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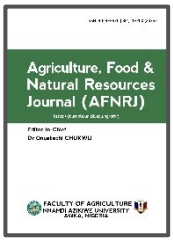

Original Article

Pricing practices, measurement variability, and profitability in the marketing of Iru (fermented African locust bean) in Ile-Ife, Nigeria

OPEN ACCESS

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ABSTRACT

The study assessed pricing, measurement practices and profitability in the marketing of Iru; fermented African locust bean, in the selected markets in Ile-Ife area, Osun State, Nigeria. A multi-stage sampling technique was adopted for this study. At first, three Local Government Areas (LGAs) of the State were purposely selected based on high concentration of Iru marketers, namely; Ife North (headquarter Ipetumodu), Ife South (Ifetedo) and Ife Central (Ile-Ife), and one major rural market was purposely selected from each LGAs (Akinola, Olode and Oja Tuntun). At the last stage, Iru traders were purposively identified within the markets based on involvement, availability and willingness to participate, and traders were systematically selected per market via systematic intercept along market transects, with every third eligible trader encountered, selected until 30 was reached, making a total of 90 respondents. Data were analyzed using descriptive statistics, budgetary analysis and One-way ANOVA. Results showed non-standardized measurements wrap measure (0.026kg-0.20kg), Congo measure (1kg). Majority of the marketers had benefit-cost ratio >1. Olode market has the highest average net profit of (₦12,426). While Akinola market had highest rate of return (36.80%). A one-way ANOVA across all sampled traders comparing profitability between measurement method indicated F (1,88) =0.48, p= 0.49> 0.05) showed no statistically significant difference at 5% level. Due to purposive selection, findings have limited generalization beyond sampled markets. The study recommended that standardized weight based pricing and improved packaging be introduced to enhance market competitiveness.

KEYWORDS: *Condiments, Packaging, Parkia biglobosa, Profitability, Measurements,*

INTRODUCTION

Parkia biglobosa commonly called African Locust Bean is an indigenous multipurpose tree of the Fabaceae family widely distributed in the West African savanna (Attuquaye *et al.,* 2023). The tree is of immense nutritional, economic, social, and ecological importance to rural communities (Boye & Gregoire, 2022). The fermented seeds, processed into condiments such as *Dawadawa* in Hausa, *Ogiri* in Igbo and *Iru* in Yoruba, it is rich in protein, essential fatty acids, iron and vitamins B (Adesiji *et al.,* 2026; Arouna *et al.,* 2023). These products serve as major flavoring agents and protein supplements in the local soups and foods (Kabir & Rukayat, 2024).

Despite its importance, the commercialization of *P. biglobosa* condiment remains largely informal. A critical constraint to the efficient marketing of *P. biglobosa* condiment is the use of non-standardized units of measurements and arbitrary pricing systems. Condiment (*Iru*) are commonly sold in containers such as basins, tins and paint rubbers without regard to weight

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or volume (Akinyemi & Adeoye, 2019). This practice leads to inconsistency in quantity, markets price comparison difficult across markets, and creates opportunities for exploitation of both sellers and buyers. In addition, poor access to market information and weak lineage results in the undervaluation of the product and limited income generation for rural households despite increasing demand (Kouyate & Bationo, 2018).

Several studies have examined profitability and value addition of locust bean (*Iru*) in other parts of Southwest Nigeria, including Oyo State (Aderoumu and Adejumo 2019) and Ondo State (Ijigbade *et al.,* 2021). However, these studies focused on value chain and pricing and not specifically on how non-standardized measurement such as sacks, tablespoons, wrap measure and *Congo* measure influence pricing and profitability variation across different rural markets in the same area. This study therefore assessed the pricing, profitability variation and measurement practices of *Iru* in Osun State, thereby providing empirical evidence on how non-standardized measurement influences profitability in rural marketing.

