ISSN 2664-4010 (Print) & ISSN 2664-6730 (Online)
South Asian Research Journal of Agriculture and Fisheries
Abbreviated Key Title: South Asian Res J Agri Fish

| Volume-1 | Issue-3 | Oct-Nov -2019 | **DOI: 10.36346/SARJAF.2019.v01i03.002**

Original Research Article

Analysis of *Moringa Oleifera* Value Chain in Northern Taraba State

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Article History
Received: 24.09.2019
Accepted: 02.10.2019
Published: 12.10.2019

Abstract: The study analyzed the economics of *Moringa oleifera* value chain in selected Local Government Areas (LGAs) of Northern Taraba state, namely: Ardo-kola, Karim-lamido, Yorro and Zing. The broad objective was to analyse Moringa oleifera value chain with a view to understand the contributions of the value chain to the participants' livelihood, namely: processors, marketers and consumers. The specific objectives were to determine the influence of the socio-economic characteristics on the efficiency of the market; analyse the structure, conduct and performance of the Moringa oleifera value chain. Data for the study was obtained from 284 respondents purposely selected consisting of 44 processors, 120 marketers and 120 consumers. Herfindahl-Hirschman Index (HHI), and linear regression were used to analyse the data. Result revealed that Linear regression showed that age was significant at 10%, formal education was significant at 1%, marital status was significant at 5% and gender was significant at 10%. The HHI revealed that there was high competition and low concentration across all the markets; in Karim-lamido LGA, only the oil industry had HHI of 1804, implying a highly concentrated market with low competition. In Yorro LGA, all the markets had low concentration and high competition as revealed by the HHI fresh leaves (13.98), dry leaves (13.21), seeds (29.74) and oil (43.07). Zing LGA had HHI of fresh leaves (91.99), dry leaves (3856.78), seed (180.13) and oil (221.56). All the industries, as evident from the result, had low market concentration, except for the dry leaf industry, with HHI value of 3856.78. Processors' marketing efficiency value was 292.2%, which indicated a highly efficient market, while the marketers had marketing efficiency value of 96.59%. It was recommended that participants should form cooperatives, so that resources can be pooled together to obtain modern facilities to improve product processing. Also, the state Ministry of Agriculture should establish Moringa oleifera seed multiplication units and Moringa oleifera plantation.

Keywords: Value chain, Efficiency, Market and *Moringa oleifera*.

INTRODUCTION

Value chain describes the full range of activities required to bring a product or service through different phases of production, including physical transformation, the input of various producer services and response to consumer demand. As such, the value chain includes the vertically linked interdependent processes that generate value for the consumer. Interest in value chain is not new, businesses have been using value chain analysis and implementation principles for years to formulate and implement competitive strategies. Value chain approaches have been used to streamline processes that generate goods and service that customer's value and to guide product improvement and innovation [1].

The value chain concept allows integration of the various players in agricultural production, processing and marketing. It defines the various roles of players as well as the scope and purpose of partnerships that can be established [2]. Also the concept of "Agricultural Value Chain" includes the full range of activities and participants involved in moving agricultural products from inputs supplied to farmers' fields and the ultimate products to consumer's tables. Each stakeholder or process in the chain has a link to the next in order for the processes to form a viable chain. At each stage, some additional transformation or enhancement are made to the product – ranging from simply moving the product from point one point to another (a common value addition of traders for example) to complex processing and commercialization. Each segment of a chain has one or more backward and forward linkages. A chain is only as strong as its weakest link and hence the stronger the links the more secured the flow of products and services within the chain [3].

Value chain describes the full range of activities required to bring a product or service through different phases of production, including physical transformation, the input of various producer services and response to consumer demand. As such, the value chain includes the vertically linked interdependent processes that generate value for the consumer. Interest in value chain is not new, businesses have been using value chain analysis and implementation principles for years to formulate and implement competitive strategies. Value chain approaches have been used to streamline processes that generate goods and service that customer's value and to guide product improvement and innovation [1].

