses of some forest fruits, which are used as food, are explained in Tables (2) and (3). There are six forest fruits used as drinks, therapy and eaten in the study area, as indicated by all (100%) respondents in El Fasher markets and 100% respondents in El Fasher rural markets. Table (2) showed the most existing fruits in El Fasher main market as indicated by 30.0% of the respondents, then followed by Nivasha market according to 7.5% of the respondents, Almwashi market 15.0%, Umdofoso market 15.0% and Zamzam market 12.5% respectively. The types of fruit species include

(*Adansonia digitata*, *Balanites aegyptiaca*, *Grewia tenax*, *Hyphaene thebaica*, *Tamarindus indica*, *Ziziphus spina-christi*), which are available in AL Fasher markets, but only three species exist in AL Fasher rural markets (*Balanites aegyptiaca*, *Grewia tenax* and *Ziziphus spina-christi*).

Table 1: Socio-economic characteristics of the respondents in El Fasher markets and El Fasher rural markets

Socio-economic parameters	El Fasher markets	El Fasher rural markets
Family size range	1-11	2-10
Sex		
Female	26(65.0)	25(83.3)
Male	14(35.0)	5(16.7)
Education		
Illiterate	10 (25.5)	7 (23.3)
Khalwa	18 (45.0)	12(40.0)
intermediate	2(5.0)	-
Primary School	9 (22.5)	8 (26.7)
Secondary School	-	2 (6.7)
University and above	1 (2.5)	1 (3.3)
Main occupation		
Farmer	-	21 (70.0)
Traders	40(100.0)	4 (13.3)
Collectors	-	5 (16.7)
The purpose of Use forest fruits		
Increase income	40 (100.0)	30 (100.0)
Personal consumption	-	-
Other	-	-
Obtaining of forest fruits		
Through direct collection		30 (100.0)
Purchased	40 (100.0)	
Other means		
Standard of living after collection or treading fruits		
Best	29(72.5)	30(100.0)
No change	11(27.5)	

- Figures in the parenthesis indicate percentage

In Table (3), the forest fruits that commonly used by the households in the study area are shown. *Tamarindus indica* is the most existing type in El Fasher market compared to the other types, as indicated by 25.3%, of the respondents in El Fasher markets, then followed by *Hyphaene thebaica* 18.7%, *Grewia tenax* 17.5%, *Balanites aegyptiaca* 14.3%, *Adansonia digitata* 12.1% and *Ziziphus spina-christi* 12.1%, figure (1).

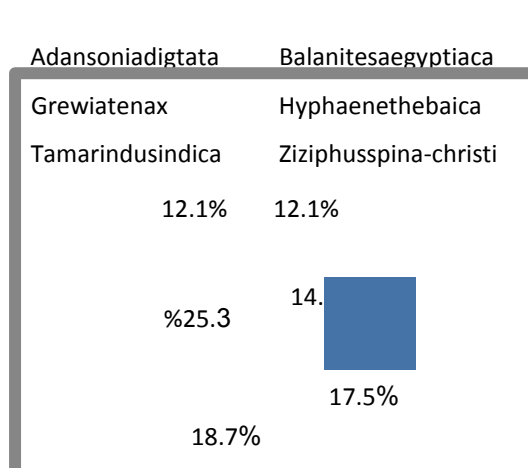


Figure (1): Types of existing fruits in El Fasher markets.

Table (1) shows the methods, purposes and season of collection of forest fruits. Collection methods include hand picking (directly from the tree or from the ground after ripening and falling down from the tree), by shaking the tree (by any means and then collection of the fallen fruits from the ground) and by dropping. These extraction methods are not destructive as do the other methods like breaking the branches or cutting down the tree. The Collection methods of *Balanites aegyptiaca* include dropping 43.3% and picking 56.7%, For *Grewia tenax* it is mostly shaking as stated by the respondents 100%, for *Ziziphus spina-christi* dropping 40.3%, picking 47.7%, and shaking 13.3%. The collection season varies according to plant species as shown in Table (4). *Balanites aegyptiaca* is mostly collected during summer, *Grewia tenax*, and *Ziziphus spina-christi* were collected during the winter. The purpose of fruits collection is to increase income as stated by 100% of the respondents.