METHODLOGY

Study Area and

The study was carried out in Ile-Ife area of Osun State, Nigeria. Ile-Ife is located between Latitudes 7°28'N and 7°45'N and Longitudes 4°30'E and 4°34'E (Ajala and Olayiwola, 2013). Osun State is located in the Southwest zone where locust bean condiment (*Iru*) trading is predominant economic activity. The State comprises thirty (30) Local Government Areas (LGAs), out of which Ife South, Ife Central and Ife North LGAs were used for the study (Figure 1).

Ile-Ife lies within the lowland rainforest zone. The vegetation is presently dominated by secondary forest, plantations, and patches of remnant primary forest due to farming and settlement (Oziegbe *et al*., 2011). A recent study in Ile-Ife also confirms that between 2002 and 2023, built-up area increased by 106.2% while vegetation cover reduced by 32.7% (Ayangbenro *et al*., 2024). The mean annual rainfall is approximately 1,302 mm, with a bimodal pattern peaking in July and September. The rainy season extends from March/April to October/November, while the dry season lasts from November to March (Oziegbe *et al*., 2011). The mean annual temperature is 25.5°C, with a range of 22.5°C to 31.4°C (Oziegbe *et al*., 2011). The mean annual relative humidity is 82% (Oziegbe *et al*., 2011)

Sampling Procedure

Multi-stage sampling technique was adopted for this study. At the first stage three Local Government Areas within the vicinity of Ile-Ife were purposively selected based on high concentration of condiment (*Iru*) traders and present of active locust bean markets. The selected LGAs are distinct administrative units with different headquarters: Ife South LGA headquarter in *Ifetedo*, Ife Central LGA headquarter in *Ile-Ife* and Ife North LGA headquarter in *Ipetumodu*. One major market was purposively selected from each LGA based on high trader volume. *Olode* market in Ife South LGA (operates every five days). *Oja Tuntun* market in Ife Central LGA (opens to the public every day) with peak activity every fortnight. *Akinola* market in Ife North LGA (a weekly market operating) only on Fridays.

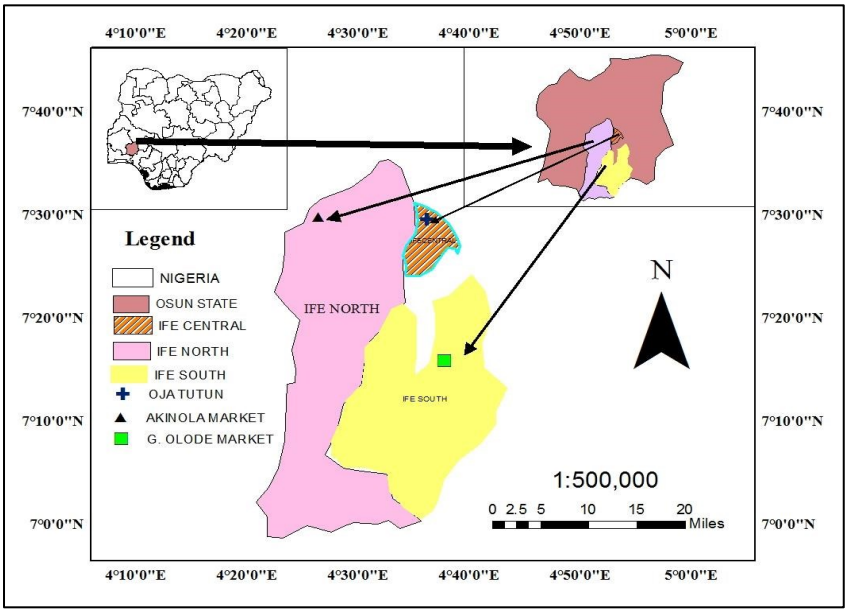

Figure 1: Map of Osun State showing the three markets for the study.

At the last stage, due to the scattered nature of traders and absence of a formal sampling frame, locust bean traders were purposively identified within the markets based on three criteria: (i) active involvement in locust bean trading (ii) availability at the time of survey and (iii) willingness to participate. Within each market, every third eligible trader encountered along the market transects was selected until 30 respondents had been recruited. This procedure yielded a total sample of 90 *Iru* traders across the three markets.

