ESTIMATION OF DEMAND FOR PROCESSED FRUIT AND VEGETABLE PRODUCTS IN HAYATABAD, PESHAWAR

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ABSTRACT
This study aimed at to explore the level of consumption and analyze the factors responsible for demand for processed fruit and vegetable products in Peshawar during the year 2005. The respondent households consisted of 5 – 6 members (mean value = 5.51), with an average monthly income of Rs.34428 through 2 earners per household. Jam, jelly, juices of mango, orange, apple and pickles were in general use; however, the consumption of these products varied by number of users and quantity consumed. On an average, a household consumed 10.98 kg of jam and 3.22 kg of jelly per year. The econometrically estimated demand function for jam suggests that the price of Jam inversely affects and income of household directly affects the demand for jam, and these effects are statistically significant at 10 and 1% levels of significance, respectively. The effects of the presence of children, adults and aged people in households and size of plot of residential house do not turn out to be statistically significant. The values of own-price and income elasticity of jam, respectively, estimate at –0.46 and 0.64, indicating that demand for Jam is price and income inelastic. The consumption of mango, orange and apple juices, respectively, estimate at 22.43, 16.05 and 18.30 litres per household per year. The demand for all three juices is price-elastic, but income-inelastic. The average consumption of pickles estimates at 1.33 Kgs. per household per year. The demand for pickles also appears to be price-elastic but income-inelastic. Results suggest that increase in income causes less-than-proportionate increase in demand, but increase in price brings more-than-proportionate decrease in quantity demanded.

Keywords: Demand, Jam, Jelly, Pakistan, Peshawar, Processed Fruits, Vegetables

INTRODUCTION
Fruits and vegetables, in its both raw and processed form, have long been important items of human diet. With the passage of time as the society advanced, the demand for food in the processed or “ready-to-use” form increased. The advanced society now a day is in the need of readily served products; the breakfast, lunch and dinner should now be processed and ready to serve on the spot.

Processing has some other advantages. Fruits and vegetables are perishable products, and cannot be stored for a longer period of time. Through processing, the withholding capacity of such products can be increased. For instance, juices, jam, jellies and canned fruits and vegetables stay for a longer period. This process not only enhances the life of perishable products but also creates a good market relative to that in raw form. It helps to withdraw the surplus produce from the market in the post harvest season, stabilizes the prices and assists in maintaining a stock of fruits and vegetables to meet the demand in off-seasons.

The processing of fruits and vegetables into squashes, juices, jams, jellies, marmalades, pickles and fruit in syrup etc. offers a variety of ways of consuming fruits and vegetables. The popularity of such products is on increase. It is hard to think of the hot and long summer without a daily refreshing glass of some squash or juice. Jam and jelly, and fruit-in-syrup are being used by more and more people as dessert while jams and marmalades are becoming indispensable items for adding spice and flavor to the food. However, the demand for the processed fruit and vegetable products is generally considered to be limited to a small high-income segment of general populace. It is a general view that such products do not form part of the normal diet of the common masses because of the high prices of products and poverty of common people.

This study has intended to investigate into the demand for and factors affecting the demand for processed fruit and vegetables products. The findings are expected to be important for a number of reasons.

First, research would reveal the factual position regarding the demand and the factors affecting the demand for processed fruit and vegetables products in the market studied.

Second, the findings would be of special importance and use to the manufacturers and industrialists who are already in the business of processing fruit and vegetables as well as those who intend to initiate such enterprises.

Third, the findings would be of immense importance for government policy makers and public and private organizations and agribusiness’s concerning the area of study.

Last, the findings would provide the background information to be used as basis for further research in the study area.
This study was carried out to study consumption of processed fruit and vegetables, with special emphasis to find out the factors responsible for the demand of such products. The objectives of the study were:

i. To study consumption of processed fruit and vegetable products in Hayatabad, Peshawar.
ii. To estimate the demand function for important processed fruit and vegetable products in the study area.
iii. To recommend policy prescriptions based on the findings of the study.

