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Economic Valuation of Fortified Cassava Peels for Goat Feeding in South-western, Nigeria

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Abstract

This paper investigates the economic value that goat farmers in South-western, Nigeria attach to fortified goat feed from waste cassava peels origin. Unavailability of vegetative forage for goat feeding all year round makes this relevant. A multistage sampling procedure was used to select 120 goat farmers. Primary data for the study were obtained with the aid of structured questionnaire. The method of analysis included descriptive statistics and contingent valuation method that terminated into the binary choice logit model. The study indicates the mean Willingness to Pay (WTP) for a 25kg of fortified goat feed as ₦1, 019: = in the study area. This for the 120 sampled farmers was ₦122, 280: = and for the total population of 7.1million, it was ₦7.2billion. Respondents' WTP however increased mainly with level of education and system of goat keeping. Farming system practiced by respondents had the likelihood of positively and significantly ($p<0.01$) affecting the WTP for fortified goat feed from cassava peels. Income equally had the likelihood of positively and significantly ($p<0.05$) affecting the WTP in the study area. Education, farm size and experience had the likelihood of positively influencing though not significantly the WTP for the compounded feed. These indicate that there exist economic potentials for the use of cassava waste (peels) in goat production in the study area. Adopting intensive system of goat farming and enhancing income of producers will go a long way to motivating investment in the feed making and its adoption in goat production.

Keywords: Economic value, willingness to pay, fortified goat feed, contingent valuation method

Introduction

FAO (2010) asserts that Nigeria is the largest producer of cassava in the world. She produces up to 49million metric tonnes of this commodity annually and 90% of the produce is consumed locally. IITA (1990) identified and highlighted the characteristics of the common forms of cassava products available

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in Nigeria. Cassava (*Manihot esculenta*) is the third-largest source of food carbohydrates in the tropics. The cassava root is long and tapered, with a firm; homogeneous flesh encased in a detachable rind, about 1mm thick, rough and brown on the outside.

Commercial varieties can be 5 to 10 cm in diameter at the top, and around 15 cm to 30 cm long. Cassava is mainly produced by small scale farmers in rural communities and is primarily produced for food especially in form of garri, fufu with little use in agribusiness sector as industrial raw material. The crop can be processed into several other products like chips, flour, pellets, adhesives, alcohol, starch etc which are raw materials in livestock, feed, alcohol/ethanol, textiles, confectionery, wood, food and soft drink industries (Adebayo, 2011).

Cassava in its crude form is widely used in most tropical areas for feeding pigs, cattle, sheep and poultry. Cassava contains about 92.2 percent carbohydrates and 3.2 percent protein in its dry matter, and so it is a high energy commodity. IITA (2002) claims that cassava products are important feed stuff for livestock feed formulation. Out of a whole cassava root, 15-20% is considered as waste (peels). In many processing enterprises, handling of cassava wastes can be a major challenge involving significant costs.

A common practice for cassava processors is to accumulate the wastes (comprising of peels and pulp) to dump sites situated less than 100 meters away from the processing centers and set fire on them. In the process much carbon dioxide and other gases that produce very strong offensive smell are emitted. In the attempt to utilize cassava waste, cassava peels are usually fed to goats but wet cassava peels contain cyanide that is poisonous to animals. In Nigeria, cassava waste can be processed into different forms of products utilizable by animals. Recycling cassava waste into marketable products provides ways of generating additional income for cassava processors and so turns waste to wealth in the process. Iheke (2008) claims it will create environmental benefit by preventing the burning of cassava waste and releasing harmful toxins into the air. One way of achieving this is by feeding value added cassava waste to animals that would provide meat and milk to human beings and so contribute to attaining food security. This paper tends to achieve this in a wider food security context by focusing on the impact pathways that include value addition processes which reduce physical and economic losses in cassava. In addition is the improved utilization of wastes (peels) in producing products indirectly for human consumption in form of animal feed. It is in this sense; this paper sets to investigate the following:

Describe the socio-economic characteristics of farmers involved in goat production.

Determine the economic value the goat farmers input to the cassava peels based fortified feed.

Assess the determinants of the willingness of goat farmers to pay for cassava peels based fortified feed.

Determine the policy framework to be put in place for appropriate and quick turn out of goat meat and milk to meet the specified per caput daily requirement.