It is in the light of this, that value chain analysis for many agricultural commodities had been conducted with a view to identifying appropriate and relevant strategies for enhancing farmers' production, processing and marketing status. The chain analysis has been widely applied as a tool on policy, programme or project planning. It is also an approach used in the content of decentralized decision making process to assist commodity stakeholders in their decision making [3]. Also, value chain analysis is useful for new producers (including poor producers in poor countries) who are trying to enter the global market in a manner which would provide for sustainable income growth [4].

Malnutrition is a major factor responsible for high rate of infant mortality in the tropics and subtropics. In the poorest countries, as many as one child in five births will die during infancy [5]. Worldwide, it is estimated that seven million people die each year from hunger – related causes and the vast majority of these deaths are caused by chronic under – nutrition [7]. Records have also shown that frequent consumption of *Moringa oleifera* (especially the leaves) can be helpful in combating malnutrition and even totally eradicate malnutrition especially among children [7].The relevance of *Moringa oleifera* in the livelihood sustenance of the participants in the value chain cannot be over-emphasized. The crop has potential use in pharmaceutical industries and is also a source of food that the common man can afford. *Moringa oleifera* has great potentials in contributing to the livelihood of participants involved in production, processing, marketing and consumption in the study area.

Moringa oleifera is a tree with a unique range of properties that makes it one of the most versatile on the planet and known to many as the "Miracle Tree". *Moringa oleifera* production in Nigeria is dominated by small scale farmers, despite the globally accorded significance and medicinal value attached with its consumption; its production, processing and marketing is grossly inadequate because the crop is used as a border crop or background tree that serves as fence to most farmers [4].

Several studies were conducted on *Moringa oleifera* products especially in the area of nutrition:- Fahey [8], Reyes [9] and Nikolas *et al.* [10] conducted nutrition study on *Moringa oleifera* and confirmed that *Moringa oleifera* products have positive impacts on growth and development of man, animal and plants respectively. However, these studies did not determine the profitability of *Moringa oleifera* production. In addition to these, Sanusi [4] conducted a research on the value chain of *Moringa oleifera* in Kano and Katsina states. From his findings, the major problems confronting the production of *Moringa oleifera* in the study area among others included lack of agronomic knowledge regarding cultivation of the crop and inadequate processing equipments but the studies did not consider the value chain in respect to the structure and performance of the market. In the same vein, Animashaun *et al.* [11] studied consumers' behaviour towards the different *Moringa oleifera* products but he did not determine the profitability of *Moringa oleifera* market amongst the participants.

Moringa oleifera products are traded on an increasing large scale in the international market, data about trade volumes and market share are not available. Judging by the increasing number of products available on the international market (as well as the growing number of international producers, it seems safe to say that demand for *Moringa oleifera* product is growing. Various potential international buyers of *Moringa oleifera* products confirm that there is a high demand for the product. However, the market structure and performance for *Moringa oleifera* has not been established. This is confirmed by the study carried out in Haity, on the prices of *Moringa oleifera* product, it revealed enormous fluctuation in prices, depending on quantity, quality and the end use of the products [12].

Moringa oleifera products are still relatively new in the Nigerian market and are not produced on a commercial scale. The quality of products currently available on the local market varies enormously, due to lack of clear processing standards which results in poor processing and packaging practices. The market for *Moringa oleifera* products can be considered as rather being informal, given that scanty commercial production exist [13].

Although there is clearly a market and growing demand for *Moringa oleifera* products, it is difficult to mark out why *Moringa oleifera* has not yet been more widely commercialized especially in developing countries like Nigeria and in places like Taraba state where it is being grown as an indigenous crop. There are no existing documented facts or research concerning the marketing efficiency or the market structure. The crop is not yet identified as an economic crop as such it is being planted as a border crop or backyard tree by most farmers which makes it difficult to realize its potentials. Therefore, this study hopes to fill these gaps so as to improve the livelihood of the participants by exploiting or taking advantage of the global market and the recent high demand of *Moringa oleifera* products.