There is little literature available on consumption or demand of processed fruit and vegetable products in Pakistan. However Agricultural Statistics of Pakistan provides data on “Per Capita Monthly Consumption of Major Food Items”, but such data mainly pertain to raw commodities and no data on consumption of processed fruit and vegetable products are available in the referred report (GoP, 2006). There is only one study by Seemi (1996), which provides elasticity estimates for apple jam. This study estimates own-price and income elasticity, respectively, at -1.64 and 0.21, suggesting that demand for apple jam is own-price elastic but income inelastic. While in this study, demand for jam has been turned out both own-price and income inelastic; however, demand for all other processed products (juices of mango, citrus, apple and pickles) is price-elastic and income inelastic. There are similar studies in other countries of the world [see for example, Ahvenainen (1999); Al-Hooti (1999); Rashida (2000); Baker (2001); Buckley (2002); Pan (2001); Pison (1999)].

MATERIAL AND METHODS

Research Site and Sampling

This study has been conducted in Hayatabad Peshawar during the year 2005. According to the latest District Census Report, the total numbers of households in Hayatabad were 8013. In order to have a manageable sample at hand, this study included 1% of the household population in sample. A sample of 80 households was selected randomly. Since the study relates to food consumption, the contacted female heads of the households for detailed interview and collection of the needed data and information.

Data Collection

A comprehensive interview schedule was prepared to collect data from the respondents (lady heads of the household). The interview schedule was first pre-tested in the study area and improved with necessary additions and modifications wherever felt necessary. Each respondent was interviewed personally at her home. Data were collected on household size and structure income of household along with number of earners in each household and quantity, price and value of processed fruit and vegetables products consumed by the households. Data on consumption of processed fruit and vegetable products during previous month or on monthly basis was collected.

Data Analysis

A number of techniques, from the simple averages to the use of econometric modeling, were applied to analyze the data. More specifically, the following analytic techniques were used.

For household size and structure, mean number of children, adults and aged were estimated along with standard deviations. For income per household and per earner, again mean values along with standard deviations and minimum-maximum ranges were estimated.

For number of processed fruit and vegetable product household users, their proportions have been estimated as percentage of the total respondents.

For average consumption of all processed fruit and vegetable products, mean values of consumption per year along with related diagnostic statistics including standard deviation, minimum-maximum range and coefficient of variation have been estimated. For estimation of demand functions of jam, juices of mango, orange and apple and pickles, the following econometrics models were specified.

\[
D_{jm} = f(PP, CH, AD, AG, HI, DPS, e) \quad (1)
\]

Where D stands for demand and subscripts namely jm, mj, oj, aj, and pi, respectively, denote jam, mango, orange, apple, and pickle. Others are explained as follows.

- \(PP\) = price of pickle
- \(PM\) = price of mango
- \(PO\) = price of orange
- \(PA\) = price of apple
- \(CH\) = number of children
- \(AD\) = number of adults
- \(AG\) = number of aged
- \(HI\) = household monthly income
- \(DPS\) = dummy = 0 for residents of ≤10 marlas plot-houses
  = 1 for residents of >10 marlas plot-houses

RESULTS AND DISCUSSION

Household Size

An average respondent household has been found to have 5 to 6 members (mean value = 5.51), including 29% children, 63% adults and 8% aged.
Children further include 24% below 5 years, 43% between 5 to 10 years and 33% between 10 to 15 years of age.

**Household Income**

On an average, the monthly household income was estimated at Rs.34428, with a minimum-maximum range of Rs.7000-Rs.75000. There are 2 earners per household (mean value = 2.01); therefore average income per earner is estimated at Rs.17128 per month.

**Fruit and Vegetable Processed Products: Number of User Households**

The study has revealed that the processed fruit and vegetable products namely jam and jelly, juices of mango, orange and apple and pickles prepared from vegetables are in general use in the study area. However, the consumption of these products varies by number of users and quantity consumed. An account of consumption of these products by number of user households is provided in Table-I.

