

CONSUMER'S PREFERENCES AND FACTORS AFFECTING THE URBAN DEMAND FOR BAOBAB (*ADANSONIA DIGITATA* L.) FRUITS IN SUDAN

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Abstract

The objective of the study was to recognize the baobab fruit consumers' preferences and factors affecting the urban demand. For this purpose, data was collected in 2015 from 100 and 150 fruit consumers in Elobeid and Khartoum markets, respectively, using structured questionnaire. Descriptive statistics (frequency and percentages) were used for data analysis. The study results reveal that there is demand for the baobab fruit and its secondary products, and thus substantial fruit pulp commercialization exists in Sudan. The most important attraction factor for the consumer is the nutritional value (vitamins) of the fruit pulp. The study suggests a need for promoting fruits processing, and this could further create a desire for domesticating and managing baobab trees in private farms and rural livelihoods improvement.

Key words: consumer preferences, demand determinants, NTFPs, tree fruits.

Introduction

Baobab (*Adansonia digitata* L.) grows naturally and is a typically scattered tree in the savannah, in fields and fallows, and is often associated with human settlements (Schreckenber 1999, Duvall 2007). The tree, of which many parts can be used as food (Gebauer et al. 2002), has an important role in contributing to family nutrition and food security, as well as to cash income generation particularly for marginalized rural communities (Jamnadass et al. 2011, Adam et al. 2012, Adam et al. 2013, Adam et al. 2015, Venter and Witkowski 2013). The fruit pulp is of high nutritional value, particularly for calcium and vitamin C (Stadlmayr et al. 2013, Bamalli et

al. 2014), has pre-biotic and antioxidant functions and high dietary fiber contents (Gebauer et al. 2002). It has been also mentioned in different African pharmacopoeias to treat malaria, ulcer, skin problems, fever, diarrhea and anemia (Diop et al. 2005, Caluwe et al. 2009), which is considered as the most important public health problems in Africa (FAO/WHO 2005).

The naturally low water content of the fruit pulp allows its long-term storage and later consumption in times of need and makes its transport to domestic and international markets easy (Gruenwald and Galizia 2005). Since 2008, dried baobab fruit pulp has been accepted as a novel food ingredient in the European Union,

as well as for the US market (CEC 2008, Wilkinson 2006, Jones 2007, FDA 2009). However, in many countries, fruits consumption is below recommended levels of the world. Wild fruits provide promising solutions for the so-called 'hidden hunger', which is currently affecting about 2 billion people over the world (IFPRI 2015). Wild fruits consumption in Sub-Saharan Africa range from about 100 g/person/day in Guinea, 71 g in Kenya, 64 g in Ghana, 55 g in Tanzania, 34 g Uganda, 30 g in Malawi, and 23 g in Mozambique (Ruel et al. 2005). These intake quantities are below the recommended daily amount of 200 g of fruits per person or 400 g of fruits and vegetables combined (WHO 2003). Nevertheless, studies on wild fruits consumption are limited (Keding et al. 2017). Thus, the objective of this paper was to investigate the baobab fruit consumers' preferences and factors affecting the consumer's urban demand.

Materials and Methods

Study area

The present study about *Adansonia digitata* fruits consumers' preferences, behavior and factors affecting the demand was conducted in Sudan (15° N and 30° E), which is situated in northeast Africa, with an area of 1,861,484 km² and total population of 35,482,233. It is bounded on the north by Egypt, on the northeast by the Red Sea, on the east by Eritrea and Ethiopia, on the south by South Sudan, Kenya, and Uganda, on the west by the Central African Republic and Chad, and on the northwest by Libya. In the northern plains and desert region, average temperatures range from 32 °C in winter (November to February) to 42 °C in summer

(March to June); the hottest months are May and June. In the central and southern regions, average temperatures are 27 °C to 29 °C. Rainfall decreases from south to north, the annual average varying from 1200 mm in the south to less than 10 mm in the north; the rainy season is from July to September. The acacia desert shrub and acacia short-grass shrub grow in the northern desert and the grasslands – in the west. The broad-leaved tropical woodland and forest region is in the most part in the southwest, where areas of luxuriant growth and closed forests are found; grass covers much of the steppe area of the southeast.