Table (2): Areas of covered by study in El Fasher markets and El Fasher rural markets.

- Figures in the parenthesis indicate percentage

Table (3) show the uses of fruits in El Fasher markets and El Fasher rural markets, where *Adansonia digitata* fruits used in El Fasher markets as drinks according to 90.9% of the respondents and therapy 9.1%. *Balanites aegyptiaca* fruits used in El Fasher

	El Fasher markets	El Fasher rural markets
Areas		
1	Nivasha market 11(27.5)	Karkar 6(20.0)
2	AL Fasher main market 12(30.0)	Ummaraheak 10(33.3)
3	Almwash 6(15.0)	Adwa 8(26.7)
4	Umdofoso 6(15.0)	Hilaila 6(20.0)
5	Zamzam 5(12.5)	-
Types of fruits		
	<i>Adansonia digitata</i>	<i>Balanites aegyptiaca</i>
	<i>Balanites aegyptiaca</i>	<i>Grewia tenax</i>
	<i>Grewia tenax</i>	<i>Ziziphus spina-christi</i>
	<i>Hyphaene thebaica</i>	
	<i>Tamarindus indica</i>	
	<i>Ziziphus spina-christi</i>	

markets as eaten food 70.6% and therapy 29.4%, while it is used in El Fasher rural market as eaten food 53.3% and therapy 46.7%, *Grewia tenax* fruits are used in El Fasher markets as drinks according to 100% of the respondents and in El Fasher rural market also as drink according to 40.0% and therapy 60.0%. *Hyphaene thebaica* fruits are used in El Fasher markets as drinks 76.5% and therapy 29.4%. *Tamarindus indica* fruits are used in El Fasher markets as drinks 78.3%, and therapy 47.9%. *Ziziphus spina-christi* fruits used in El Fasher markets and El Fasher rural markets as eaten food according to 100% of the respondents.

Table (3): Types and uses of forest fruits exist in studied area in El Fasher markets and El Fasher rural markets.

Fruits	Type exist in the merchants collectors	uses	
		El Fasher markets	El Fasher rural markets
<i>Adansonia digitata</i>	11(12.1)	Drinks 10(90.9) Therapy 1(9.1)	-
<i>Balanites aegyptiaca</i>	13(14.3)	Eaten 12(70.6) Therapy 5(29.4)	Eaten 16(53.3) Therapy 14(46.7)
<i>Grewia tenax</i>	16(17.5)	Drinks 17(100)	Drinks 12(40.0) Therapy 18(60.0)
<i>Hyphaene thebaica</i>	17(18.7)	Drinks 13(76.5) Therapy 5(29.4)	-
<i>Tamarindus indica</i>	23(25.3)	Drinks 18(78.3) Therapy 11(47.8)	-
<i>Ziziphus spina-christi</i>	11(12.1)	Eaten 11(100)	Eaten 11(100)

Table (4): Forest fruits, purposes of collection, methods and season of collection in El Fasher markets

Scientific name	Arabic name	Season of collection	The purposes of fruits collection	Collection method
<i>Balanites aegyptiaca</i>	Haglieg	Dec-July	Increase income 30(100)	Dropping 13(43.3) picking 17(56.7)
<i>Grewia tenax</i>	Gidame	Nov -Feb	Increase income 30(100)	Shaking 30(100)
<i>Ziziphus spina-christi</i>	Sidir	Nov -Jan	Increase income 30(100)	Dropping 12(40.0) picking 14(46.7) Shaking 4(13.3)

In Tables (5), and (6), purchase and selling prices and quantities of forest fruits in El Fasher markets and El Fasher rural markets are shown

