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ANALYSIS OF PROFIT OPTIMIZATION AMONG STREET BEEF PROCESSING ENTERPRISE IN MAIDUGURI METROPOLIS, BORNO STATE, NIGERIA

Ali, I. M.[1], Jibrin, S. A. [2*], Abubakar, S. M. [3] and Yawudima, B. Z.[4]

[1]Department of Agricultural Economics, University of Maiduguri, Borno state, Nigeria
[2]Department of Agricultural Economics and Extension, Borno State University, Maiduguri, Borno State, Nigeria
[3]Department of Agricultural Economics, University of Maiduguri, Maiduguri, Nigeria
[4]Department of Agricultural Economics and Extension, Borno State University, Maiduguri, Borno State, Nigeria

*Corresponding author: shuaibjibril6@gmail.com

ABSTRACT
The study analyses profit optimization on processed beef enterprises in Maiduguri Metropolis, Borno State, Nigeria. A structured questionnaire was administered to generate primary data for the study while secondary data were retrieved from secondary sources such as journal, internet etc. A two-stage sampling procedure was used in selecting respondents for the study. At the first stage, three out of the fifteen (15) wards (*Bulabulin, Gamboru* and *Hausari*) were purposively selected, while in the second stage, a proportionate random sample of 15 Beef processing enterprises from the three (3) wards were considered for the study. Descriptive statistics such as: frequency distribution, percentages, mean, gross margin analysis and general allocation model were used as analytical tools for the study. The result for the staked and stakeless processed beef revealed average revenue of ₦109,793.5 and ₦42,195.3; average total variable cost of ₦54,520 and ₦ 2,800 and gross margin of ₦55,273.5 and ₦19,395.133 respectively. The study concluded that revenue and consequently profit were optimized when processed beef entrepreneurs produced and sold a mean quantity of 1.2kg staked and 0.7kg of stakeless beef given a mean constrain of 13logs and 50.5kg of fuel wood and beef respectively.

Keywords: Profit Optimization, Street beef processing, Enterprise.

INTRODUCTION
There are many sources of animal protein in Nigeria, several studies revealed that beef is the predominant and the most widely consumed animal protein source (Ali et al, 2022). Beef is the third most widely consumed flesh across the globe, accounting for 25% of all flesh production worldwide after pork and poultry which stand at 38% and 30% respectively (Jibrin, et al., 2022). Argentina, the United States and Peoples Republic of China are the world three largest consumers of processed beef per capita (USDA, 2021). According to Jibrin, et. al; (2022) Nigeria is one of the leading countries in sub–Saharan Africa in cattle production and beef consumption. The country had over 14.73million cattle, consisting of 1.47million milking cows and 13.26 million beef cattle. However, less than 1% of this population were managed commercially while about 99% were managed under unimproved traditional system (Jibrin, et al., 2022). Therefore, the traditional system continues to have grave implications on commercialization of cattle production and cattle products, prices and their utilization in the country (Idi, et. al; 2020). However, the cattle industry provides a means of livelihood for a significant proportion of pastoral households and participants in the cattle value chain in sub-humid and semi- arid ecological zones of Nigeria (Agbede, 2019 and FAO, 2020). Beef is a flesh providing protein and is one of the two major inputs for street beef processing enterprises, commercial beef processing cubicles and in varieties of household foods, restaurants for direct human consumption. Street beef processing enterprises are

widely distributed in the study area whose function is to provide conditions under which abattoir dressed beef are barbecued to be palatable and healthy for human consumption. There are number of steps required for these processes which include: washing of dressed beef with warmed water; cutting clean beef into different shapes and sizes; applying additives, spicing and oiling to provide required longevity and taste with heat that provides required temperature. The enterprises carryout the above processes for both stake and stakeless barbecued beef that provide protein. Nevertheless, there is no informed study that provides an optimum use of the current resources (beef and fuel-wood log) of the industry to produce stake and stakeless barbecued beef using the same energy source. This paper therefore intends to determine Profit Optimization Among Street Beef Processing Enterprises in Maiduguri Metropolis Borno State. The specific objectives were to: compute cost of woodlots; abattoir dressed beef and revenue from sales of staked and stakeless processed beef; analyze profit optimization of staked and stake less beef processing enterprises in the area and examine profit constraints associated with staked and stakeless processed beef enterprises in the study area.