The principal study cities are Elobeid and Khartoum. Elobeid (13° 18' N and 30° 22' E) is located in the dry zone of central Sudan, North Kordofan state. The total population is about 340,940 (UNDP 2010). The city is approximately 600 km from the capital Khartoum. The city has one of the most important agricultural gum Arabic markets in Sudan. Khartoum (15° 33' N and 32° 32' E) is the capital of the country with total population of 4,286,000. The selected study cities provide contracting cases in terms of their socio-economic and other characteristics. Khartoum has higher population (12 %) of the national figure while Elobeid constitutes 0.96 % of the total country population. In addition, these cities were chosen because there are markets for baobab fruits.

Data collection and analysis

A consumer survey was conducted in two cities each in different state (Elobeid and Khartoum) to investigate fruits consumed including priorities, purpose of consuming, consumer's preferences (fruit attributes), consuming form and desired products, attitude to consumption of the fruit pulp, and

problem experienced by fruit consumers. A total of 250 consumers (100 in Elobeid and 150 in Khartoum) were randomly selected using structured questionnaire in 2014. The questionnaire was pre-tested and redesigned before use. Pre-testing involved five consumers in each city market on a convenience basis but from among the target group. To ensure ethical issues, effective communication, and improve reliability of the study results, a consumer was informed in advance about the study objectives, the voluntary nature of her/him in the research, what expected from her/him if she/he participates, and how her/his privacy will be respected. The study focused on consumer as a unit of analysis because findings at consumer level were expected to have stronger influence on the design of interventions on trading the fruits than perceptions at either collector or trader levels. Consumers are the primary architects of an industry through the decisions they make about products on market (Kohls and Uhl 1998).

Data analysis involved the process of arranging data into computer readable form for statistical analysis (coding), checking for mistakes and entering data into computer. Data was coded to obtain a limited set of attributes for a variable composition. Descriptive and inferential statistics involving frequency tables, and percentages were used for data analysis using SPSS and Microsoft Excel Programs.

Results

Socioeconomics characteristics of the respondents

The results show that sixty percent (60 %) of the consumers ($n=150$) are females in both study areas. The mean age for a

consumer of fruit is 45 years. Consumers' age distribution ranges from 18 to 65 years. The majority of the consumers are married. The average consumer household consists of five persons. The education level for the consumers ranges from no formal education (35.5 %) through primary school (30.4 %), higher secondary school (20.7 %) to university education (13.4 %). The annual average income for the consumer is SDG 12,000 (US\$ 2,068).

Consumers' preferences

A number of different types of wild fruits are traded and consumed in both Elobeid and Khartoum. At least 8 wild fruits are consumed. Table 1 shows the consumers' ranking of the wild fruits in the two market places, baobab fruit is the most commonly consumed. Consumers ranked *Adansonia digitata* fruit among the wild fruits with an overall mean ranking/score of 2.00 and 2.10 for Elobeid and Khartoum markets, respectively. It is followed by *Grewia tenax* (Forssk.) Fiori. fruit in both market places. The respondents said they like *A. digitata* fruit because it is easy to process into several products (e.g. juice). *G. tenax* fruit is the second most popular fruit in Elobeid and Khartoum. Based on the rankings, it seems that consumers use *A. digitata* and *G. tenax* fruits for similar purposes. Therefore, *G. tenax* fruit might be considered a competing fruit to *A. digitata*. For instance, in Khartoum the retailers observed that they can sell *G. tenax* fruit and *A. digitata* and still be able to satisfy the market. They mentioned the following fruits as the potential close substitutes for *A. digitata* fruit: *G. tenax* and *Tamarindus indica* L. in Khartoum. However, in Elobeid the retailers and consumers report no close substitutes to *A. digitata* fruit as it has historical and cultural uses in the region.

Table 1. Ranking of preferred wild fruits for consumption (n=250).