Table 5: Forest fruit quantities, purchase and selling prices and profits per year in El Fasher markets

Fruits	Purchase price per year SDG	Selling price per year SDG	Quantity sold per year (kg)	Profit per year SDG
<i>Adansonia digitata</i>	44443.6±14824.07	59661.8±18569.74	2192.7±749.6	15218.2±4275.9
<i>Balanites aegyptiaca</i>	1338.3±236.8058	1835.6±335.2803	411.4±80.7	497.3±105.8
<i>Grewia tenax</i>	28375.0±4568.9167	37500.0±6387.0393	956.3±160.2	9125.0±1889.5
<i>Hyphaene thebaica</i>	10720.00±1938.1366 d	15000.0±3004.1216 d	1468.2±245.14 d	4280.0±1138.4 d
<i>Tamarindus indica</i>	5453.7±1656.0656 e	8010.1±2766.2124 e	920.4±306.01 e	2556.4±1117.6 e
<i>Ziziphus spina-christi</i>	4176.0±360.5551 f	5832.0±882.3020 f	720.0±128.43f	1656.0±267.1 f

The average quantity sold per year of *A. digitata* in El Fasher markets was found to be (2192.7 kg), and the average purchase price found was (44443.6 SDG), while the average selling price was (59661.8SDG) and the average profit found per year was (15218.2SDG). No significant difference was found between EL Fasher markets and within each market, in the purchase, selling prices, quantity sold per year and profit found per year.

For *B. aegyptiaca* the average quantity sold per year was (411.4kg), and the average purchase price was (1338.4 SDG), while the average selling price was (1835.6SDG), and the average profit per year was (497.3SDG). No significant difference was found between EL Fasher markets and within each market, in the purchase, selling prices, quantity sold per year and profit found per year.

The average quantity sold per year of *G. tenax* was (956.3kg), and the average purchase price was (28375.0SDG), while the average selling price was (37500.0SDG) and the average profit per year was (9125.0 SDG). No significant difference was found between EL Fasher markets and within each market, in the purchase and selling prices, quantity sold per year and profit found per year.

Concerning *H. thebaica* fruits, the average quantity sold per year was (1468.2kg) and the average purchase price was (10720.00 SDG/kg), while the average selling price was (15000.0 SDG/kg) and the average profit per year was (4280.0 SDG/kg). Significant difference was found between EL Fasher markets and within each market, in the purchase and selling prices, quantity sold per year and the profit per year.

The average quantity sold per year of *T. indica* was (920.4kg), and the average purchase price was (5453.7SDG), while the average selling price was (8010.1SDG), and the average profit per year was (2556.4SDG). Significant difference was found between EL Fasher markets and within each market,

in the purchase and selling prices, quantity sold per year and the profit per year.

For *Z. spina-christi* the average quantity sold per year was (720.0 kg), and the purchase price was (4176.0 SDG), while the average selling price was (5832.0 SDG/), and the average profit per year was (1656.0 SDG). Significant difference was found between EL Fasher markets and within each market, in the purchase and selling prices, quantity sold per year and the profit per year.

In Table (5) the results showed that the highest value for the average purchase and selling prices per year found was for *A. digitata*, in El Fasher markets (59661.8 SDG) and (44443.6 SDG), respectively. While the lowest average selling and purchase prices found was for *B. aegyptiaca* (1835.6SDG) and (1338.3 SDG), respectively figure (2).

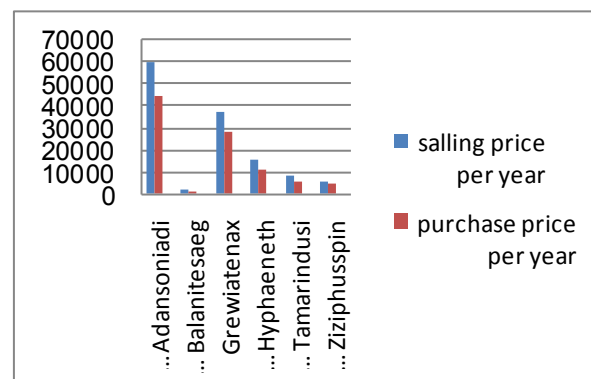


Figure 2: Selling and purchase prices per year for the different fruits in El Fasher markets.