METHODOLOGY

The study was conducted in Maiduguri metropolis that comprises Maiduguri metropolitan area and the peripheral wards of Jere, Konduga and Mafa local government areas of Borno State. It lies between latitudes 10°9″N and13^{0}44″N of the equator and longitudes 12°26″E and 14°38″E of Green Which Meridian. The area is characterized by short rainy season of 3-4month (June-September) followed by a prolong dry season of more than 8months which support the growth of shrubs and other short trees that provide pasture for cattle grazing. The current metro area population of Maiduguri 2021 is 803000 at 2.16% increase from 2020 (NMAP, 2021). The major stakeholders in the street beef processing industry in the area are Hausa-Fulani, Gwoza and few Kanuris. Different local breeds of beef cattle are used as source of beef for the processed stake and stakeless barbecued beef. Two stage sampling procedure were used to select sample for the study. Purposive selection of three wards out of eighteen was considered based on concentration of beef processing enterprises in the areas. The three wards include: Bulabulin, Gamboru and Hausari. While in the second stage, a proportionate sample of fifteen representative beef processing entrepreneurs were drawn from the list of Beef Processing Enterprises in the ratio of: 40%, 33% and 27% for Gamboru, Hausari and Bulabulin respectively. Data from primary and secondary sources were used for the study. The primary data were collected using structured questionnaire, supplemented by interview schedules administered by trained enumerators in case of respondents who could neither read nor write. While secondary information was reviewed from journals, survey information, diaries and internet source.

The analytical tools used for the study include: descriptive statistics such as frequency distribution, means, percentages; gross margin analysis and general allocation model for optimization.

General Allocation Model

The general allocation model of optimization was used to achieve objectives three which takes into consideration the following models:

$GM_s = TR_s - VC_s$……...1

$GM_l = TR_l - VC_l$……2

$Maximized\ TGM_{s\&l} = GM_s + GM_l\ (objective\ function)$……..3

Where

Maximized TGM = Total Gross margin from sale of steaks of both staked and stakeless processed beef (defined as total revenue less total variable cost for each enterprise)

GM_S= Gross margin from sale of steaks of staked processed beef

GM_L = Gross margin from sale of steaks of stakeless processed beef

There exist some limitations during the processing activities written in the form of quantities of the two major inputs used in the processing of beef shown in linear inequalities which are subject to:

$F_L + F_S \leq F$ (log of fuel wood constraint)

$B_L + B_S \leq B$ (quantity of beef constraints)

Where:

F_L = number of logs of fuel wood used in producing stakeless processed beef

F_S = number of logs of fuel wood used in producing staked processed beef

F = available logs of fuel wood that was used.

B_S = quantities of beef used in making staked processed beef

B_L = quantities of beef used in making stakeless processed beef

B = available quantities of beef that were used in making processed beef

The third aspect of this technique is the non-negativity constraints express as;

L.S ≥ 0 (non-negativity constraints)

Where:

L = stakeless processed beef

S = staked processed beef

These three aspects of a linear programming were incorporated into a single mathematical model as follows.

$TGM = GM_s +$

$GM_l\ (objective\ function)$.....3

Subject to;

$F_L + F_S \leq F$ (fuel wood constraint)

$B_L + Bs \leq B$ (beef constraint)

Where: L.S ≥ 0 (non-negative constraint)

It is expected that beef processing enterprises particularly those producing both staked and stakeless processed beef would produce at optimized profit level.

RESULT AND DISCUSSION

Revenue and profit estimates as well as estimated constraints associated with beef processing enterprises are presented below.

The result from table 1a revealed that majority (60%) of the staked processed beef enterprises were categorized as small scale, 26% as medium scale while only 14% were categorized as large scale. This was done based on the revenue being generated by the enterprises.