Scientific	Name of fruit tree	Local	Rank			
			Mean Score*		Position based on Mean (score/rank)	
			Elobeid (n=100)	Khartoum (n=150)	Elobeid (n=100)	Khartoum (n=150)
<i>Adansonia digitata</i> L.		Gongles	2.00	2.10	1	1
<i>Ziziphus spina-christi</i> (L.) Desf.		Nabag	3.75	3.81	4	5
<i>Blانيتes aegyptiaca</i> (L.) Delile		Lalob	4.50	4.00	6	6
<i>Grewia tenax</i> (Forssk.) Fiori		Guddeim	3.00	2.71	2	2
<i>Sclerocarya birrea</i> (A. Rich.) Hochst.		Humeid	4.00	5.00	5	8
<i>Hyphaene thebaica</i> (L.) Mart.		Dom	3.20	3.70	3	4
<i>Tamarindus indica</i> L.		Aradeib	4.56	3.21	7	3
<i>Borassus aethiopum</i> Mart.		Deleib	5.00	4.90	8	7

Note: * – calculated by adding the individual ranking by the respondent and dividing by total number of respondents. This means that the lower the mean the more popular the fruit is (a fruit positioned as 1 is more popular than one positioned 2 or 3 in ranking).n presents number of respondents.

Reasons for fruit consumption

Reasons for consuming the fruits are generally the same for the two study areas as reported by the respondents during the market survey. In both study areas, nutritional value (vitamins) and sweetness are the most popular reasons. In Elobeid, reasons for fruit consumption include vitamins (75 %), sweetness (20 %), cultural value (3 %), and snack value (2 %). In Khartoum, the chief purposes for fruit consumption are vitamins (90 %), sweetness (9 %), and snack value (1 %). The consumers in Khartoum didn't mention cultural value as reason for consuming the fruit. The fruit nutritional value is reported by the respondents as important reason behind the consumption of the fruit in both study areas.

Raw versus processed fruits

Based on study results, there is processing of *A. digitata* fruit in both study areas. The fruit is consumed both in raw and pro-

cessed form. The majority of consumers in Elobeid (67 %) and in Khartoum (80 %) consume the processed fruit, while only 30 % and 20 % indicated that they consume it raw in Elobeid and Khartoum, respectively (Table 2). When consumers are asked in which of the two forms they would want to consume the fruit, the majority prefer processed fruit. Table 2 shows different consumer consumption desires in the study areas. The majority of consumers would like to have rather processed fruits than raw.

Some respondents want raw fruit for reasons of safety and health, while the respondents who prefer processed fruit are for reasons of food security and value addition and having better products than raw on the market. The desired processed products for the consumers are juice, fine powder, jam and ice cream. A segment of the consumers is knowledgeable about the benefits of processing the *A. digitata* fruit into other products. Juice and jam are the most preferred in Khartoum, while consumers in Elobeid prefer only juice.

Table 2. Current and desired consumption by study markets.

Market (n=250)	Scenario	Consumption form			Total, %
		Raw, %	Processed, %	Raw & processed, %	
Elobeid (n=100)	Current	30	67	3	100
	Desired	20	70	10	100
Khartoum (n=150)	Current	20	70	10	100
	Desired	1	97	2	100

Factors influence fruit consumers' behavior

Table 3 explains ten attributes of *A. digitata* fruit and marketing environment the consumers consider when making decisions to purchase the fruit. The two attributes mostly valued by consumers are

taste and cleanness of the fruit. About 90 % of the consumers in Elobeid and 88.5 % in Khartoum mentioned taste of the fruit as the strongest factor considered. Cleanness of the fruit is considered strongly by 80 % of the consumers in Elobeid and 77 % of the consumers in Khartoum.

Table 3. Comparison of factors considered by consumers when buy *Adansonia digitata* fruit.