OBJECTIVES OF THE STUDY

The broad objective of the study was to analyze *Moringa oleifera* value chain with a view to understand the contribution of the enterprise to the livelihood of participants namely; (processors, marketers and consumers) in Taraba state. The specific objectives were to:

- analyse the influence of respondents socio-economic characteristics on the efficiency along the *Moringa oleifera* value chain,
- analyse the structure of the *Moringa oleifera* mark*et al*ong the value chain in the study area,

METHODOLOGY

The Study Area

Taraba state is located in the north east part of Nigeria. The state lies between longitude 9° 10' and 11° 50' E of the Greenwich meridian and latitude 6° 30' and 9°36' N of the equator [14].The state has a land area of about fifty nine thousand four hundred square kilometre (59,400) with a population of two million three hundred thousand seven hundred and thirty six (2,300,736) people [15].

The state shares a common boundary with Bauchi state in the north and Gombe state in the north east, Adamawa state in the east and plateau state in the North West. The state is further bounded to the west by both Nasarawa and Benue states while it shares an international boundary with the Republic of Cameroun to the south and south east [16]. Taraba state is characterized with a tropical climate marked by dry and rainy seasons. The rainy season starts in April and ends in October. The wettest months are August and September. The dry season starts in November and ends in April. The mean annual rainfall ranges from 800mm in the north to over1800mm in the south. The mean minimum daily temperature recorded is 14.8°c and the mean maximum daily temperature recorded is 34.4°C [14].

The dominant soil groups in the state are ferruginous (gleyric, luvi soil, eutroc, regosol, and ferric luvisol) found in the north and entisols along the southern parts. The central parts of the state are covered with vertical and ultisol group [14]. The vegetation cover of the state is in the guinea savanna. The topography is essentially marked with mountainous land traversed by big river valleys such as Benue, Taraba, Donga and Bibinu. The valleys of Mambilla and Fali Mountains form part of those undulating landscape of the state [14].

The state is predominantly agrarian in nature, with about 80% of its inhabitants depending on subsistence agricultural practices, mainly in food crops [14]. The climate, soil and hydrology of the study area provide a conducive atmosphere for the cultivation of most staple foods, grazing of animals, fresh water fishing and forestry. The rock alluvial tract of soil found in most part of the state makes Taraba state conducive for growing various foods and cash crops. The main farming system practices in the area are either mono cropping or mixed cropping. The ethnic groups found in Taraba state are Ichen, Jukun, Kuteb, Jenjo, Mumuye, Wurkum, Bandawa, Chamba, Hausa-fulani and Tiv among others.