While in table 1b, 53% of the stakeless processed beef were categorized as small scale, 34% as medium scale and 13% were categorized as large-scale enterprise. This indicated that the enterprises in the large-scale category were the minorities and generated more revenue than the others, showing average revenue of 109793.50 and 42195.33 naira for the staked and stakeless processed beef respectively.

The result from table 2a &2b revealed that majority (60%) of the staked processed beef enterprises were categorized as small scale, 26% as medium scale while only 14% were categorized as large scale because of variable cost incurred by the enterprises. Whereas 60% of the stakeless processing enterprises were categorized as small scale while medium and large scale constituted 20% each. This showed average costs of ₦54520and ₦22800 for the staked and stakeless processed beef respectively This indicated that the large-scale category was in the minority and incurred more than the others because they processed larger quantities.

The result from table 3 revealed that majority (80%) of both staked and stakeless beef processing enterprises used 1-20 wood logs as fuel in processing, while 66.67% of the enterprises used 1-40kg of beef in processing staked and stakeless beef. Majority (73.33%) of small scale beef processing enterprises used 1-10 wood logs for processing and 1-20Kg was processed as staked beef by 53.33% of the same enterprises, while 20% of the medium scale beef processing enterprises used 11-20 wood logs per week to process 21-40kg for processed staked beef by 40% and 41-80Kg was processed into both staked and stakeless beef given only 26.66 of the medium scale beef processing enterprises, while 6.67% of the large scale beef processing enterprises utilized more than 41 wood logs and 81Kg of beef in processing staked and stakeless beef per week.

Result of table 4 indicated 60% and 80% of the small scale staked and stakeless processed beef enterprises earned profit of 1,000-40,000 naira respectively. Similarly, medium scale staked and stakeless enterprises earned profit of 41000 to 60,000 naira respectively, while 13.33% and 6.67% of the large-scale category earned 610000 and above for staked and stakeless beef processing enterprises respectively.

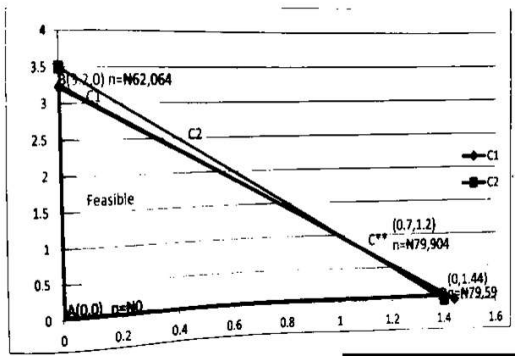

Figure 1: graph showing optimum profit estimates of staked and stakeless beef processing enterprises**.**

The result from table 5 showed that the profit is optimum at point C (₦79,904) which is the optimal point of profit where the value of staked(S) and stakeless (L) beef processed and sold were 1.2 and 0.7 respectively.

CONCLUSIONS AND RECOMMENDATION

The study analysed the profit optimization on beef processing enterprises in Maiduguri Metropolis Borno state, Nigeria. The main objective of the study was to analyse optimum profit among street beef processing enterprises in the study area. Two stage sampling procedure was used to select respondents for the study. At the first stage, three out of the fifteen (15) wards were purposively selected based on concentration of beef processing enterprises: Bulabulin, Gamboru and Hausari wards. While in the second stage, fifteen (30%) beef processing entrepreneurs were randomly selected using the sample frame of 50 beef processing enterprises obtained from the Association of Beef Processing Entrepreneurs in the area. From the three wards: 40% was drawn from Bulabulin, 33% and 27% from Gamboru, and Hausari respectively. The data was analysed using descriptive statistics: frequency distribution, percentages, means and graphical method of general allocation model of optimization to analyse the profit on staked and stakeless beef processing enterprises. The result showed total revenue of ₦147,053 and ₦42,195 for the staked and stakeless processed beef respectively. The result for total variable costs revealed variable cost of ₦54,520 and ₦22,800 for the staked and stakeless processed beef respectively. The result further estimated profit of ₦55,273 for the staked processed beef as well as ₦19,395 for the stakeless beef. The two constrained variables considered in the study were quantities of fuel wood (logs) and beef (Kg): estimated at 8.47logs and 32.8logs for the staked and stakeless beef processing enterprise. In a similar vein, 36.2kg and 14.33kg of steak for the processing of staked and stakeless beef respectively. Given available average constraint 12.7logs and 50.5kg as constrained resource of fuel wood and beef where the values of staked and stakeless processed beef were 1.2 and 0.7 respectively. This was explained by the model indicating the value of staked and stakeless beef at each point along the curve where profit was optimum at point C (₦79,904) which was the optimal point of processing for optimization of profit