The highest average quantity sold per year was (2192.7 kg) for *A. digitata*, in El Fasher markets and the lowest found was (411.4kg) for *B. aegyptiaca*, in El Fasher markets, figure (3).

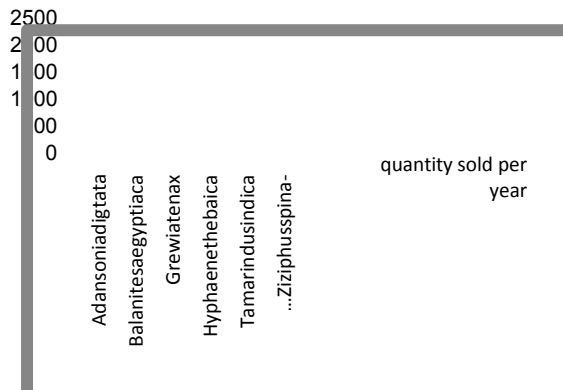


Figure 3: Quantity sold per year for the different fruits in El Fasher markets

The highest average profit per year found was for *A. digitata*, (15218.2 SDG), followed by *G. tenax*, (9125.0 SDG), *H. thebaica*, (4280.0 SDG), *T. indica*, (2556.4 SDG), *Z. spina- christi*, (1656.0 SDG), and *B. aegyptiaca*, (497.3 SDG), respectively, figure (4).

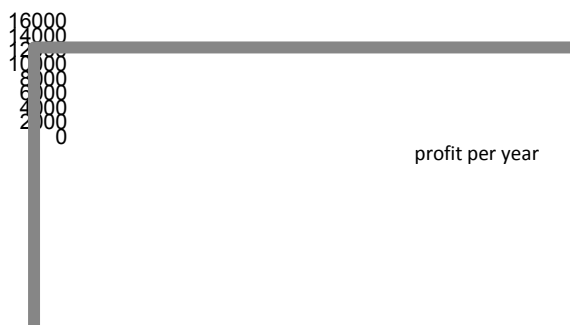


Figure 4: Profit per year for the different fruits in El Fasher markets.

Table (6): Selling prices and profit per year of fruits collected in El Fasher rural markets.

Fruits	Quantity of collection per year (kg)	Cost of collection (SDG)	The selling price (SDG/kg)	Profit per year (SDG)
Balanites aegyptiaca	11.15	-	4.2± .2	46.5±5.8
Grewia tenax	3.83	-	28.4± .4 a	108.5±6.0
Ziziphus spina-christi	8.50	-	8.1± .4	68.6± 8.5

Table (6) explained The average selling prices and profit for fruits collected per year in El Fasher rural markets, The average selling price of *B. aegyptiaca*, found was (4.2 SDG/kg). The average quantity collected per year was (11.15 kg) and the average profit per year was (46.5 SDG). No significant difference was found between EL Fasher rural

markets and within each market, in the Selling prices and in the profit per year.

The average selling price for *G. tenax* found in El Fasher rural markets, was (28.4 SDG/kg). The average quantity collected per year per person was (3.83 kg) and the average profit per year was (108.5 SDG). A significant difference was found between EL Fasher rural markets and within each market, in the selling prices, while no significant difference was found, in the profit per year.

The average selling price for *Z. spina-christi* found in El Fasher rural markets, was (8.1 SDG). The average quantity collected per year per person was (8.50 kg) and the average profit per year was (68.6 SDG). No significant difference was found between EL Fasher rural markets and within each market, in the selling prices and also in the profit per year.