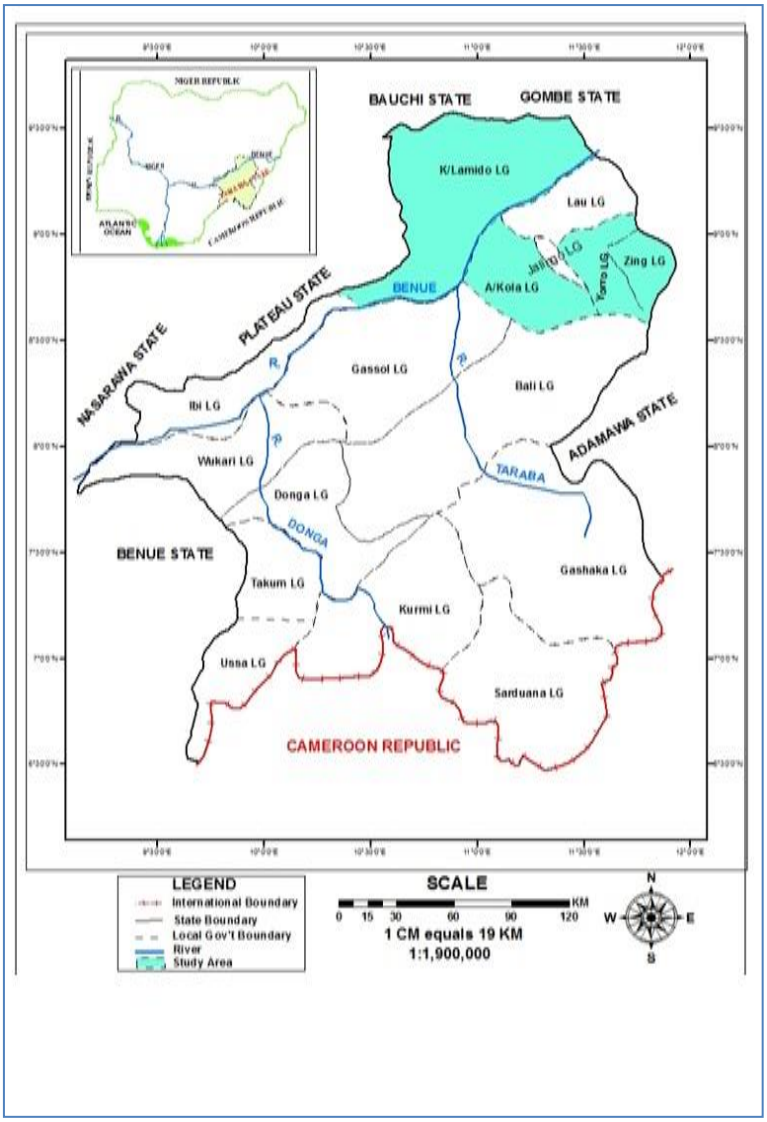

Fig-1: Map of Taraba State Showing Study Area

Sources of Data

Primary data used for the study were collected with the aid of structured questionnaires.

Sampling Techniques

A multi-stage sampling technique was used for this study. The 1st stage was a purposive selection of four Local Government Areas out of the six Local Government Areas in Northern Taraba. This selection was based on the intensity of *Moringa oleifera* farming activities. The Local Government Areas selected are; Ardo-kola, Karim-lamido, Zing and Yorro. The 2nd stage involved the random selection of three villages from each of the selected LGAs of the state.

The 3rd stage involved random selection of participants in the following manner: - The first step is the selection of the processors, which was by Snowball method, that is the use of one key informant, the processors were few in number, as such all the processors from each LGA were purposively selected; Ardo-kola had 13 processors, Karim 9, Yorro 8, and Zing 14. The second step is the selection of Marketers which was done randomly, 10 marketers were chosen per village and thus gives a total of 30 marketers per LGA, given a grand total of 120 marketers for the four LGAs. The technique adopted for the selection of consumers was random selection by truncation (systematic random sampling). This means the researcher sat with an identified seller in an identified market for the purpose of selecting consumers. For every three (3) consumers that patronized the identified *Moringa oleifera* seller, the first was selected up to the point of selecting ten (10) consumers in the identified market. The identification for the market was purposively done while selection of the sellers and consequently consumers was randomly achieved. Ten (10) consumers were covered per each market per village, giving a total of twenty (30) consumers from each LGA. This gives a grand total of one hundred and twenty (120) consumers across the study areas. The selection of 30 consumers per LGA was on the assumption that large sample size starts from 30 [20, 4]. The overall sample size for the entire study was two hundred and eighty four respondents consisting of processors (44),

marketers (120) and consumers (120) were drawn from the four LGAs making a total of two hundred and eighty four (284) participants across the study areas.