Attributes	Respondents, % (n=250)					
	Strongly considered		Considered		Not considered	
	Elobeid (n=100)	Khartoum (n=150)	Elobeid (n=100)	Khartoum (n=150)	Elobeid (n=100)	Khartoum (n=150)
Taste of the fruit	90.00	88.50	9.00	10.50	1.00	1.00
Color of the fruit	60.00	30.00	38.50	55.00	1.50	15.00
Maturity of fruit	77.00	56.43	23.00	43.57	10.00	0.00
Price of the fruit	25.34	20.00	74.66	60.00	0.00	20.00
Selling site	50.56	66.00	40.00	42.00	10.00	2.00
Packing of the fruit	22.36	40.00	20.00	50.00	56.64	10.00
Source of the fruit	76.13	50.00	23.87	22.34	0.00	20.66
Cleanness of the fruit	80.00	77.00	20.00	32.00	0.00	1.00
Size of the fruit	45.65	30.33	50.35	60.00	4.00	9.67
No pests	100.00	100.00	00.00	00.00	0.00	0.00

Factors affecting the demand for *Adansonia digitata* fruits

The consumers of *A. digitata* fruit in the two study areas experience a number of problems such as fruits having different taste (20 %), spoilage of the fruits (13.5 %), seasonality of the fruits (12.9 %), high fruit price (5.5 %), and unhygienic selling environment (2.6 %). Less common problems were stomach pains after eating the fruits

(0.5 %), inconsistent supply of the fruit (0.5 %), no fruit grading system (0.3 %), raw fruit being the only competition from available on market (0.2 %), and fruit contains too many seeds (0.2 %). About 43.8 % of the respondents said they did not experience any problems as consumers of the fruits. Related to the general problems consumers face with the fruit is the preferred form in which the fruit should be marketed. The consumers' preference

is having packed fruit (50 %), grade the fruit based on size and taste (43.1 %), and processed fruits into juice, jam and fine powder (90.5 %).

Discussion

The study results reveal that married respondents formed the majority of the consumers of the *A. digitata* fruits. Ramadhani and Schmidt (2008) also reported that in Zimbabwe the purchasing behavior for *Uapaca kirkiana* Müll. Arg. and *Strychnos cocculoides* Baker fruits is correlated with the gender, marriage status, education and market sites for the respective fruit. Their study further revealed that educated people were more likely to buy the fruits than less educated categories. The findings suggested that there might have been a family influence in purchasing behavior of indigenous fruits (Ramadhani and Schmidt 2008). One possible explanation for such influence could be a higher level of appreciation of the nutritional and other value because of the knowledge about *A. digitata* fruit. These findings, including that of this study, identify and stress the importance and need to educate (sensitize/raise awareness) population on the nutritional value and benefits of consuming the fruit. In this regard, strategic extension services and/or events would be appreciated.

In the study areas, the current findings show *A. digitata* fruit as the most preferred and popular fruits followed by *Grewia tenax* fruit. The current study also has shown that *A. digitata* fruit was preferred both raw and processed fruit product for several reasons, including sweetness and nutritional value. Nutrition and taste are popular reasons for choosing the fruit among consumers. Study findings sug-

gested that consumers can increase their nutritional well-being by utilizing the fruit tree products. Foods from trees and forests such as fruits, vegetables and bushmeat are rich in micronutrients (Chivandi et al. 2015) and can often be acquired cheaply and easily without the need for significant capital investment (Awodyin et al. 2015). Ensuring access to nutritionally important foods such as fruits, vegetables and animal source foods is particularly important for preventing micronutrient deficiencies (Stadlmayr et al. 2013) but the widespread usage of wild foods focuses primarily on knowledge, use and nutritional composition of wild foods, and not on contributions to human nutrition (Buchmann et al. 2010).

Some fruit demand drivers were based on fruit characteristics and market environment. Based on the study results there were ten attributes of fruit and marketing environment the consumers considered when making decisions to purchase the fruit. Most of the consumers value taste and cleanness of the fruit. Taste was the most strongly considered. This finding shows that consumers of the fruit regarded quality measures (taste, cleanness, etc.) of the important when selecting fruit for consumption. In some studies on indigenous tree fruits (ITFs) consumers also regarded quality measures (texture, taste and flavors) more than price (Harker et al. 2003). Buying behavior for *A. digitata* fruit was also influenced among others by price, size, pest infection, color, maturity, packing, and source of the fruit. These in order to increase the sales and income generation, collectors and traders must provide fruits with the characteristics identified by the consumers. These might be addressed in two major ways to expand the fruit demand. One way would be through marketing strategies which

such attributes as pricing, fruit maturity, packing, selling site and cleanness could be addressed. The other way is scientific research. Matters of size of fruit, pest and taste may require genetic improvement (Assogbadjo et al. 2008). Different tastes may result substantially from tree-to-tree variation in fruit characteristics and thus a lack of uniformity in quality. Gebauer and Luedeling (2013) report the existence of a high morphological diversity in baobab stands in Sudan.