Due to the purposive selection used for LGAs, markets and initial trader identification, the findings are representative of the sampled markets and have limited generalization to all *Iru* traders in Ile-ife or Southwestern Nigeria.

Data Collection

Primary data were collected using a semi-structured questionnaire administered to *Iru* traders in the selected markets. The questionnaire elicited information on traders' socioeconomic characteristics, marketing practices, measuring units, purchase and selling prices, marketing costs and other variables relevant to profitability assessment. Key informant interviews were also conducted to complement the questionnaire data and provide additional insights into local measurement and pricing practices.

Description and Standardization of Local Measurement

To determine the weight equivalents of non-standardised measuring units, samples of *Iru* sold using the selected units were measured with a digital weighing scale. Particular attention was given to the units relevant to the study, including the *Congo* and wraps. In this study, *Congo* measure refers to a local volumetric plastic bowl commonly called *Congo* in South-Western Nigeria, approximately 1. 0 kg per bowl, wrap measure refers to small molded balls wrapped in nylon/leaves. During fieldwork, different sizes of wrap were found, determined by number of tablespoons contained: half tablespoon (0.026 kg) to six tablespoons (0.20 kg) per wrap. Thus, wrap measure ranged from approximately 0.026 kg to 0.20 kg based on authors' field measurement

Data Analysis

Data were analysed using descriptive and inferential statistics. Frequencies, percentages and means were used to summarise respondents' characteristics, measurement practices, prices and marketing costs. Budgetary analysis was used to estimate the costs and returns associated with *Iru* marketing. One-way analysis of variance (ANOVA) was used to test for significant differences in profitability between traders using the *Congo* measure and those using wraps measure. Statistical significance was assessed at the 5% level.

Profitability Analysis

Profitability was determined as average monthly profitability per trader. This was used to allow comparison across markets with different markets days. Olode market (every five days), Akinola market (weekly on Friday). Oja Tuntun market (daily). All cost and profit figures are therefore reported on average per month per trader basis.

Budgetary analysis was employed to estimate the costs, returns, net profit, rate of return and benefit–cost ratio associated with *Iru* marketing. Profitability Indicators used were:

Net Profit

$$NP = TR - TC \quad (1)$$

Total Cost

$$TC = TFC + TVC \quad (2)$$

Total Revenue

$$TR = Q \times P \quad (3)$$

Rate of Return

$$ROR = \frac{Net\ profit}{TC} \times 100 \quad (4)$$

Benefit Cost Ratio

$$BCR = \frac{TR}{TC} \quad (5)$$

Where: NP= Net Profit, TR = Total Revenue (selling price × quantity of locust bean/wraps), TC = Total cost incurred, TFC = Total Fixed Cost (expenditure incurred on fixed assets used in marketing e.g. rents, tax), TVC is the Total Variable Cost (cost incurred in marketing locust bean e. g. cost of raw and processed materials, packaging and transportation and labour cost etc.).

Rate of Return (ROR) is defined as return per naira invested in marketing, expressed as percentage

Benefit-cost ratio (BCR) greater than one (1) indicates profitability

For the ANOVA model:

$$Yij = \mu + Mi + eij \quad (6)$$

Yij= Net profit of jth marketer using ith measurement scale, μ= Overall mean, Mi= Effect of ith measurement scale (i=1,2: Congo measure, Wrap measure) and eij= Random error term

RESULTS AND DISCUSSION

Demographic Information of the Respondents

The dominance of female marketers (95.6%) indicates that marketing of *Iru* is gender based with 6-10 household individuals (Table 1). This is in line with the findings of Ijigbade *et al.,* (2021) reported that locust bean processing and marketing are predominantly female occupation with available family labour for their business. Majority (53.3%) were within the age category of 41-50 years. This suggests that people in this age bracket are still active and experienced It was observed

that 50.0% of the marketers attended primary school, the result also revealed that most of the marketers were within the age range of below 48years (53.3%). However, this does not hinder their interest in the trade. In agreement with Adesiji *et al.,* (2026) age and educational qualification in marketing of *Iru* is not a barrier for involvement in the trade.

