

HEDONIC PRICE ANALYSIS FOR HOG PLUM PURCHASE DECISION IN SOUTHERN PART OF BANGLADESH

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Abstract

The hog plum (*Spondias mombin*) is locally known as *Amra* is very popular fruit in Bangladesh. It is very delicious fruit and sources of Vitamin C. The purpose of this study is to identify the importance of the attributes of hog plum on its price. A total of 121 respondents were interviewed to identify the attributes of hog plum purchase decision using both OLS and robust regression models. Results show that quantity, whole fresh and blemish free are important attributes for hog plum purchase decision. Quantity, blemish free and traceability are significantly important attributes for low income consumer groups whereas quantity and whole fresh are significantly important attributes for high income consumer groups. The implication of the study is that proper hog plum farming system and its marketing activities design are necessary for making it a profitable business.

Keywords: Hog Plum, Quality attributes, hedonic price, robust regression.

Introduction

Consumption of fruit is highly recognized in human diet. The daily per capita fruit requirement is between 250-300gm (Bhuiyan, 2012). Most of the people do not consume fruit daily because of its high cost, one of the several reasons. Hog plum is one of the less expensive and mentionable fruit for its promising profit percentage and nutritional values. According to Department of Agricultural Extension (DAE), approximately 7,200 tons hog plum is grown around 650 hectares of land in only three southern districts of Bangladesh namely Pirojpur, Jhalokathi and Barishal (Islam and Sujon, 2016).

Hog plum (*Spondias mombin*) is edible, delicious and sources of Vitamin C (Siddiqui *et al.*, 2015). It is also a valuable health food which are low in calories, high in vegetable proteins, zinc, chitin, fiber, vitamins and minerals. The fruit is found in Bangladesh and especially available in the period of March-September. It is also found in Assam and Bombay and it can be used to prepare different value added product (Akter *et al.*, 2012). The fruit is also known as "*Amra*" in Bangladesh. The people of all ages are fond of this fruit during the summer season. The fruit is usually consumed in green stage but it can be used to prepare pickle or chutney, jam and other processed food. The fruit is normally sold in

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open markets or in the busy streets like bus station, train station, launch station and even in the ferry ghat.

The purpose of this study is to identify the importance of attributes for hog plum purchase decision and its impact. The hedonic price model was used to identify the importance of each of the attributes of hog plum. The price that finalized by bargaining from both the buyer and seller is hedonic price. According to hedonic price model, consumers do not purchase product rather they purchase the product for its attributes which maximizes the utility of the product (Lancaster, 1966).

The earliest study of hedonic prices for food was firstly carried out by Waugh in 1927 who studied how quality determined the price of vegetables, asparagus (Waugh, 1928). A number of literatures on the hedonic prices of agricultural commodities are available including tomatoes (Bierlen and Grunewald, 1995), milk (Gillmeister *et al.*, 1996), chicken (Ahmad and Anders, 2012) and eggs (Karipidis *et al.*, 2005).

The hedonic prices are also available on fruits including apples (Kajikawa, 1998; Ricks *et al.*, 2002; Endrizzi *et al.*, 2015; Sarder *et al.*, 2020), mango (Yaseen *et al.*, 2016), grapes (Golan and Shlit, 1993), guava and hog plum (Hossain and Badiuzzaman, 2020) and fruit juices (Weemaes and Riethmuller, 2001). The hedonic price study on fruit especially on hog plum in Bangladesh is very scarce. The reason is that the awareness of the consumers regarding the fruit attributes is not well known. Therefore, the study is used to achieve the following specific objectives.

- (1) To identify the influential hog plum characteristics for consumer purchase decision, and
- (2) To quantify the role of each of the hog plum characteristics in explaining the fruit price variation as well.

The next section of this study details the methodology of the study followed by data description and sampling in section 3, results and discussion in section 4. Conclusion of the study in the last section.

Methodology

The hedonic price models were highly applied in food industry. A hedonic price function is used to determine the relative importance of product attributes since the consumers do not purchase product rather they purchase the product for its attributes. A consumer utility is expressed in the following equation:

$$U = f(S_1, S_2, \dots, S_n) \quad (1)$$

Where, S_1 is the service provided by the product i . Ladd and Zober (1977) identified that each of the service or attribute can contribute positively or negatively to the consumption of product i . According to Ladd and Zober (1977), "The price paid for the product equals the sum of the marginal yields of the

characteristics provided by the product, multiplied by the marginal implicit prices of the product's characteristics”.