In El Fasher rural markets the highest value of the average selling price and highest value of the average profit per year found was for *G. tenax* (28.4 SDG) and (108.5 SDG), respectively. While the lowest values found were for *B. aegyptiaca*, (4.2 SDG) (46.5 SDG) respectively. The highest average quantity collected per year per person was (11.15 kg) for *B. aegyptiaca*, while the lowest quantity was (3.83 kg) for *G. tenax*, figure (5).



Figure 5: Selling prices, collected quantities and profit per year of fruits in El Fasher rural markets.



Photo 1: Fruits of *Adansonia digitata* (Tabaldy) in El Fasher markets.



Photo 4: Fruits of *Hyphaene thebaica* (Dome) in El Fasher markets.



Photo 2: Fruits of *Balanites aegyptiaca* (Haglieg) in El Fasher markets.



Photo 5: Fruits of *Tamarinds indica* (Ardabe) in El Fasher markets.



Photo 3: Fruits of *Gerwia tenax* (Gidame) in El Fasher markets.



Photo 6: Fruits of *Zyziphus spina-christi* (Nabag) in El Fasher markets.

CONCLUSION

According to the study results, trading and collection of fruits contribute significantly to household income generation.

All these fruits (*Tamarindus indica*, *Adansonia digitata*, *Balanites aegyptiaca*, *Grewia tenax*, *Zizyphus spinaChristi*, *Hyphene thebaica* Photos1-6) gave positive contribution to income of household, but the type of fruits found in El Fasher markets were more than those in El Fasher rural markets.

Adansonia digitata is most profitable fruits for the traders in El Fasher markets, which found to be (15218.2SDG) per person per year and *Gerwia tenax* (108.5 SDG) per person per year is most profitable fruits for the collectors in El Fasher rural markets.

Adansonia digitata, *Hyphaene thebaica* and *Tamarindus indica*, are found in El Fasher markets but not found in El Fasher rural market, because no trees were found around El Fasher area.

Trading of forest fruits seems to be most profitable compared to the collection of fruits.

The extraction methods are not destructive compared to the other methods like breaking the branches.

Forest fruits contribute significantly to the food supply, particularly, in low income households. The majority of the households harvest forest fruits for domestic use and for sale as a primary source of income with the wealthy earning more than the poor. The availability of forest fruits plays an important role in rural livelihoods through ensuring food security, dietary diversity and sustained income.

Forest fruits are not only relevant for certain groups but for everyone in the community.

REFERENCES

- Abdalla, E. A., 2016. Contribution of Non-Wood Forest Products in Food Security and income generation for Rural households in North Dar Fur State, Sudan: Case Study of El Fasher Locality, MSc. Thesis, Al Fashir University, Sudan
- Abdualrahman, M. A. Y., Ali, A. O., and Suliman, A. M. A. 2011. Nutritional Evaluation of Guddaim Fruits (*Grewiatenax*) and its Utilization in Ice-cream Production.
- Abdel-Rahman, N. A., Awad, I. and Elrakha, E. B. B. 2014. Characterization of some Sudanese Edible Forest Fruits
- Aboshora, W., Lianfu, Z., Dahir, M and Gasmalla, M. A. A. 2014. Physicochemical, Nutritional and Functional Properties of the Epicarp, Flesh and Pitted Sample of Doum Fruit (*HyphaeneThebaica*).
- Adam, Y. O and Pretzsch, J. 2010. Contribution of local trade in *Zizyphus spina-christi* Fruits to rural household's economy in Rashad locality, Sudan.
- Agustino, S., Mataya, B., Senelwa, K and Enoch G. Achigan-Dako© African Forest Forum. 2011. Non-Wood Forest Products and Services for Socio-Economic Development.
- Ahmed, M. E., Hamid, H. B. B and Haydar E. 2012. Effects of *Grewiatenax* (*Guddaim*) as a natural food on the hemoglobin level and growth among displaced children of Darfur State, Western Sudan.
- Bukar, A. M., Kyari, M. Z., Gwaski, P. A., Gudusu, M., Kuburi, F. S and Abadam, Y. I. 2015. Evaluation of phytochemical and potential antibacterial activity of *Zizyphus spina-christi* L. against some medically important pathogenic bacteria obtained from University of Maiduguri Teaching Hospital, Maiduguri, Borno State – Nigeria.
- Eltom, N. N. E. H. 2006. The nutritive constituents and potentiality of fruits from *Adansonia digitata* (*Tabaldi*), *Grewiatenax* (*Guddeim*), *Tamarindus indica* (*Aradeib*).
- FAO. 2010. Forest trees and Livelihoods
- FAO. 1995. Non-wood forest products for rural income and sustainable forestry..
- FTP. 2000. The role of Non-Wood Forest Product food security and income generation.
- Gebauer, A., Jens, J., El-Siddig, K. and Eberta, G. 2002. The Potential of Under-utilized Fruit Trees in Central Sudan.
- Hansda, R. 2009. The outlook for Non-wood forest products in Asia and the Pacific by food and agriculture organization of the United Nations regional office for Asia and the Pacific Bangkok.
- Ibrahim, G. A., Abdalla, N. I and Fangama, I. M. 2015. Contributions of Non-Wood Forest Products to Household Food Security and Income Generation in South Kordofan State, Sudan.
- Idrees, B. S. M and Mohammed, S. M. 2015. Physicochemical Characteristics of Seeds of *Hyphaene thebaica* (L.) Mart.
- Khalil 2014 (AR). Uses of forest trees for treatments of certain diseases, economic, social and environmental in North Darfur state – Tawilla locality.
- Meteorological Station, El Fasher, 2015. Rainfall report, El Fasher, North Darfur, Sudan.
- Maruod, M. E., Ibrahim, S. M., Mahmoud, T. E and Hassan, A. A. A. 2015. Non-Timber Forest Products (NTFPs); A Pathway to Achieve Food Security and livelihood in El Salam locality in western sector localities of South Kordofan State, Sudan.
- Office of Statistics and Information, North Darfur, 2015. Report, North Darfur, Sudan
- Paul P, G. 2014. Local community perceptions of the importance of Non-Wood Forest Products in Tanzania.

- Salih, N. K-E. M. and Yahia, E. M. 2015. Nutritional value and antioxidant properties of four wild fruits commonly consumed in Sudan.
- Seleem, H. A. 2015. Effect of Blending Doum (*Hyphaenethebaica*) Powder with Wheat Flour on the Nutritional Value and Quality of Cake.
- Sharma, N. and Patni, V. 2012. *Grwiatenax* (Frosk.) Fiori. A traditional medicinal Plant with enormous economic prospective.
- Siam A.M.J., Elnour I.A., and Khamis M.A. (2011). The role of indigenous wild food plants in household food security: Case study: North Darfur State (Malliet, Malha and Umkaddada Localities) (unpublished).
- Siam A.M.J., Elnour I.A., and Khamis M.A. (2011). The role of indigenous wild food plants in household food security: Case study: North Darfur State (Malliet, Malha and Umkaddada Localities) (unpublished).
- Siam, A. M. J., Khamis, M. A. and El Nour I. A. 2014. Environmental and Socioeconomic Interactions of Wild Edible and Associated Woody Plants in North Darfur, *Journal of Al Fashir University for Applied Sciences*, Issue No.3, P.1-22, Sudan
- Tesfaye, A. 2015. *Balanites* (*Balaniteaegyptiaca*) Del., Multipurpose Tree a Prospective.
- Tukur, R and Rabi'u, M. 2013. An assessment of multi-purpose use of *AdansoniaDigitata* (Baobab tree) for sustainable development in the semi urban fringes of Dutsin mausinma katsina state Nigeria.