Methodology

The study was carried out in South Western Nigeria with the focused area as Ogun and Osun states. Multistage sampling technique was used to select respondents for the study. The first stage involved the purposive selection of 2 zones each from the Agricultural Development Programme (ADP) delineated zones in each of the states. Three extension blocks were then selected from each of the zones to make a total of 12 blocks in the two states. Ten goat farmers were selected from each block to produce 120 respondents. Out of the 120 questionnaire, primary data from 109 respondents were suitable for analysis. 8

blocks were chosen for the feed adoption demonstration.

The diffusion model of rural development was adopted in introducing the feed to the farmers in each of the 8 demonstration points where experimental stations were cited mainly in cells having considerable number of goat farmers. At each demonstration station, preference was given to local leaders whose production technique and farm organization were held up as example to be followed by farmers in the immediate communities/locality. Animals selected at each experimental station (mainly growers) were fed 0.5kg quantity of fortified goat feed for a period of 21days to establish the spread of the new feed through demonstration effect.

Analytical procedure

The analytical tools of descriptive statistics and the contingent valuation method that terminated into the binary choice logit model were used in this paper. The descriptive statistics involved tabular presentation, means and percentage distribution. The Contingent Valuation Method (CVM) is a generally used method for the estimation of the value of non-market goods. CVM methodology is used to generate willingness to pay (WTP) or willingness to accept (WTA) functions for large and diverse set of consumer goods for use in planning and policy contexts. It is a valuation method based on questionnaire that offers the respondents an opportunity to make an economic decision on non market goods, where no market exists. The valuation is contingent upon the simulated market presented to the respondents.

This method was employed for this paper by determining the mean willingness to pay using a logit model. The paper presents the farmers' willingness to pay which was obtained through the double-bounded dichotomous choice framework proposed by Hanemann *et al.* (1991). The method involves two consecutive bids being proposed to consumers, with the second bid contingent upon the response to the first bid.

The mean WTP is calculated based on the approach of Hanemann (1984) as used by Turcin and Giraud (2001) and Cooper and Loomis (1992) as follows:

$$L_i = 1/ [1+ exp^{-(\alpha + \beta iXi)}] \quad (1)$$

Where:
L_i = Respondent acceptance probability to the bid offered.
β_i = Vector representing the coefficients of all covariates.
X_i = Vector representing all covariates shown as follows:

X_1 = Age (Years)
X_2 = Farm Size (Number of animals)
X_3 = Experience in Goat Keeping (Years)
X_4 = Education (Years)
X_5 = Income (Naira)
X_6 = Farming System (intensive=1, otherwise=0)
X_7= Sex (male=1, female=0)
X_8 = Marital Status (married =1, otherwise=0)
X_9 = Religion (Christian=1, otherwise e =0)
U_i = Random error

The Cooper and Loomis (1992) procedure for the determination of mean WTP is as follows:
$P^- = 1/|\beta| * \ln (1+\exp^a)$ (2)

Where:
a = intercept
β = coefficient of bid
P^- = restricted mean WTP.

Results and discussion

Socio-economic characteristics of goat farmers

Majority of the respondents (33.3%) fell on the age category of 51-60years (table 1).They can therefore be said to belong to the less economically active group going by their age. Both sexes are involved in goat production, but the female gender however constitutes the majority as they occupy 55.96% of the distribution. Most of the respondents (90.4%) are married. The distribution of the respondents by educational status showed that

45.9% have no formal education while primary, secondary and tertiary education were on the levels of 22.9, 22.0 and 9.2 percent in that order. The level of sophistication in education portends a proper understanding of the essence of nourished feed and its advantage on goat production in the study area. Most of the sampled respondents had below 10 animals (50.46%) while few of the respondents had above 30 animals (6.42%). This shows that those who are actively involved in goat production are very few and the implication is that goat production is carried out as a source of secondary income. Farming system practices for goat keeping in the study areas were mainly the extensive system with 79.8% of respondents in such practice while the remaining percentage are involved in the intensive system. The respondents annual incomes in the study area were mainly below ₦25,000: = (52.29%) while those earning above ₦100,000 were on the level of 12.84 percent.

