Agricultural Economics Research Review
Vol. 29 (Conference Number) 2016 pp 161-170
DOI: 10.5958/0974-0279.2016.00043.4

Determinants of Consumption Probability and Demand for Fruits in India

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Abstract

The study has identified the determinants of choice probability and amount of demand for major fruits at the household level in India by utilizing consumer expenditure survey data collected by the National Sample Survey Organization (NSSO) for the years 2004-05 and 2011-12. Heckman sample selection model has been used to estimate the functional relationship between household level characteristics and fruit consumption as the zero expenditure is encountered for some households in the data set. The study has revealed that increase in prices of fruits has an inverse relationship with fruits consumption. The consumption expenditure on fruits in India has increased with increase in income with time. Considering high prices and lower production of fruits, the government should adopt appropriate measures to increase plantation of fruit crops. There is also the need to generate awareness regarding health effects of fruit consumption, particularly among younger generation.

Key words: Fruits, prices, household income, Heckman model, consumption probability

JEL Classification: E31, D13, C33

Introduction

The consumption of fruits and vegetables has a protective role on human health. It significantly reduces occurrence of non-communicable diseases, such as cardiovascular disorders, obesity, type 2 diabetes mellitus and cancer (Steinmetz and Potter, 1996; Ness and Powles, 1997; Van Duyn and Pivonka, 2000; WHO, 2003; Bazzano, 2005). World Health Organisation (WHO) has recommended a daily intake of at least 400 grams of fruits and vegetables to prevent diet-related chronic diseases and micronutrient deficiencies. The average intake of fruits and vegetables is 280 grams per day per person in India and it accounts for only 9 per cent of the total calorie intake. Though the country ranks second in production of fruits and vegetables in the world, consumption of fruits and vegetables is abysmally low (Danaei *et al*., 2005). Reductions in morbidity and mortality from diet-related diseases can be attained only when the population follows the recommended dietary patterns, including an adequate intake of fruits and vegetables. The latest phyto-nutrient report has shown that due to life-style changes, the younger generation consumes less nutritious food than elder people (Mukherjee *et al*., 2016).

In India, the lower intake of fruits is largely due to dietary choice of individuals, which is skewed towards cereals. Besides, the lack of availability of fruits round the year and their high costs are cited as the important reasons of lower consumption. The fruits and vegetables are perishable in nature and 30-35 per cent of the produce is lost during harvest to distribution. Only 2 per cent of these crops are processed into value-added products. In addition, availability, accessibility, taste and preferences, consumer awareness, quality consciousness, expanding urbanization, opening of

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food malls, easy availability of packaged food and drinks, irregular food habits and life-style changes, all act together in a complex manner to shape decision-making and dietary consumption patterns of individuals and households. