ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 18 No. 2 August 2018 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Afr. J. Food Agric. Nutr. Dev. 2018; 18(2): 13438-13451 DOI: 10.18697/ajfand.82.17075

MARKET VALUATION OF PROCESSED FRUIT JUICE ATTRIBUTES IN UGANDA: WHAT DO MARKET PRICES OF PROCESSED FRUIT JUICE REFLECT?

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ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 18 No. 2
August 2018
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

ABSTRACT

The demand for processed fruit juice is rising in Uganda due to growth in urbanization, incomes and middle class. Though locally-processed fruit juice is available, much of the domestic demand is being satisfied through imports mainly from South Africa and Kenya, leading to a variety of products in the market. Since processed fruit juice is a heterogenous product, this study assessed the implicit market values of its quality attributes for enhancement of nutrition security in Uganda. By fitting market data to the hedonic price model, size of package was slightly discounted in processed fruit juice per 100 ml serving. For a unit (ml) increase in size of package of fruit juice, the price per serving decreased by Ush0.11 (< US$0.01). Further, fruit juices in transparent packages were significantly cheaper per serving than those in non-transparent packages by Ush23 (US$0.01). Besides packaging, the influence of important quality attributes on its market price was weak. Only fruit juices with added sugar and preservatives were discounted on the market. Fruit juice concentration and flavour did not have any effect on the market price of processed fruit juice, probably because market prices of fruit juices were relatively uniform per serving irrespective of the fruit juice concentration and flavour. Informal interview with one of the local fruit juice processors revealed that the price of fruit juice reflected the cost of packaging material that constituted about 70% of total production costs. Results from this study have far reaching implications for agribusinesses and policy makers for promotion of nutrition security in Uganda. Local fruit juice processors and distributors could opt for the market-oriented pricing and segmentation strategies to offer a wide range of products including premium fruit juice products for high-end, nutrition and health conscious consumers. Moreover, any government efforts to lower the cost of fruit juice packaging material will promote local fruit juice production and consumption in Uganda.

Key words: processed fruit juice, hedonic price model, attributes, convenience, nutrition

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INTRODUCTION

Price is one of the key elements in the development of the marketing strategy for agricultural and food products besides product, place, and promotion [1]. In the marketplace, the price of a product can convey diverse messages to consumers since it is viewed by them as an indicator of quality [2], value/cost [3], scarcity [4], or status symbol [5]. Setting the right price of a product, therefore, requires an agribusiness firm not only to consider consumers' buying motivations and preferences for the product but also to align its pricing strategies to its strategic objectives. Moreover, continuous revision of product prices is imperative since agribusiness firms operate in a complex and dynamic environment involving changing product cost and market structure as well as consumer preferences and disposable incomes [1].

Processed fruit juice is a heterogeneous product consisting of many objective and hidden quality attributes, such as freshness, taste, flavour, texture, shelf life, packaging material, brand, and origin, which influence its price. Using revealed preference methods, previous studies have shown nutrition, packaging, brand, and origin of processed fruit juice influenced its market price [6, 7, 8] or the price consumers were willing to pay for it [8]. The price per serving (200 ml) of sugar-added fruit juice was discounted in Australia by 3.05 AU cents for every additional gram of sugar per 200 ml serving, while a small premium of 0.2 AU cents per serving for every 1% increase in juice concentration was charged [6]. In the same study, the package size of fruit juice was discounted by 3 AU cents for an additional serving and fruit juice in re-sealable containers was discounted by 10.4 AU cents per serving [6]. In Germany, it was also found that a one-percent increase in the package size lowered the price of apple juice by 0.35% and of orange juice by 0.29% [7]. In the United States, findings from a National Household Food Acquisition and Purchase Survey revealed that added sugar and selected nutrients earned positive price premiums in non-diet fruit juice, while added sugar and all nutrients were discounted in diet fruit juice [8]. Moreover, other fruit juice attributes, such as brand, flavour, organic labels, diet labels, package type, and store type influenced its price. All of the above studies used the hedonic pricing model.

Other studies that used conjoint analysis found that packaging and labelling attributes influenced the price consumers were willing to pay for fruit juice [9, 10]. Consumer evaluation of packing attributes of orange juice in Brazil showed that nutrition labels (naturalness, Vitamin C and without added preservative) had a significant effect on their purchase intentions [9]. In the United States, consumers were found to be willing to pay more for Polyethylene Terephthalate (PET) bottle and the no sugar-added claim on 100% fruit juice [10]. Nonetheless, stated preference methods, such as conjoint analysis, have been criticized for using hypothetical cases or products to reveal ex-ante consumer valuation of product attributes as opposed to revealed preference methods (for example, hedonic price method) that use real cases or products [11].