The consumers experience seasonal supply of the fruit by the traders. The fruit is available at most only a quarter of the year due to their seasonality nature (Adam et al. 2012). More tree fruits have seasonal production and demand patterns that also influence their marketing (Adam 2015), suggesting that there are among the important constraints in the trade of the fruit (Adam et al. 2013). However, the availability of *A. digitata* fruit at a time when most agricultural crops are not harvested improves nutrition and secures income generation especially for rural people (Adam 2015). The reason for consuming the fruit was generally same for the two study areas with sweetness and nutritional value/vitamins as the most popular reasons. The fruit was consumed both in raw and processed form. Referring to the Indian scenario, Haq et al. (2008) reported that the higher nutritional value and medicinal properties of some fruits could be exploited by producing products for niche markets, such as health foods and natural products. They observed that many of indigenous tree fruits have considerable marketing potential. Adam (2015) made similar observation whereby *A. digitata* fruits are eaten raw or processed in the form of fine powder, juice and other products with processed and unprocessed fruits being

occasionally sold to urban markets for cash income. As indicated by this study, low levels of processing might be because of limited technology to add value to the product. Unlike Khartoum (1 %), in Elobeid 20 % of consumers preferred raw to processed fruit. The reason for the differences in consumption from preference is not clear or certain but could be about awareness level. The Khartoum market might be more exposed to processed fruit product than Elobeid market. For Elobeid the indication of preference was based on the knowledge that exists among the consumers of what was possible to produce. In Khartoum, it appeared that the people were more aware of the potential products into which the fruit could be processed. This could have been due to the Food Research Center (FRC) in Khartoum which disseminates and scales up baobab fruit products development technologies. Studies have also shown that effective utilization of indigenous knowledge and community preferences were a key to domestication of *A. digitata* tree (Assogbadjo et al. 2008) and trading of its products (Adam 2015). Most of the foregoing reasoning for consuming and preferring raw to processed fruit products seems to revolve around limited knowledge of the alternative utility forms of the fruit. It seems the fruit has not been rigorously promoted especially with the support of FRC in Khartoum. A side from increasing the income for the rural collectors and traders, promoting the processing of the fruit would encourage fruit tree domestication and management to satisfy expanded market demand including people who have apprehension for unfamiliar products. It is however, important to note that knowledge exists about the importance of processing the fruit and could be investigated further.

Conclusions

This study has shown that the demand for baobab fruit is propelled by desire for vitamins and sweetness among others. Such desires are addressed by consuming the fruit in basically two utility forms. The raw form in the market place is the commonest followed by the processed form. Very few people consume the fruit in both the raw and processed form at the present. Analysis of the responses revealed that some of the consumption preferences were due to the limited knowledge on possible utility options on the part of the consumers. Processing of the fruit is welcomed by consumers for various purposes including health, value added and better products. Consequently, a number of potential products and opportunities for product development have been identified in this study comprising, fine powder, juice, etc.

Recommendations

The raw fruits should be processed into other finished products desired by the consumers. There is also a need for disseminating the appropriate information/knowledge to the various actors in the *A. digitata* fruit commercialization. In this regard, research should therefore work to strengthen communication among all stakeholders especially collectors/traders who have limited access to information like potential utility forms of the fruit. For instance, consumption in only raw form is a result of ignorance about processing. Equally, information about the nutritive value of the fruit can help improving demand and enable it compete with other exotic fruits. Therefore, this study is recommending public awareness and education by extension methods among

all actors including formal, private, and agribusiness sectors to accord them an opportunity to make enlightened choices about the fruit. The strategic extension/education intervention packages may be to systematically promote the consumption of the fruit in addition forms either unknown or currently unacceptable to the majority of the consumers. This could expand the fruit demand which can create an incentive for tree species domestication and management on private farms.

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