The following regression model was therefore, used to identify the marginal implicit prices:

$$\log\text{price} = \beta_0 + \beta_1\chi_1 + \beta_2\chi_2 \dots \dots \dots + \beta_n\chi_n \quad (2)$$

Where, $\log\text{price}$ is the logarithm of price, β_i are the parameters to be estimated for χ_i exogenous variables and β_0 is the constant for no error terms. All the exogenous variables are binary variables except quantity purchase of hog plum. The quantity of hog plum purchase is measured in continuous variable. Halvorsen and Palmquist (1980) explained the binary variables in such a way that the percentage changes of the dependent variable-in this case the price of hog plum will be measured in terms of independent variables say, its form (1 if the hog plum is whole fresh, and 0, otherwise), *ceteris paribus*. It indicates the percentage changes in price over the baseline level for certain attributes (whole fresh, big size, hard texture, blemish free etc.). On the other hand, the coefficient of the continuous variable indicates that holding other factors fixed, the percentage changes in price is explained in relation to a unit changes in quantity. Both the OLS and robust regression models were estimated with the help of log-linear model. The robust regression models were estimated due to heteroskedasticity problem. The models were tested with the help of Breusch-Pagan/ Cook-Weisberg test.

Data description and sampling

A questionnaire is primarily produces with the help of available literatures and then a pilot study was conducted among 30 consumers of the hog plum in Barishal Sadar, Dumki and Patuakhali. The pilot study shows that all the factors included in the model were influential for hog plum purchase decision. An interview schedule was then finalized to collect the data from the respondents and 6 field workers were appointed for conducting the survey. The study used stratified sampling technique where the four coastal districts were selected as strata at first, and then the random sampling technique were used to interview the respondents. A total of 121 samples were collected from the Barishal division, located in the southern part of Bangladesh. The four districts of Barishal division namely Barishal, Pirojpur, Jhalokathi, and Patuakhali were selected for the hog plum purchase decision. The highest number of samples were taken from Barishal district by 45% followed by Pirojpur, Jhalokathi and Patuakhali by 31%, 14% and 10% respectively (Table 1) according to the hog plum production volume (BBS, 2018). Table 1 represents the descriptive statistics of both the dependent and independent variables including area, monthly income and expenditure on fruits.

Table 1. Descriptive statistics of dependent and independent variables

Variable	Description	f	\bar{x}	Min	Max	S
Price	Per kg price in Bangladeshi Taka (BDT)	121	73.34	25.00	120.00	22.16
logprice	Logarithm of price	121	1.84	1.40	2.08	0.15
Quantity	Total purchase at a time in kg	121	1.14	0.10	6.00	1.15
Fresh	1 if hog plum is whole fresh and 0, otherwise	121	0.64	0.00	1.00	0.48
Size	1 if hog plum is big in size and 0, otherwise	121	0.52	0.00	1.00	0.50
Texture	1 if the texture of hog plum is hard and 0, otherwise	121	0.76	0.00	1.00	0.43
Blemish	1 if the hog plum is free from blemish and 0, otherwise	121	0.45	0.00	1.00	0.50
Chemical	1 if the hog plum is free from chemical and 0, otherwise	121	0.53	0.00	1.00	0.50
Traceability	1 if the hog plum has no traceability and 0, otherwise	121	0.48	0.00	1.00	0.50
Area						
	Barishal	55	0.45			
	Pirojpur	37	0.31			
	Jhalokathi	17	0.14			
	Patuakhali	12	0.10			
Income						
	Low if monthly income is less than BDT 20,000	67	55.37			
	High if monthly income is BDT 20,000 or more	54	44.63			
Expenditure	Monthly Expenditure on fruit:					
	Less than BDT 2,000	81	66.94			
	BDT 2,000-4,000	35	28.93			
	Above BDT 4,000	5	4.13			

Note: f , s and \bar{x} refers to the number of frequency, standard deviation and the average value. Min and Max refers to the minimum and maximum response of the consumers. Source: Author's own estimations, Field Survey (August-December, 2019).