Table 1: Distribution of goat farmers by socio-economic characteristics

Variable	Ogun state		Osun state		Pooled	
Description	Frequency	%	Frequency	%	Frequency	%
Respondents	56	51.38	53	48.62	109	100
Age						
Below 30	2	3.6	1	1.86	3	2.75
30-40	14	25.0	12	22.64	26	23.85
41-50	15	26.8	7	13.24	22	20.18
51-60	15	26.8	21	39.62	36	33.04
Above 60	10	17.8	12	22.64	22	20.18
Gender						
Male	25	44.64	23	43.40	48	44.04
Female	31	53.36	30	56.60	61	54.96
Marital status						
Married	48	85.71	48	90.57	96	88.07
Single	-	-	-	-	-	-
Widow(er)	8	14.29	5	9.43	13	11.93
Education						
No formal Edu.	30	53.57	20	37.74	50	45.9
Primary	14	25.0	11	20.75	25	22.9
Secondary	9	16.0	15	28.30	24	22.0
Tertiary	3	5.36	7	13.21	10	9.2
Farm size						
Below 10	28	50.0	27	50.94	55	50.46
11-20	18	32.14	17	32.07	35	32.11
21-30	6	10.72	6	11.33	12	11.01
Above 30	4	7.14	3	5.66	7	6.42
Farming system						
Intensive	9	16.07	0	0.00	9	8.3
Semi-intensive	13	23.21	0	0.00	13	11.9
Extensive	34	60.71	53	1.00	87	9.8
Income (Naira)						
Below 25,000	30	53.57	27	50.94	57	52.29
25,000-50,000	16	28.60	12	22.65	28	25.69
51,000-75,000	2	3.60	2	3.77	4	3.67
76,000-100,000	4	7.14	2	3.77	6	5.51

Above 100,000	4	7.14	10	18.87	14	12.84
Experience (years)						
Below 10	25	44.64	13	24.53	36	34.86
10-20	24	42.85	22	41.51	48	42.20
21-30	6	10.71	13	24.53	19	17.43
Above 30	1	1.80	5	9.43	6	5.51
Religion						
Christian	23	58.9	30	56.60	53	48.6
Muslim	33	41.07	23	43.40	56	51.4

Source: Computed from field survey data, 2013

WTP for fortified cassava peels feeds by goat farmers

The pooled mean WTP for the 25kg fortified cassava peel feeds by goat farmers in the two states, a representative of the study area was N1,019: =.1,642. This was N737.5 and N1471.6 for Ogun and Osun states respectively (Table 2). This amounts to N122,280: = for the 120 sampled goat farmers in the study area and for the entire population of 7.1 million in the study area if they are all encouraged to imbibe goat rearing with the fortified feed, it would be 7.2billion. This is quite an enormous investment to encourage potential investors to venture into for timely production of goat meat and milk to meet the yearning needs of the people in solving the deficit inherent in the per caput protein consumption requirement as specified by the FAO.

Table 2: Maximum likelihood estimate of a double bounded dichotomous choice response to willingness to pay for cassava peels based feed in the study areas

Variable	Pooled Data Coefficient and t-ratio	Ogun State Coefficient and t-ratio	Osun State Coefficient and t-ratio
Constant	-5.1113*** (-2.8095)	-5.297* (-1.8386)	1.813 (0.4403)
Age	0.275E-02 (0.1364)	0.691E-02 (0.2513)	0.126E-01 (0.2617)
Education	0.375E-01 (0.1483)	0.8453** (1.9867)	-0.7061 (-1.4672)
Farm size	0.572E-02 (0.1951)	-0.2518 (0.4535)	0.1732 (1.597)
Farming system	1.5362*** (2.851)	1.1640* (1.6749)	-
Income	0.98E-05* (1.6300)	0.374E-05 (0.2614)	0.114E-04 (1.2350)
Experience	0.82E-03 (0.35E-01)	0.442E-01 (0.9768)	-0.823E-01* (-1.6742)
Gender (dummy)	0.7893 (1.4101)	0.8886 (1.0173)	-0.688 (-0.541)
Marital status (dummy)	0.2397 (0.3436)	-0.7418 (-0.6956)	1.5712 (1.1815)
Religion (dummy)	-0.1825 (-0.3767)	-0.7120 (-0.9145)	-1.4320 (-1.3235)
Mean WTP	₦1019	₦737.5	₦1471.6
Pseudo R^2	0.15	0.15	0.30
LLF	-74.99	-35.4	-30.6

Respondents	109	56	53

LLF - Log-likelihood function. An average weight of a bag of cassava waste feed was estimated to be 25kg. *** Significant at 1% level, ** significant at 5% level, *significant at 10% level.
Source: Computed from field survey data, 2013.