Conclusion: The study concluded that revenue and consequently profit were optimized when beef processing entrepreneurs processed and sold a mean quantity 1.2kg of staked and 0.7kg stakeless beef given a mean constraint of 13logs and 50.5kg of fuel wood and beef respectively.

Recommendation:

The following measures were recommended based on findings of the study.

1. Beef processing for barbecuing should be at an optimal level considering the costs of the two input constraints (Beefsteak and fuelwood log)
2. The input constraints (beefsteak and fuel wood) should be utilized efficiently to reduce processing cost of barbecued staked and stakeless beef.
3. Beef processing entrepreneurs should promote sales at a price that encourages consumers to purchase more quantities and reduce deterioration of processed beef for optimum revenue and profit

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Table 1a: Estimated revenue of processed beef entrepreneurs in the study area

Quantities of beef (kg) individual quantities and prices of processed beef (g) individual revenue (in Naira) of processed beef						
			Staked processed beef			
	1	**2**	**3**	**1**	**2**	**3**
A 130kg (₦124,000)	111g (50) (₦500)	50g (300) (₦200)	25g (372) (₦100)	₦24,000	₦62,000	₦37,000
B 840kg (₦160,000)	240g (32) (₦1000)	125g (160) (₦500)	50g (40) (₦200)	₦32,000	₦80,000	₦48,000
C 159kg (₦24,000)	149g (9.6) (₦500)	48g (60) (₦200)	23g (70) (₦100)	₦4,800	₦12,000	₦ 8200
		Total				**₦ 308,000**
			Stakeless processed beef			
	1	**2**	**3**	**1**	**2**	**3**
120kg (₦46,213)	386g (13.3) (₦1000)	1430g (400) (₦500)	80g (166) (₦200)	₦ 9,242.6	₦13,863.9	₦ 23106.5
820kg (₦46,800)	24g (166) (₦56.4)	18g (72) (₦200)	9g (100) (₦234)	₦ 9,360.0	₦14,200.0	₦ 23400
153kg (₦8,733)	26g (23) (₦76)	16g (562) (₦4.7)	14g (900) (₦4.7)	₦ 1,746.6	₦2,619.9	₦ 4366.5
Total						**₦180,346**

Source: Field survey 2022

Table 1b: Estimated revenue of processed beef entrepreneurs in the study area

Revenue Variable	**Frequency**	**Percentage**	**Mean revenue**
Total revenue accrued from processing staked beef (TRs)	**9**	**60**	
Small scale (₦1000-100,000)	**4**	**26**	**109793.50**
Medium scale (₦101,000-200,000)	**2**	**14**	
Large scale (above ₦200,000)	**15**	**100**	
Total revenue accrued from processing stakeless beef (TRI)	**8**	**53**	
Small scale (₦1000-40,000)	**5**	**34**	**42195.33**
Medium scale(₦41,000-60,000)	**2**	**13**	
Large scale (above ₦60,000)			
Total	**15**	**100**	

Source: **Field survey, 2022**

Table 2a: Estimated Cost of Processed Beef Entrepreneurs in the Study Area

S/N Quantities of beef (kg) individual quantities and prices of processed beef (g) individual cost (in Naira) of processed beef total variable sts (in Naira)						
			Staked processed beef			
	1	**2**	**3**	**1**	**2**	**3**
130kg (₦76,384)	111g (50) (₦305.0)	50g (310) (₦123.2)	25g (61.6)	₦15,276.8	₦38,192	₦22,915