While flavour and shelf-life were not found to be influential attributes to the price of fruit juice in most of the above empirical studies, consumer preferences for it vary by country. In a cross-country comparative study, orange and mixed fruit flavours were the most preferred in Greece and Netherlands followed by peach and apple flavours in Greece and

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Netherlands, respectively [12]. In the same study, it was also revealed that the preferred shelf-life of fruit juice also differed between countries: short-life in Greece and long-life in Netherlands. Whilst, in India, mango, apple, orange, and pineapple were found to be the most preferred fruit juice flavours in that order [13].

In general, consumer preferences for processed fruit juice vary by individual consumer and country perhaps pointing to differences in socio-cultural and economic environment among other factors. Consumer food taste preferences have been partly linked to their social and cultural origins, social ambitions and accumulated cultural capital [14]. Based on their preferences, behaviours and demographics, processed fruit juice consumers have been segmented in Brazil [9], China [15]; United States of America [10]; and Germany [16]; Greece and Netherlands [12]; and Ireland [17]. Common to all the above consumer segmentation studies is the premium segment that seeks natural and nutritious fruit juices. Convenience and lower price seekers are other universal groups of consumers. Other distinctive groups include brand, diet, and environment conscious consumers.

In Uganda, the demand for processed fruit juice is rising and it is being driven by urbanization, growth in incomes and middle class, and more nutrition and health conscious population [18]. Much of the processed fruit juice demand is satisfied through imports from mainly South Africa and Kenya. Available statistics depict that Uganda imports about 18.4 million liters of fresh fruit juice per year worth about US$30 million and the annual growth in importation of fresh fruit juice, for the period 2002-2006, was reported at 56 percent to 135 percent [18]. In response to existing market opportunity, fruit juice processing in Uganda began with the involvement of both local and global agribusinesses. These companies procure fruit concentrate from international sources but have also started sourcing certain kinds of fruits locally for processing. Whether imported or locally-made, processed fruit juice of different brands and variety is distributed to consumers predominantly through supermarkets and retail shops [19]. From the supply side stand point, the main question though is that what do prices of the various processed fruit juices available on the Uganda market reflect?

Using market data and the hedonic price method, this study attempted to determine the implicit market values of quality attributes of both locally-produced and imported processed fruit juices in Uganda. Findings from this study will inform pricing decisions made by fruit processing and distributing agribusinesses as well as guide formulation of suitable policies to boost consumption of processed fruit juice as well as nutrition security in Uganda.

MATERIALS AND METHODS

Theoretical framework

In this study, market valuation of processed fruit juice attributes was done using a hedonic price model that was derived by consideration of both demand and supply conditions of the product market [20]. The hedonic price model follows the random utility theory that postulates that consumers derive utility, not from a good per se but rather from a bundle of its attributes [21]. Thus, the price of any processed fruit juice product i (p_i) is a function of its n attributes. That is:

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(1) $p_i = p_i(z_{i1},..,z_{ij},..,z_{in})$

Assume a representative processed fruit juice consumer faces the following utility maximization problem:

(2) Max $U = U(X, \mathbf{Z})$ s.t. $M - p_i - X = 0$

where U represents utility, X is a composite (numeraire) good, $\boldsymbol{Z}$ is a bundle of processed fruit juice product attributes j (j = 1, 2, ..., n), and M is income.

By taking first order conditions of equation (2) above, we get the the marginal implicit price for characteristic z_j, and corresponds to the regression coefficients to be estimated in equation (1).

(3) $$\frac{\partial U/\partial z_j}{\partial U/\partial X} = \frac{\partial p_i}{\partial z_j}$$

Equation (3) above is nothing but a condition that states that the consumer's marginal willingness to pay for attribute z_j is equal to the marginal cost of purchasing more of z_j. Furthermore, the utility function U can be rewritten as:

(4) $U = U(M - p_i, z_{i1},..,z_{ij},..,z_{in})$

Inverting equation (4), solving for p_i, and holding all but characteristic j constant yields the following bid curve, B_j:

(5) $B_j = B_j(z_j, \mathbf{z}^*_{-\mathbf{j}}, U^*)$

Equation (5) above is the bid curve showing the maximum amount a consumer would be willing to pay for a unit of processed fruit juice product as a function of z_j, holding chosen quantities of all other attributes and utility at the optimal level. It exhibits a diminishing willingness to pay with respect to z_j or a diminishing marginal rate of substitution between z_j and X. Consumers can have different bid curves based on their individual preferences and/or incomes.

In a similar way, the hedonic price model can be derived from the supply side of the product market where a firm's cost of production of processed fruit juice product can also be expressed as a function of its attributes. Offer curves can then be derived from the firm's cost function and shows the minimum price a firm would be willing to accept to sell a unit of processed fruit juice product as a function of z_j, holding chosen quantities of other attributes and profit at the optimal level.

(6) $C_j = C_j(z_j, \mathbf{z}^*_{-j}, \pi^*)$

Assuming a perfectly competitive market bid and offer curves for all processed fruit juice product attributes and for each market participant are at equilibrium. This implies that utility-maximizing consumers purchase the processed fruit juice product with the desired attributes and the market price charged by profit-maximizing producers is the sum of all the implicit prices of its quality attributes.

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By focusing on the supply side of the market, the price per serving of 100 ml of processed fruit juice in Ugandan shilling (Ush), P_i, was assumed to be linearly related to different fruit juice attributes, such as: nutrition, taste, convenience, packaging, brand, and country of origin, as in the previous study [6]. That is:

(7) $$P_i = \beta_O + \beta_1 Z_1 + \beta_2 Z_2 + ... + \beta_{16} Z_{16} + \varepsilon$$

Where:
Z_1 is volume of fruit juice in ml.
Z_2 is juice concentration measured by per cent of fruit juice.
Z_3 is amount of Vitamin C measured in milligrams per 100 ml of fruit juice.
Z_4 is amount of energy measured in kilo calories per 100 ml of fruit juice.
Z_5 is amount of carbohydrates measured in grams per 100 ml of fruit juice.
Z_6 is a dummy variable for sugar addition (1 if yes, 0 otherwise).
Z_7 is a dummy variable for juice preservation (1 if yes, 0 otherwise).
Z_8 is a dummy variable for fruit flavor of juice (for example, 1 if orange, 0 otherwise).
Z_9 is size of package of fruit juice in ml.
Z_{10} is a dummy variable for type of packaging (1 if carton, 0 otherwise).
Z_{11} is a dummy variable for package re-sealability (1 if yes, 0 otherwise).
Z_{12} is a dummy variable for package transparency (1 if yes, 0 otherwise).
Z_{13} is shelf life of juice in days.
Z_{14} is a dummy variable for re-cyclability of package (1 if yes, 0 otherwise).
Z_{15} is a dummy variable for presence of quality sign on package (1 if yes, 0 otherwise).
Z_{16} is a dummy variable for country of origin of fruit juice (1 if Uganda, 0 otherwise).
ε is error term, β_0 is intercept, and β_1 to β_{16} are parameters or marginal implicit values or prices of processed fruit juice attributes.

Data collection method and analysis

Data on price and non-price characteristics of processed fruit juice were collected from Nakumatt supermarket aisle with permission from supermarket management. Nakumatt, a Kenyan supermarket chain, located in Oasis Mall in Kampala, carried various brands of processed fruit juice, both local and foreign. Local fruit juice brands that existed on the supermarket shelf included: *Splash*, *Yo-Juice*, *Daima* and *Jakana*. There were over ten (10) imported fruit juice brands: *Minute Maid*, *Tropicana*, *Del Monte*, *Ribena*, *Yatta*, *Ladid*, *Afia*, *Sun Exotic*, *Enjoy*, *Jaffa Gold*, *Pick n Peel*, *Fanaka*, *Quencher*, *Fruit Dale*, *Maaza*, *Pure Heaven*, *Popular*, *Greenland* and *Vimto*. Many imported brands originated from Kenya although a few came from as far as United Kingdom, Israel, and Egypt. These brands were packed in different sizes, fruit concentrations, packages, and flavours. There were up to 98 different product packages, out of which 89 had complete information necessary for analysis. The statistical package for social scientists (SPSS) computer software was used to generate descriptive statistics and non-parametric tests, and estimate the hedonic price model.

Before data were analysed, it was first subjected to diagnostic checks, such as missing variables and multicollinearity. Firstly, the volume of fruit juice perfectly correlated with size of package of fruit juice and as such only the latter variable was considered in the

analysis. Type of package was excluded from the analysis since it was also perfectly correlated with transparency of package. All plastic bottles were transparent while cartons were not. Further, amounts of Vitamin C and fibre were dropped from the model during analysis due to the presence of fewer observations. It was not also possible to ascertain the texture/pulpiness of fruit juice and so, this taste variable was not included in the model. To test for multicollinearity, both tolerance and variance inflation factor (VIF) measures were obtained. While the tolerance measure ranged from 0.413 – 0.847, VIF ranged from 1.180 – 2.242, depicting an acceptable level of multicollinearity in the final model.

RESULTS AND DISCUSSION

Attributes of processed fruit juice brands in supermarkets

Fruit juices were made from specific or blend of different fruits such as mango, orange, apple, pineapple, blackcurrant, strawberry, passion. They were packed in various sizes: 200, 250, 300, 500, and 1000 ml. The fruit juice concentration ranged from as low as 5% to a maximum of 100%. Some of these brands were exclusively 100% fruit juice others were formulated in different fruit juice concentrations including 100% or had low fruit juice concentration of 10% or less. Most of the brands had nutrition labels on them indicating levels of either/and energy, carbohydrate, fibre, fat, or vitamin C. For example, for those brands that had indicated the amount of Vitamin C in the nutrition label it ranged from 1.8 -30 mg/serving of 100 ml. Some brands claimed to have additional vitamins (A and E) and minerals (iron). The shelf life of juices ranged from 300-365 days. The retail price of fruit juice per serving (100 ml) ranged from Ush500 (US$0.21) to Ush600 (US$0.25), depending on the brand (Table 1).

Other quality attributes of processed fruit juice brands

There were two types of packages used: Tetra Pack's cardboard-based cartons (75.5%) and PET (Polyethylene Terephthalate) plastic bottles (24.5%). Plastic bottles were transparent, available in 300 ml and 500 ml sizes only. While all plastic bottles were resealable once opened, only cartons of larger sizes (500 ml and above) could be resealed. Smaller cartons (200, 250, 300 ml) were not resealable once opened probably because consumers are expected to drink these fruit juice servings at once. All plastic bottles were transparent and in sharp contrast to cartons. In all the fruit juice packages were signs and information indicating they were recyclable. All the juice packages bore signs of quality assurance meaning that they had been approved and considered safe for consumption by the respective regulatory bodies: Uganda National Bureau of Standards (UNBS), Kenya Bureau of Standards (KEBS), and others. Over a half (56%) of the packages had no sugar label on them, particularly those with higher fruit juice concentrations. Besides, about 29% of the packages indicated preservatives had been added to juice and, this seemed to be the case with less concentrated fruit juice brands (Table 2).

Implicit values of Attributes of Processed Fruit Juice

The hedonic pricing model was estimated using the ordinary least squares (OLS) method. The best-fit model had a coefficient of determination or adjusted R^2 of 0.543. This means that over 54% of the variation in the price per serving (100 ml) of fruit juice was

explained by size of package, sugar added, preservative added, transparency of package, and country of origin of fruit juice (Table 3).

The size of package of fruit juice had a small negative influence on the price per serving of fruit juice. For a unit serving (100 ml) increase, the price increased by Ush 0.11 (less than US$0.01). The other packaging variable that was significant was transparency of package. Fruit juices in transparent packages were significantly cheaper per serving than those in non-transparent packages by Ush22.92 (US$0.01). Presence of quality sign, package re-sealability, shelf-life of juice, and re-cyclability of package were found to have no influence on price per serving of fruit juice perhaps because of lack of variation in data. These findings are partially consistent with those from earlier studies conducted in other countries, such as Australia and Germany, where the size of package of fruit juice had a negative influence on its price per serving and fruit juice in re-sealable containers was discounted per serving [6, 7].

In Uganda, the cost of packaging material for processed fruit juice was perceived to be high. An informal interview with one of the fruit juice processors revealed that the market price of fruit juice in Uganda reflected the cost of packaging material that constituted about 70% of total costs of production [22]. This is because the government imposed a high import duty on long life packaging materials. Moreover, cartons and plastic bottles used in Uganda were small (one litre and less) and costly as compared to large (five litres or more), cost-saving and re-sealable containers (such as tins) used in Australia [6]. This suggests that any strategic intervention by the fruit juice processors and/or government to reduce the cost of packaging material, might lead to further discount on package size per serving of processed fruit juice in Uganda.

Nutrition and taste variables that were considered in this study included: fruit juice concentration, amount of energy, amount of carbohydrates, and whether sugar and preservatives were added on fruit juice. While fruit juice concentration did not have any influence on the price per 100 ml serving of fruit juice, fruit juices with added sugar and preservatives were significantly cheaper than those without them by Ush13.99 (US$0.01) and Ush14.97 (US$0.01), respectively. Amounts of energy and carbohydrates had no significant influence on price per serving of fruit juice. Regarding the taste variables, the only variable that was included in the model used in this study was the fruit flavour of juice, but, it was found not to influence the price per serving of juice.