Factors affecting WTP of goat farmers

Socio-economic factors affecting consumers' willingness to pay for fortified cassava peels feeds were carried out using the logit regression model. The result shows for the whole study area, farming system (P<.01) and income (p<.10) positively and significantly affected the likelihood in the willingness of goat farmers to pay for fortified cassava based feed in goat production (Table 3). This is understandable as the people on intensive cultivation system will be more willing to pursue the search for alternative source of feeds as compared to farmers on extensive system. Income is equally very important in accessing the alternative compounded and costlier feed and so it is expected to positively and significantly affect the likelihood in the WTP of goat farmers. Education, farm size and experience equally increased the likelihood in the willingness to pay for the compounded feed positively though not significantly. Educated people are generally expected to be more informed about benefits of value added feed for goats and poisoning hazards of using wet cassava peels. This is true for farm sizes and experience of goat farmers. Farmers with large farm sizes will tend to be more anxious to seek for alternative compounded feeds especially with the advent of the dry season than one with smaller livestock size. Experience goes a long way in motivating the goat farmers to feed the small ruminants intensively rather than engaging in semi-nomadic practices that are stressful and nutrient wasting to the animals.

Table 3: Factors affecting willingness to pay of goat farmers for cassava peels based feeds.

Variable	Coefficient	t-ratio	Marginal Effect
Constant	-6.2677***	-2.5100	-
Age	0.1687	0.5986	0.285E-01
Education	0.5278*	1.6859	0.891E-01
Farm size	0.2501	0.5680	0.422E-01
Farming system	2.0833***	3.1952	0.3520
Income	0.3800	1.2179	0.6421E-01
Gender (dummy)	0.6003	0.8460	0.1014
M. status(dummy)	-2.0161*	1.7355	-0.3406
Religion (dummy)	-0.313E-01	-0.50E-01	-0.530E-02
Experience	0.3235	0.7792	0.546E-01
LR X^2	40.1348		
Pseudo R^2	31.289		
LLF	-64.135		

LLF-Log likelihood function, M. status- Marital Status Note: ***, **, * implies significance at p<0.01, p<0.05 and p<0.10 levels respectively.
Source: Computed from field survey data, 2013.

Conclusion

The goat farmers operated on a secondary and very small scale but were sophisticated enough in education and awareness to understand the essence of properly compounded feed in nourishing small ruminants to adequate and timely development in the production process.

The mean WTP for the 25kg bag fortified cassava peels based goat feed was N1,019:= This equals N122,180: = for the 120 sampled goat farmers at the purchase of a bag each and 7.2billionfor the entire population of 7.1million in the study area if they are all encouraged to take to secondary goat farming.

This is enormous enough to encourage investment in this fortified goat feed venture than allowing the current situation where cassava peels are left as waste with the consequent associated health hazards.

Goat farmers on intensive goat rearing and more enhanced income were found to be more likely to imbibe the adoption of fortified goat feeds in production. Education, farm size and experience had the positive likelihood to enhance this adoption. Farmers with marital status as compared to the unmarried had less likelihood in their WTP for cassava peel based fortified goat feed. Lack of spouse support may be accountable for the desperate need to adopt the more intensive production system for survival.

There is the need for investment in cassava peels based goat feed and the adoption of intensive system in which fortified feed is utilized in goat production in the study area. All efforts should be put in place by all relevant agencies – government and non-government alike to assist in this direction by enhancing the income base of the farmers. This can be affected through emphasizing loans and credit disbursement to goat farmers. This can be affected especially through the NIRSAL financial component of the current ATA of the federal government in which all the states of the federation are beneficiaries that involves partnership with the apex Central Bank, commercial banks and the insurance organizations. In such a way, the goal of achieving sufficiency in protein consumption by the citizenry would have gone a long way in being achieved.

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