It appears that almost 100% of the households surveyed use jams and 54% household use jelly. Amongst fruit juices, 76% households use mango juice, followed by 39% and 34% households, which respectively use orange and apple juices. Pickles are used by 95% of the households under study.

**Consumption of Processed Fruit & Vegetable Products**

The average quantities of processed fruit and vegetable products consumed by the 80 sampled households have been calculated and given in Table II to IV, along with other related diagnostic statistics, for discussion in the proceeding paragraphs.

**Jam and Jelly**

On an average, a household consumes 10.98 kgs. of jam and 3.22 kgs. of jelly per year (Table-II).

The consumption of jam seems relatively stable as compared to the consumption of jelly, as reflects from the coefficient of variation (CV = standard deviation/mean value) estimated. The number of households consumed jelly was not sufficient to estimate the demand function of jelly.

Using the data on consumption of Jam and its related aspects, we estimated demand function of jam.

\[ D_{jam} = 7.916 - 0.04430PJ + 0.536CH + 0.309AD + 0.106AG + 0.000205HI - 1.777DPS \]

R² = 0.363, F₆,₇₃ = 6.920 (Sig. = 0.000) …….. (6)

The above results suggest that, as per economics theory, the price of Jam (PJ) inversely affects and income of household (HI) directly affects the demand for Jam (D_{jam}); these effects remained statistically significant at 10 and 1% significance levels, respectively. The effects of presence of children (CH), adults (AD) and aged (AG) people in households and size of plot of residential house do not turn out to be statistically significant.

**Mango, Orange & Apple Juices**

Mean values of consumption of mango, orange and apple juices, respectively, were estimated at 22.43, 16.05 and 18.30 litres per household per year.

The use of orange and apple juices has varied heavily across households (CV = 1.53 & 1.55) relative to that of the mango juice (CV = 0.95). The empirical results of the econometrically estimated demand for Juices of mango, orange and apple are provided, as follows.

\[ D_{mj} = 214.333 - 1.615PM - 1.221PO - 1.403PA + 1.226CH - 2.241AD + 2.3591AG + 0.000407HI - 2.442DPS \]

R² = 0.449 F₈,₇₁ = 7.328 (Sig. = 0.000) …….. (7)

\[ D_{oj} = 293.336 - 1.630PO - 1.476PM - 3.065PA + 4.927CH - 1.288AD - 3.244AG + 0.000139HI + 9.124DPS \]

R² = 0.408 F₈,₇₁ = 6.120 (Sig. = 0.000) …….. (8)

\[ D_{aj} = 749.385 - 17.961PA - 0.068PM - 0.002PO - 1.658CH - 3.138AD - 1.520PO + 0.000351HI - 0.726DPS \]

R² = 0.306 F₈,₇₁ = 2.309 (Sig. = 0.029) …….. (9)

The above stated empirical results suggest that, in all three cases of fruit juices, own prices exert statistically significant inverse effects on quantities demanded (D_{mj}, D_{oj} & D_{aj}). Significant negative signs of cross prices of orange (PO) and mango (PM) in demand functions of mango and orange juices, respectively, indicate that the two juices are complement to each other. The price of apple juice (PA) carries insignificant coefficients in demand functions of both mango and orange juices, indicating that apple juice is supplement in the demand for both mango and orange juices. The estimated demand for apple juice reinforces the same results, that is, mango and orange juices are supplement to apple juice. Presence of children (CH) shows significantly positive effect on demand for orange juice compared to other juices, suggesting the preference of children for the orange juice. Presence of adult and aged people does not
show significant effects on demand of all the three juices. Household income (HI) shows some effect on the demand for mango and little effects for juices of oranges and apples. The coefficients of dummy for the residents of houses higher than 10 marlas (DPS) have turned out to be insignificant, suggesting that there are no significant differences between demand for juices across inhabitants of lower than or higher than 10-marlas houses.

**Pickles**
The mean consumption of pickles was estimated at 1.33 Kgs. per household per year (Table-IV). The demand for pickles (Dpickle) seems to be significantly affected inversely by price (PP) and directly by household income (HI) and presence of adults (AD) in the households.

\[
D_{\text{pickle}} = 5.975 - 0.0508PP + 0.0447CH + 0.129AD + 0.0253AG + 0.000017HI - 0.173DPS
\]

\[
(5.782)(6.111)(0.762)(2.141)(0.224)(0.000)(0.000)(0.449)
\]

\[
(0.036)(0.824)(0.705)(1.871)(0.483)(0.065)
\]

\[R^2 = 0.561, F_{6,73} = 15.564 \text{ (Sig.} = 0.000)\]

Children (CH) and aged (AG) do not seem to affect the demand for pickles. Size of residential houses (DSP) also does not show significant effects.

**Estimation of Elasticity of Demand**
The demand functions estimated for jam, juices of mango, orange and apple and pickles provide slope coefficients, which can be used for estimation of elasticities of demand, using the following formula.

\[
\text{Elasticity} = \text{Slope} \left( \frac{\delta D}{\delta P} \right) = \left( \frac{\delta D}{\delta P} \right)
\]

Where \( \delta D \) and \( \delta P \), respectively, are mean values of quantity demanded and respective prices and slope (= \( \delta D/\delta P \)) is the coefficient attached with the respective explanatory variables included in the above reported demand functions. Using elasticity formula, the own-price and income elasticities are estimated and provided in Table-V.

The values of own-price and income elasticity of jam, respectively, estimate at –0.46 and 0.64 and are less than 1; the demand for jam is therefore price and income inelastic.

The estimated own-price elasticity of demand for all the three juices (mango, orange and apple) is greater than –1, indicating that the demand for these juices is price-elastic. However, their demands appear to be income-inelastic. In the same token, demand for pickles turns out to be price-elastic but income-inelastic.

**CONCLUSIONS AND RECOMMENDATIONS**
It is inferred that the demand for almost all processed fruit and vegetables products is income inelastic in spite of the fact that the respondent households relate to relatively high-income group (average monthly income: Rs.34428 per household; Rs.17128 per earner). In addition, with the exception of jam, the demand of all other products (juices of mango, orange & apple and pickles) is price-elastic. The results thus suggest that increase in income causes less-than-proportionate increase in demand, but increase in price brings more-than-proportionate decrease in quantity demanded.

Based on the findings of the study and conclusions drawn, the following recommendations are in order.

i. The results of this study are limited to a small area restricted to Hayatabad locality of Peshawar city. The research needs to be replicated in other parts of Peshawar as well as other cities of the province of North West Frontier so that results can be generalized. The replication of study is therefore recommended.

ii. New studies should also explore two additional aspects of the consumption of processed fruit and vegetable products, namely: (1) whether it is financial stress or other factors, which have limited consumption to a few products; (2) whether wealthy consumers consume more commodities and have higher level of consumption.

iii. The results of the present study have serious implications for producers of such products, that is, they should not raise prices of their products; otherwise their sale would decrease. It is recommended that such producers try to reduce their cost of production.
Table-I: Consumption of Processed Fruit & Vegetable Products by Number of User Households

<table>
<thead>
<tr>
<th>Processed fruit &amp; vegetable products</th>
<th>Number of user household</th>
<th>% of total households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jam</td>
<td>80</td>
<td>100.00</td>
</tr>
<tr>
<td>Jelly</td>
<td>43</td>
<td>53.75</td>
</tr>
<tr>
<td>Mango Juice</td>
<td>61</td>
<td>76.25</td>
</tr>
<tr>
<td>Orange Juice</td>
<td>31</td>
<td>38.75</td>
</tr>
<tr>
<td>Apple Juice</td>
<td>27</td>
<td>33.75</td>
</tr>
<tr>
<td>Pickles</td>
<td>76</td>
<td>95.00</td>
</tr>
</tbody>
</table>