Analytical Techniques

The analytical tools that were used include the following:

- Linear Regression
- Herfindahl-Hirschman Index

RESULTS AND DISCUSSION

Influence of socio economic characteristics on *Moringa oleifera* processors and marketers along the value chain

The influence of the socio-economic characteristics of the respondents (processors and marketers) along the value chain was analysed using the linear regression method. The results are presented in Table 1. The socio-economic characteristics included in the model were age, sex, marital status, education and experience. Linear regression analysis was used to show the influence of the socio-economic characteristics on the efficiency of the processors. Formal education was significant at 5% level of probability indicating that most of the processors are into the business because of their level of enlightenment. Age was significant at 10% level of probability and experience was significant at 1% probability level. Since *Moringa* is a traditional crop for most herbal medicine practitioners, the experience obtained over the years counts in terms of processing the leaves and the seeds. On the other hand, other variables such as gender, household size, marital status and source of obtaining the seeds and leaves, were not significant. The influence of the socio-economic characteristics on the marketers shows that level of experience was significant at 5% probability level. This could mean that most marketers are acquainted with the customers of *Moringa oleifera* products; they know where to dispose or advertise their product. Also, Gender was significant at 10% probability level. This is because most of the marketers of *Moringa oleifera* products are females. This is particularly common in Northern Nigeria, where most of the young women are encouraged to pick a trade while at home so as to enhance their livelihood. Marital status was significant at 5% level of probability. This is because the married women are encouraged to pick up a trade while they are indoors, so that they are economically viable and can support their families. Education was also significant at 5% probability level. This indicates that most marketers are exposed and literate. Therefore, they can access market information of modern technology. Age was significant at 1% probability level. This is because as one advances in age, the ability to be agile becomes less and productivity decreases with increase in age.

Table-1: Regression analysis of effect of some selected socio-economic variables on processors and marketing efficiency

Variables	Processors			Marketers		
	Coefficient	Standard error	t-ratio	Coefficient	Standard error	t-ratio
Constant (Y)						
Age	0.0863407	0.0479009***	1.80	-0.02670	0.01325*	-2.0151
Sex	-0.0148942	1.3102	-0.01	-6848368	0.3576113***	-1.92
Marital status	0.452717	0.5982787	0.76	0.182206	0.0807453	2.26
Household size	0.1536067	0.141615	1.08	0.0388198	0.055733	0.488
Education	0.616862	02590156**	2.38	2.26294	1.36279**	1.6605
Experience	0.7014653	0.0488403*	14.4	0.2675662	0.1032573**	0.011
Source	6.162638	4.297327	1.43	-0.3042898	0.3122427	-0.97
R-squared	**0.6893**			**0.6827**		
Adj. R squared	**0.6390**			**0.6631**		

Source: Field Survey, 2017.

Note: * = P<1%; ** = P<5% and *** = P<10%

Market Structure

The structure of a market is the set of conditions and characteristics that describe and define the market type. To describe market structure, economists consider the number, size and distribution of firms; the extent of product differentiation; the effectiveness of barriers to entry; and the extent to which the industry is vertically integrated [17].

The result from the analysis of Hirfindahl-Hirschman Index (HHI), as presented in Table 2 shows that fresh leaves marketers had HHI of 622.95, dry leaves 1349.24, seed 90.75 while the oil had 828.45. When the result was pooled, the total HHI was 2891.39. The HHI (far above 1800) indicated that there is high concentration and low competition in the market. The above result corroborates the work of Seanicaa *et al*. [18] that the degree of market concentration is inversely related to the degree of competition. This high concentration could be attributed to low number of sellers in the market, indicating that each seller could determine the price.

On the other hand, the processors in the study operated within two firms: the dry leaves, with HHI of 9.48 and oil, with HHI of 9393.77 When pooled together, the gross HHI for the processors is 9403.25 which is above the base line of 1800, and therefore indicated that the market is also highly concentrated in structure, implying that there is little competition. Both the consumers and sellers could determine how the market will operate per time.

Table-2: Herfindahl Hirschman Index (HHI) for marketers and processors

Marketers				Processors			
Firms	**Market share**	**% of market share**	**HHI**	**Firms**	**Market share**	**% of market share**	**HHI**
Fresh leaves	678200	24.96	622.95	Dry leaves	53000	3.08	9.48
Dry leaves	998100	36.73	1349.24	Oil	1668600	96.92	9393.77
Seed	258850	9.53	90.75	**Total**	**1721600**	**100.0**	**9403.25**
Oil	782100	28.78	828.45				
Total	**2717250**	**100.0**	**2891.39**				

Source: Field Survey, 2017.