Marketing of Fermented Locust Bean

Table 2 shows that majority of the marketers did not process the condiment but sourced their product from the processors (56.7%). However, 43.3% of the marketers processed the fermented *Iru* by themselves. 62.5% of the locust bean buyers are the direct consumers. This implies that locust bean condiment (*Iru*) has high demand at household level as food condiment, which shortens marketing channel and reduces marketing cost, thereby increasing marketing margin for marketers. Furthermore, 66.7% of the marketers have only one sales outlet, which indicate limited business expansion and maybe due to inadequate capital to establish multiple outlets. The dominance of shed (77.8%) as a type of sales outlet suggest that marketer operate in temporary structure with minimal infrastructure. This may affect the quality and hygiene of the product during display and sales. This is supported by Okolo *et al.,* (2023) who reported high fungal contamination of *Iru* in Lokoja markets due to unhygienic handling. About 32.2% of the marketers received advance payment from their buyers mostly the consumers. Both retailers and consumers would prefer to buy from the wholesalers since there are price differentials as describe by (Adejumo *et al.,* 2014).

Table 1: Demographic distribution of marketers

Variable	Category	Frequency	Percentage (%)
Gender	Male	4	4.4
	Female	86	95.6
Age (years)	Below 30	9	10.0
	30–40	6	6.7
	41–50	48	53.3
	51–65	23	25.6
	70 and above	4	4.4
Marital status	Married	72	80.0
	Single	9	10.0
	Widow	9	10.0
Ethnicity	Yoruba	90	100.0
Household size	Fewer than 5	42	46.7
	6–10	48	53.3

Table 2. Processing, sourcing and marketing characteristics of *Iru*

Variable	Category	Frequency	Percentage (%)
Does the respondent process *Iru*?	Yes	39	43.3
	No	51	56.7
Reported source of *Iru*	None	38	42.2
	Processors	51	56.7
	Processors and wholesalers	1	1.1
Buyers of *Iru**	Wholesalers	11	7.6
	Retailers	43	29.8
	Consumers	90	62.5
Additional sales outlet	Yes	30	33.3
	No	60	66.7
Type of sales outlet	Concrete/block shop	5	5.6
	Shed/shelter	70	77.8
	Assembly point	8	8.9
	Other	7	7.8
Sells in other traditional markets	Yes	47	52.2
	No	43	47.8
Procurement payment method	Cash	75	83.3
	Credit	15	16.7
Receives advance payment from buyers	Yes	29	32.2
	No	61	67.8
People hawk on the respondent's behalf	Yes	43	47.8
	No	47	52.2
Reported relationship with hawkers	Children	44	48.9
	No response	46	51.1
Payment of hawkers	Per week	1	1.1
	No payment	89	98.9

Types of Fermented Locust Beans Condiment (Iru)

The result in Table 3 showed that The most common type sold was *Iru woro* (98.9%) followed by *Iru pete* (44.4%). *Iru woro* also has the highest patronage (92.2%) and was the preferred type among the consumers (87.8%). The dominance *Iru woro* could be attributed to the fact that it is the first stage of fermentation and requires less processing time compare to *Iru pete*. Other forms are *Iru gbigbe* and *Iru lilo* but were less common. This agrees with Adejumo *et al.,* (2014) who reported that locust processing in Arigidi Akoko is strenuous and time-consuming, thus marketers prefer less processed forms

Table 3: Locust bean (*Iru*) types

Variable	Category	Frequency	Percentage (%)
Types marketed	*Iru woro* (unmashed)	89	98.9
	Iru pete (mashed)	40	44.4
	Iru lilo (ground bean)	3	3.3
	Iru gbigbe (dried bean)	4	4.4
Type with highest patronage	*Iru woro* (unmashed)	83	92.2
	Iru pete (mashed)	6	6.7
	Iru gbigbe (dried bean)	1	1.1
Preferred type among consumers	*Iru woro* (unmashed)	79	87.8
	Iru pete (mashed)	11	12.2