Table 2. Hog Plum purchase decision in the study area

Dependent Variable: logprice	All			Low Income Group			High Income Group		
	β	$S_{\bar{x}}$	p	β	$S_{\bar{x}}$	p	β	$S_{\bar{x}}$	p
Quantity	-0.219	0.022	0.000	-0.166	0.038	0.000	-0.217	0.031	0.000
Fresh	-0.037	0.015	0.018	-0.048	0.020	0.022	-0.036	0.024	0.141
Size	0.003	0.008	0.715	-0.006	0.012	0.641	-0.007	0.012	0.568
Texture	0.011	0.016	0.496	-0.009	0.022	0.671	0.013	0.026	0.630
Blemish	0.031	0.017	0.067	0.001	0.023	0.979	0.069	0.025	0.008
Chemical	0.002	0.017	0.902	-0.031	0.037	0.402	0.011	0.025	0.663
Traceability	-0.005	0.017	0.775	0.028	0.029	0.353	-0.045	0.026	0.096
Constant	1.997	0.018	0.000	2.020	0.022	0.000	1.982	0.029	0.000
	n=121, R-squared=0.589, F-statistic=25.18 ^{***}			n=54, R-squared=0.683, F-statistic=14.16 ^{***}			n=67, R-squared=0.590, F-statistic=12.13 ^{***}		

Note: *, **, *** denote the statistical significance at 10%, 5% and 1% levels under their p-values. β , $S_{\bar{x}}$ and p refer to coefficients, standard error and the p-value. Source: Author's own estimations, Field Survey (August-December, 2019).

The results show that most of the respondents spend less than BDT 2,000 on fruits per month since the maximum interviewed respondents were under low income group having income has less than BDT 20,000 and they are 67% of the total respondents. The average price of per kg hog plum is BDT 73 which denote that the price of the hog plum is somewhat high because on average, a respondent purchase only one kg hog plum. The highest variation ($C.V = \frac{S}{\bar{X}} \times 100$) are observed in blemish free and in having no traceability of the hog plum by 111% and 104% respectively. The results indicate that the price highly varied due to blemish free and having no traceability.

Results and Discussion

The purchase decision of hog plum is estimated in two ways using two different regression models. The first model is estimated for the full sample using robust regression model due to have heteroskedasticity problem (see appendix 1). Moreover, the full sample was divided in two groups considering income of the respondents. The following Table 2 shows the estimated parameters of the three different hedonic price models.

The results show that all models are fit since F statistics are significant at 1% level. The R-squared values are reasonable. For example, the value of R squared for all consumers model is 0.589 which indicates that the price of hog plum is varied by 59% for each of the independent variables included in the all consumers model.

All consumers' model: All the estimated parameters of the exogeneous variables are expected and found that quantity, whole fresh and blemish free are significantly important for hog plum purchase decision. Varela *et al.* (2009) studied consumer preference in the fruits markets of Taiwan and Udegbe (2019) studied consumer preferences in Nigeria. Both of the study revealed that traditioanl fruits are preferred due to fresh fruits but they didn't identify the willingness to pay for this attribute. The results also show that hog plum is discounted at approximately 22% for every one extra kg purchased. At the same time, the price per kg of hog plum is decreased by approximately 4% if the hog plum is whole fresh compared to sliced, *ceteris paribus*. It indicates that the consumers want to purchase the ready hog plum which is directly consumed in the form of sliced or the pickle of hog plum. On the other hand, the price per kg of hog plum is increased by approximately 3% if the hog plum is blemish free which is in line with the study of Hossain and Badiuzzaman (2020) for guava purchase decision. Ricks *et al.* (2002) also found the similar result for apple purchase decision. They stated that the fruit skin with flaws or blemish were considered as low quality fruit. Yaseen *et al.* (2016) inferred that Pakistani consumers are mostly considered blemish free, size and colour for mango purchase decision.

When we subgroup the consumers, the OLS regression model is considered for low income group consumers because of having no heteroskedasticity (see also appendix 1) whereas in case of high income group consumers, robust regression is used due to have heteroskedasticity problem (see appendix 1). The value of R squared for low income group consumers are higher than the high income group. The results of the subgroups of the consumers show that high income group consumers consider more fruit quality characteristics than the low income group (Huang and Lin, 2007). Quantity and whole fresh are significantly important for low income consumers whereas quantity, blemish free and traceability are important characteristics for high income consumers. The results show a different purchase decision of hog plum in southern part of Bangladesh.