Processors' HHI in the respective LGAs

The market structure was also examined at the Local Government level. The analysis revealed that there is high level of competition at the LGA level that is low concentration of market. From the analysis in Table 3, Zing had the highest HHI of 1353.50, which is smaller than 1800, implying that there is high competition amongst the processors. Other LGAs (Ardo-kola, Karim-lamido and Yorro) had HHI of 748.57, 601.72 and 128.14, respectively. Thus there is high competition across all the LGAs.

The comparative HHI analysis among the respective LGAs for seed to oil processors revealed that all the respective LGAs had HHI values less than 1800, implying that there is high competition among processors across the different LGAs.

Table-3: Processors' HHI in the respective LGAs

Leaves					
	Ardo-kola	**Karim-lamido**	**Yorro**	**Zing**	**Total**
Market share	28.15	24.53%	11.32	36.79%	100.00
HHI	748.57	601.72	128.14	1353.50	2831.94
Oil					
Market share	26.55	23.13	14.63	35.69	100.00
HHI	704.86	535.00	214.12	1274.10	2728.09

Source: Field Survey, 2017.

Marketers' HHI in the respective LGAs

The result of the marketers' HHI in the different LGAs revealed that in Ardo-kola LGA, the dry leaves marketers had the highest HHI of 1068.94, which is below 1800. Thus, there is high competition and low concentration in the dry leaves industry in the area. Similar result, from Table 4, is also obtained in other industries (fresh leaves, seed and oil) in the LGA.

In Karim-lamido LGA, the HHI for fresh leaves (445.05), dry leaves (422.38), and seed (252.12) respectively fell below the baseline of 1800, implying low concentration and high competition. On moving to the oil industry, an HHI of 1804.02 was obtained, implying a highly concentrated market and low competition.

In Yorro LGA, it was generally observed that across the firms, there was low concentration and high competition in all the industries: fresh leaves (13.98), dry leaves (13.21), seed (29.74) and oil (43.07). Zing LGA, the HHI obtained was as follows: fresh leaves (91.99), dry leaves (3856.78), seed (180.13) and oil (221.56). All the firms had low concentration and high competition, except for dry leaves industry, with HHI value of 3856.78 which is far above 1800, implying high concentration and little competition. It can then be concluded that at the LGA level, the competition is high but the concentration of marketers is low.

Table-4: Marketers' HHI in the respective LGAs

		Fresh leaves	**Dry leave**	**Seed**	**Oil**	**Total**
Ardo-kola	Market share	13.14	32.69	28.15	26.01	100.00
	HHI	172.69	1068.94	792.61	676.56	2710.80
Karim-lamido	Market share	21.10	20.55	15.88	42.47	100.00
	HHI	445.05	422.38	252.12	1804.02	2923.57
Yorro	Market share	13.98	13.21	29.74	43.07	100.00
	HHI	195.46	174.48	884.35	1855.24	3109.52
Zing	Market share	9.59	62.10	13.42	14.88	100.00
	HHI	91.99	3856.78	180.13	221.56	4350.45

Source: Field Survey, 2017.

Marketing Efficiency

There are two approaches for analyzing market performance. The first approach analyzes the productive efficiency of well-defined marketing sub systems, while the second approach focuses on analyzing marketing structure and resulting performance. The methods and criteria used by both approaches are instrumental in identifying the actual and potential inefficiencies into marketing systems and characteristically, lead to development of market policy recommendations to government [19].