Method of Measurement

The result in Table 4 shows that 96.7% of the marketers packaged locust bean condiment (*Iru*) in nylon. This is in line with the study carried out by Adejumo *et al.,* (2014) who reported that the use of nylon bag and polythene bag are necessary for retailers who buy in mini bowls. The implication is that nylon reduces packaging cost but reduces market value. Regarding measurement, 52.2% of respondents reported using a standard unit, described in the questionnaire as a wrap measure or *Congo* measure, while 47.8% reported not using a standard unit. The findings suggest that measurement practices were not uniform among all marketers. The use of different containers or portions may make it difficult for buyers to compare quantities and prices accurately. The importance of measurement is corroborated by Adesiji *et al.,* (2026) who reported 80% of processors always measure the condiment. Furthermore, 98.9% marketers reported that seasonality affects availability, with high sales in rainy season (81.1%) compared to dry season (18.9%). This implies that peak production coincides with rainy season, leading to lower purchase price and higher marketing margin for marketers.

Size and Selling Price of the Condiment Types

Table 5 shows that *Iru* was sold in different units. The variation reflects non-standardized measurements, consistent with the finding in Table 5 where 47.8% had no standard unit. The weight of wrapped *Iru* in a *Congo* measure filled to brim was found to contain approximately 1kg. Wraps were measured in tablespoons (½, 1,3 6). ½ tablespoon weighs 0.026kg, 1 tablespoon weighs 0.052kg, 3 tablespoon weighs 0.106kg, 6 tablespoon weighs 0.20kg. This confirms wide variation in quantity sold per wrap (0.026kg-0.20kg). For instance, 1kg *Congo* measure sold at processor level for average ₦1,000 while 0.026kg wrap sold at ₦30 retail, which translates to about ₦1,153/kg, indicating price differential as product moves from processor to retailer. Even under those assumptions, the difference represents a gross price differential, not a net marketing margin, because transport, packaging, labour, losses and other marketing costs have not been deducted. This corroborated with Kabir & Rukayat (2024) reportedly found that locust bean marketing remained profitable under a different packaging or quantity arrangement

Table 4: Method of measurement

Variable	Category	Frequency	Percentage (%)
Packaging method	Nylon	87	96.7
	Nylon and plastic	3	3.3
Use of a standard measurement unit	Yes (wrap/*Congo* measure, as reported)	47	52.2
	No	43	47.8
Perceived effect of measurement on income	Yes	79	87.8
	No	11	12.2
Seasonal effect on availability or sales	Yes	89	98.9
	Uncertain	1	1.1
Season with higher reported sales	Rainy season	73	81.1
	Dry season	17	18.9

Table 5: Size and selling price of the condiment types

Marketing level and unit	Price range (₦)	Average price (₦)
Processor: wrap	10–100	55
Processor: *Congo*	800–1,200	1,000
Processor: dozen wraps	100–500	300
Retailer: wrap	10–50	30
Retailer: dozen wraps	120–600	360

Approximate conversions: 1Congo measure= 1kg. wraps were measured in tablespoons (½, 1,3 6). ½ tablespoon=0.026kg, 1tablespoon=0.052kg, 3tablespoon= 0.106kg, 6tablespoon =0.20kg. Measurements were standardized using digital scale (0.001g sensitivity).