840kg (₦94,560)	240g (32) (₦591)	125g (160) (₦295)	50g (40) (₦709.2)	₦18,914	₦47,280	₦22915
159kg (₦16,596)	149g (9.6) (₦345.75)	48g (60) (₦138.3)	23g (72) (₦66.4)	₦3,192.2	₦8,298	₦ 4778.80
Total						**₦ 187489**
			Stakeless processed beef			
	1	**2**	**3**	**1**	**2**	**3**
120kg (₦46,213)	386g (13.3) (₦1000)	143g (40) (₦500)	80g (166) (₦200)	₦9,242.6	₦13,863.9	₦ 23106.50
820kg (₦46,800)	24g (166) (₦56.4)	18g (72) (₦200)	9g (100) (₦234)	₦9,360.0	₦14,200.0	₦ 23400
153kg (₦8,733)	26g (23) (₦76)	16g (562) (₦4.7)	14g (900) (₦4.7)	₦1,746.6	₦2,619.9	₦ 4366.50
Total						**₦101746**

Source: **Field survey, 2022**

Table 2b: Estimated costs of processed beef enterprises in the study area.

S/N	Cost Variable	Frequency	Percentage	Mean Variable Cost
3	**Total variable cost (in Naira) incurred processing staked beef (TVCs)**	**9**	**60**	
	Small classes (₦1000-40,000)	**4**	**26**	**54520**
	Middle classes (₦100,000-60,000)	**2**	**14**	
	High classes (₦60,000 and above)	**15**	**100**	
	Total			
4	**Total variable cost (in Naira) incurred processing stakeless beef (TVCl)**	**9**	**60**	
	Small classes (₦1000-40,000)	**3**	**20**	**22800**
	Middle classes (₦41,000-60,000)	**3**	**20**	
	High classes (₦60,000 and above)			
	Total	**15**	**100**	

Source: Field survey, 2022

Table 3: Constraints associated with beef processing enterprises

Constraint Variable	Frequency	Percentage
Scale	**Available fuel wood (logs) used in processing staked beef per week (Fs)**	
Small 1-10	11	73
Medium 11-20	3	20
Large ≥ 21	1	7
Total	**15**	**100**
Available fuel wood (in logs) used in processing stakeless beef per week (F_L)		
Small 1-10	12	80
Medium 11-20	2	13.33
Large ≥ 21	1	6.67
Total available fuel wood (in logs) used in processing both staked & stakeless per week (F)		
Small 1-20	12	80
Medium 21-40	2	13.33
Large ≥ 41	1	6.67
Available beef (in kilograms) used in processing staked beef per week (B_s)		
Small 1-20	8	53.33
Medium 21-40	6	40
Large ≥ 41	1	6.67
Available beef (in kilograms) used in processing stakeless beef per week (B_L)		
Small 1-10	11	73.33

	Profit (Π) points on graph	Quantity (in kilogram) of staked beef being processed	Quantity (in kilogram) of stakeless beef being processed	Profit value (in Naira) of staked processed beef	Profit value (in Naira) of stakeless processed beef	Total profit (in Naira) earned at each point along the graph
	Point A	0	0	0	0	0
	Point B	0	3.2	0	62,064	62,064
	Point C**	1.2	0.7	66,327.6	13,576.5	79,904
	Point D	1.44	0	79,593	0	79,593
Medum	11-20	3		20		
Large	≥ 21	1		6.67		
Total available beef (in kilograms) used in processing both staked & stakeless beef per week (B)						
Small	1-40	10		66.67		
Medium	41-80	4		26.66		
Large	≥ 81	1		6.67		
Total		15		100		

Source: Field survey, 2022

Table 4: Estimated profit (in Naira) of processed beef enterprises per week in the study area.

Profit Variable	Frequency	Percentage
Profit earned in processing staked beef		
Small scale (₦1000-40,000)	**9**	**60**
Medium scale (₦41000,000-60,000)	**4**	**26.67**
Large scale (≥₦61,000)	**2**	**13.33**
Total	**15**	**100**
Profit (in Naira) earned in processing stakeless beef		
Small scale (₦1000-40,000)	**12**	**80**
Medium scale (₦41,000-60,000)	**2**	**13.33**
Large scale (≥₦61,000 and above)	**1**	**6.67**
Total	**15**	**100**

Source*:* Field survey, 2022