Market Performance

Performance is a measure of pricing and operational efficiency. Individual producers as well as the public have a stake because the degree of efficiency attained affects producer price and profit, cost to the consumer and their real income, and the general resource utilization. Improved marketing efficiency is a common goal of farmers, marketing organizations, consumers and society [21]. Higher efficiency means better performance. Markets are efficient when the ratio of the value of output to the value of input throughout the marketing system is maximized [22]. Performance of the market is the reflection of the impact of structure and conduct on product price, cost and the volume and quality of output [8]. If a market structure resembles monopoly rather than pure competition, one can expect poor market performance.

The efficiency measures in Table 5 reveal that all the markets were efficient in marketing and processing of *Moringa oleifera* products. The processors had efficiency value of 292.02% while the marketers had efficiency of 96.5%, which is a little lower than 100%. Thus, it can be inferred that the processors were more efficient than the marketers. The marketing efficiency is perfect if the efficiency measure is 100%, while more than 100% implies excess profit and marketing efficiency of less than 100% results to inefficiencies. The results obtained in this study is in consonance with Andem *et al.* [23], who obtained a marketing efficiency of bitter cola to be 135.2%, which implies that bitter cola market is efficient in the area. Also, Onu and Iliyasu [24] in their study obtained a marketing efficiency of 254.7%, an implication that marketing and pricing policy in food grain marketing is highly efficient in the area. On the whole, it can be concluded that the *Moringa oleifera* marketing is generally efficient in the study area.

Table-5: Efficiency of processors and marketers

Components	Processors	Markerters
Gross margin (X_1)	11,398	7789.34
Average Marketing cost in Naira (X_2)	3903.18	8066.31
Average Efficiency (X_1/X_2*100)	292.02	96.57

Source: Field survey, 2017.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of Findings

The study was on the economic analysis of value chain of *Moringa oleifera* in Taraba state, specifically in Northern Taraba. Four Local Government Areas were selected, namely: Ardo-kola; Karim-lamido; Yorro and Zing. The activities examined along the value chain were the processors, marketers and consumers. 30 participants were chosen for each activity in each LGA, summing up to 120 participants across the LGAs and a grand total of 360 participants in all. However, only 44 participants were involved in processing of *Moringa oleifera* across the four LGA, with Ardo-kola LGA having 13; 9, in Karim-lamido; 8 in Yorro and 14 processors in Zing.

Linear Regression was used to analyze the effect of socio-economic characteristics on the efficiency of the marketing of *Moringa oleifera* value chain. The result obtained shows that formal education was significant at 5%, age was significant at 10%, while years of experience was significant at 1% for processors. For the marketers, gender was significant at 10%, marital status at 5%, while education was observed to be significant at 5%. This implies that for both processors and marketers, age was a common factor which enhanced the productivity of the participants. Furthermore, the structure, conduct and performance of the participants were examined. The Hirfindahl-Hirschman Index (HHI) was used to determine the market structure. The result obtained shows that for both processors and marketers, the market was highly concentrated, which implies that there is low competition in the study area. It was observed from the marketing efficiency that processors had an efficiency value of 292.2%, which indicates that the market is highly efficient, while the marketers had 96.59%, which can be considered as efficient too.

CONCLUSION

The value of *Moringa oleifera* increased as it moved from the point of harvest to the final consumer. The value added by activities along the value chain varied. Marketing of *Moringa oleifera* was found to be efficient. The study also reveals that *Moringa oleifera* products were profitable. Furthermore, it was discovered that, the market structure is weak and no specific market has been allocated for the sales of the product. Also, lack of modern equipment for processing has hindered the product from meeting the global standard required for processing and packaging for export.

RECOMMENDATIONS

Based on the finding in this study, the following are recommended:

- Moringa farmers should form cooperatives to enhance and increase productivity volume.
- By the help of extension workers, Moringa Farmers can be educated on the recent development in global market.
- Farmers should also be encouraged to modern processing and packaging equipment, so as to meet international standards.
- Since it was discovered that Marketing of Moringa is efficient and profitable, young people should be exposed to thus enterprise.
- Commonly owned equipments can be purchased to encourage communal participation.

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