Table-II: Consumption of Processed Fruit & Vegetable Products: Jam and Jelly

<table>
<thead>
<tr>
<th>Processed fruit &amp; vegetable products</th>
<th>Mean consumption (per year)</th>
<th>Standard Deviation</th>
<th>Minimum-maximum Range</th>
<th>Coefficient of variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jam (Kgs.)</td>
<td>10.98</td>
<td>4.7367</td>
<td>5.28-27.00</td>
<td>0.4314</td>
</tr>
<tr>
<td>Jelly (Kgs.)</td>
<td>3.22</td>
<td>3.8035</td>
<td>0.00-10.80</td>
<td>1.1886</td>
</tr>
</tbody>
</table>

Table-III: Consumption of Processed Fruit & Vegetables Products: Mango, Orange & Apple Juices

<table>
<thead>
<tr>
<th>Processed Fruit &amp; Vegetables Products</th>
<th>Mean consumption (per year)</th>
<th>Standard Deviation</th>
<th>Minimum-maximum Range</th>
<th>Coefficient of variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mango Juice (Litres)</td>
<td>22.43</td>
<td>21.2131</td>
<td>0.00-72.00</td>
<td>0.9457</td>
</tr>
<tr>
<td>Orange Juice (Litres)</td>
<td>16.05</td>
<td>24.5959</td>
<td>0.00-69.00</td>
<td>1.5325</td>
</tr>
<tr>
<td>Apple Juice (Litres)</td>
<td>18.30</td>
<td>28.3184</td>
<td>0.00-71.00</td>
<td>1.5475</td>
</tr>
</tbody>
</table>

Table-IV: Consumption of Processed Fruit & Vegetables Products: Pickles

<table>
<thead>
<tr>
<th>Processed fruit &amp; vegetables products</th>
<th>Mean consumption (per year)</th>
<th>Standard Deviation</th>
<th>Minimum-maximum Range</th>
<th>Coefficient of variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickles (Kgs.)</td>
<td>1.33</td>
<td>0.8549</td>
<td>0.00-5.00</td>
<td>0.6428</td>
</tr>
</tbody>
</table>

Table-V: Own-Price and Income Elasticities of Processed Fruit & Vegetable Products

<table>
<thead>
<tr>
<th>Products</th>
<th>Mean value</th>
<th>Slope coefficient</th>
<th>Estimated elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jam</td>
<td>10.98</td>
<td>-0.0443</td>
<td>-0.46</td>
</tr>
<tr>
<td>Own-price</td>
<td>112.97</td>
<td>0.000205</td>
<td>0.64</td>
</tr>
<tr>
<td>Income</td>
<td>34428</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mango Juice</td>
<td>22.43</td>
<td>-1.615</td>
<td>-3.84</td>
</tr>
<tr>
<td>Own-price</td>
<td>53.33</td>
<td>0.000407</td>
<td>0.62</td>
</tr>
<tr>
<td>Income</td>
<td>34428</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orange Juice</td>
<td>16.05</td>
<td>-1.630</td>
<td>-4.74</td>
</tr>
<tr>
<td>Own-price</td>
<td>46.65</td>
<td>0.000139</td>
<td>0.30</td>
</tr>
<tr>
<td>Income</td>
<td>34428</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apple Juice</td>
<td>18.30</td>
<td>-17.961</td>
<td>-39.66</td>
</tr>
<tr>
<td>Own-price</td>
<td>40.41</td>
<td>0.000351</td>
<td>0.66</td>
</tr>
<tr>
<td>Income</td>
<td>34428</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickles</td>
<td>1.33</td>
<td>-0.0508</td>
<td>-4.26</td>
</tr>
<tr>
<td>Own-price</td>
<td>111.66</td>
<td>0.000017</td>
<td>0.44</td>
</tr>
<tr>
<td>Income</td>
<td>34428</td>
<td></td>
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</tr>
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</table>
REFERENCES


Piason, 1999. Dynamics of vegetable production, distribution and consumption in Asia. AVDRC Publication No. 00-498.