Profit Analysis in Selected Market

Table 6 presents profitability analysis of locust bean condiment (*Iru*) marketing in the selected markets. The total cost ranged from ₦18,752.7 in Akinola to ₦37,870 in Olode market while total revenue ranged from ₦25,643.7 to ₦50,296.3 in Olode market. Akinola markets recorded the highest rate of return (36.8%). This implies that for every ₦100 invested, marketers realized ₦36.8 as profit. The benefit cost ratio was greater than 1 in all markets (1.33-1.37). However, the profitability estimates alone do not establish that non-standard measurement increases marketing margins. That relationship would require a direct comparison of costs, quantities sold and revenue across measurement methods. The findings of this study corroborate with (Ijigbade *et al.,* 2021; Oso *et al.,* 2022), that the business is profitable.

Table 6: Profitability level of marketers of locust bean condiment in selected markets

Profitability indicator	*Olode Market*	*Akinola Market*	*Oja tuntun Market*
Total fixed cost (₦)	503.30	166.00	891.30
Total variable cost (₦)	37,367.00	18,586.00	32,105.00
Total cost (₦)	37,870.30	18,752.70	32,996.30
Total revenue (₦)	50,296.30	25,643.70	43,927.00
Net profit (₦)	12,426.00	6,891.00	10,930.70
Rate of return (%)	32.8	36.8	33.1
Benefit–cost ratio	1.33	1.37	1.33

Profitability Difference Across Measurement Scales

Table 7 presents the analysis of the difference in profitability between traders selling *Iru* by the *Congo* measure and those selling it in wraps. The analysis included 90 observations: 38 for traders using the *Congo* measure and 52 for wraps measure.

The reported mean profit was ₦8,847.97 for traders using the *Congo* measure and ₦10,984.75 for traders selling in wraps. Thus, the observed mean was higher among wrap sellers. However, the one-way analysis of variance indicated that the difference was not statistically significant, (F (1,88) = 0.48, p=0.49). Since the p-value exceeded the 5% significance level, the null hypothesis of no difference in mean profit was accepted.

This result indicates that the study did not find sufficient statistical evidence of a difference in mean profit between the two groups. It does not establish that the methods are equally profitable or that measurement practices have no effect on profitability. The findings may be considered alongside Kabir & Rukayat (2024), who reportedly found a positive gross margin for packaged locust bean products. However, gross margin and net profit are different indicators, and comparisons between studies should account for their respective methods, cost components and units of analysis.

Table 7: Profitability Difference Across Measurement Scales

Summary	Measurement method	Number of observations	Sum of profit (₦)	Mean profit (₦)	Variance	
	Congo measure	38	336223.00	8847.97	201693973.40	
	Wrap measure	52	571207.00	10984.75	213069717.30	
ANOVA	**Source of Variation**	**Sum of squares**	**Df**	**Mean square**	**F**	**p-value**
	Between Groups	10024496.15	1	100244961.15	0.48	0.49
	Within Groups	1832923259.50	88	208286734.40		
	Total	1842947755.65	89			

CONCLUSION AND RECOMMENDATIONS

The study examined the marketing characteristics, measurement practices and profitability of *Iru* marketing in selected markets in Osun State. The findings indicate that the trade was predominantly among sampled trader, with variation in non -standardized measurement practices. *Iru* marketing was found to be profitable among the sampled traders, assuming the reported profitability calculations are correct. The trade was characterized by the use of non-standardized measurements units. While marketing remains profitable under these practices, the evidence presented does not establish non-standardized measurement causes reduced profitability.

Based on the observed measurement practices, the study recommends (i) promotion of low-cost preservation and packaging technologies by extension agencies, (ii) introduction of weight based-pricing using standardized scales, (iii) formation of cooperative society to enhance effective productivity and decision making.

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Authors' Contribution

OAO managed data collection, development of methodology, interpretation of analyzed data. ISO managed data analysis, interpretation of analyzed data, writing of manuscript. BFD supervised the study and reviewed manuscript. AEU provided material support and reviewed manuscript. All authors reviewed and approved the manuscript.

Ethical Statement

Not applicable

AI Declaration Statement

The authors declare that Microsoft Word Editor was use for grammar and Spell checking, and Metal AI was used for language editing and formatting only. All outputs were critically reviewed and approved by all authors, who accept full responsibility for the content of the manuscript.

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