Low income consumer group: The low income consumers are willing to pay less both for whole and purchase more than one kg of hog plum. The per kg price of hog plum is decreased by 17% if one extra kg is purchased, on the other hand, they will pay 5% less if the hog plum is whole fresh rather than sliced, if other things remain constant. It indicates that the more the price of hog plum, the less they desire to purchase. At the same time, the consumers are highly interested to buy the other forms of hog plum rather than whole fresh like sliced, pickle of hog plum etc.

High income consumer group: The high income consumers are willing to pay more for blemish free and traceability whereas they are willing to pay less for more quantity purchase. The hog plum is discounted at approximately 22% for every one extra kg of hog plum purchase; on the other hand, the consumers will pay 5% more if there is a traceability of the hog plum, *ceteris paribus* which is in line with the study of Sarder *et al.* (2020). They found that consumers pay more for traceable apple and less for more quantity purchase. Mabiso *et al.* (2005) also stated that consumers prefer and willing to pay more the labelled apple over non-labelled one. Endrizzi *et al.* (2015) stated that information can be important for certain group of consumers which is almost related with the usage of traceability. The consumers will pay 7% more if the hog plum is blemish free.

The results indicate the different purchase decision by income group of the consumers. The high income group consumers differ by blemish free and traceability whereas the low income group consumers differ by whole fresh of the hog plum. Quantity is the only factor considered by both of the consumer groups. The implication of the study is that the producer of the hog plum should care about the blemish of the hog plum. The intermediaries involved in the hog plum supply chain should care about the traceability, and blemish free of the hog plum and ultimately the pricing strategy of hog plum. The intermediaries may introduce private labelling for the identification of the quality fruits. The reason is that the consumers in this study are found to pay more for the fruits having traceability over the non-traceability ones. Otherwise, the hog plum consumers

may seek the available alternatives such as guava (*Psidium Guajava*), pummelo (*Citrus Maxima*), ceylon olive (*Elaeocarpus Serratus*) etc. which may hinder the sales and farming of hog plum in near future.

Conclusion

The trading of hog plum may be a profitable venture to different intermediaries meeting the consumer need and demand. The farming system of hog plum and its pricing system are the barriers of its business success. The purpose of the study was to identify the attributes of hog plum to its purchase decision and its relative importance. The results of this study show that low income consumers group have different purchase decision than the high income consumers group. The results also show that high income consumers consider more attributes than the low income consumers. In the full sample regression model, it is seen that quantity, whole fresh and blemish free are the important attributes for hog plum purchase decision. Quantity, blemish free and traceability are important attributes for high income consumers purchase decision whereas quantity and whole fresh are important attributes for low income consumers purchase decision.

The implication of this study is that the farmers should care about the farming system of hog plum. To have the consumer required hog plum, the farmer should produce the hog plum blemish free. The intermediaries, on the other hand, should care about the form of hog plum and its traceability. The form of the hog plum indicates the raw hog plum into slice, pickle, chutney, and jam etc. The traceability of hog plum indicates the packaging of the hog plum under different grading. The hog plum would be a profitable business if the seller consider these issues as the consumers need and demand.

The following recommendations may be considered for the better production and marketing activities of the hog plum venture:

- ✓ The proper transportation, preservation and marketing facilities should be developed for reducing a large number of damage and spoil of hog plum.
- ✓ The utility may be increased through the processing and value addition of hog plum by preparing jam, pickle, chutney etc.

The study may be altered for the larger sample size collected from the whole country. The study may be different if the consumption pattern is identified in relation to the gender of the respondents. The contingent valuation method may be applied for finding the consumer's willingness to pay if a number of characteristics and a larger sample size would be available. Conjoint analysis may be applied to rank the characteristics of hog plum as well, the scope of the future research.

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Appendix 1

Heteroskedasticity Test by Breusch-Pagan/ Cook-Weisberg test

Heteroskedasticity Test	Full Sample	Low Income Group	High Income Group
Chi-square	21.580	0.370	15.090
p-value	0.000	0.543	0.000

Note: The null hypothesis is rejected for both full sample and low income group consumer purchase decision since the values of chi-square are significant at 1% level of significance. It indicates that there are heteroskedasticity in both of the model. On the other hand, the null hypothesis is accepted for high income group consumers since the value of chi-square is not significant at 1%, 5% or even 10% level of significance. It indicates that there is no heteroskedasticity.