However, fruit juice concentration has been found in earlier studies to positively influence the market price of fruit juice [6, 7]. This suggests that the influence of nutrition attributes on the price of fruit juice was weak in Uganda since only fruit juices with added sugar and preservatives were discounted on the market. The absence of influence of fruit juice concentration and flavour on the market price of processed fruit juice in Uganda may be because market prices of fruit juices were relatively uniform per volume serving irrespective of the fruit juice concentration and flavour. There was only one isolated brand where apple juice was priced slightly above other flavours per given serving. With the growing middle-class, this presents an opportunity for Ugandan fruit juice processors to expand the breadth of product offerings including those targeted at nutrition and health conscious consumers as identified in other countries [9, 10, 12, 15, 16, 17].

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Lastly, local fruit juice brands were significantly cheaper per serving than imported brands by Ush33.08 (US$0.01). The discrepancy in market prices per 100 ml serving of local and imported fruit juice brands could be attributed to transport costs and import duty levied on imports. Nonetheless, local fruit juice brands might not need to compete with foreign brands via price only; embodiment of quality attributes could enable them to gain a competitive edge over the latter, particularly among brand-conscious consumers as found in previous studies [8, 9, 15].

CONCLUSION

Findings from this study show that the market price of processed fruit juice in Uganda depends very much on the packaging costs and is weakly associated with important quality attributes, such as nutrition and taste. This has far reaching implications for local agribusinesses and policy makers for promotion of nutrition security in Uganda. In their competitive strategy, local fruit juice processing and distributing agribusinesses need to produce and offer a wide range of products targeting various market segments. While processed fruit juice can be packaged in various portion sizes, it can also be offered in assorted concentrations, flavours, and shelf-life. This makes it possible for positioning it in the market as a functional, refreshing, thirst quenching, and convenient food product. It also allows for introduction of brands and product lines with a broad spectrum of prices, ranging from cheap to premium fruit juice products for high end, nutrition and health conscious consumers. On their part, policy makers could re-consider import duty charged on fruit juice packaging material as a short-term measure to reduce local fruit juice processors' costs. Nonetheless, to have a comprehensive view of the processed fruit juice market in Uganda, further research is recommended to investigate consumer preferences and willingness to pay for attributes of processed fruit juice.

ACKNOWLEDGEMENT

Funds for conducting this study were obtained through the Competitive Faculty Research Grant from the African Economic Research Consortium (AERC), Nairobi, Kenya.

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Table 1: Attributes of processed fruit juice at selected supermarket

Attribute	N	Mean	Minimum	Maximum	Standard deviation
Size of package (ml)	98	661.22	200.00	1000.00	337.10
Juice conc. (%)	89	47.28	5.00	100.00	41.40
Energy (Kcal*)	92	51.73	41.00	72.00	6.12
Carbohydrates (g*)	92	12.27	9.10	18.10	1.51
Fibre (mg*)	23	12.36	.10	44.00	14.94
Vitamin C (mg*)	39	10.59	1.80	30.00	5.42
Shelf life (days)	98	361.02	300.00	365.00	15.66
Price (Ush*)	98	570.41	500.00	600.00	38.61

Note: * per 100 ml serving; and Exchange rate: 1 US$ = Ush 2,400

Table 2: Other quality attributes of processed fruit juice brands at supermarket

Attribute	Frequency	Percent
Sugar added (yes)	55	56.1
Preservatives added (yes)	28	28.6
Presence of quality sign (yes)	98	100.0
Type of package (tetra)	74	75.5
Resealability of package (yes)	48	49.0
Transparency of package (yes)	29	29.6
Recyclability of package (yes)	98	100.0

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Table 3: Determinants of price per serving (100 ml) of processed fruit juice

Variable	Coefficient	Standard error	t-statistic	p-value
Intercept	676.129	12.461	54.260	0.000
Size of package (ml)	- 0.114	0.012	-9.583	0.000
Sugar added (yes)	-13.988	6.191	-2.259	0.026
Preservative added (yes)	-14.966	6.809	-2.198	0.030
Transparency of package (yes)	-22.917	7.210	-3.179	0.002
Country of origin (Uganda)	-33.084	5.852	-5.654	0.000
Adjusted R^2	0.543			
Number of observations	89			

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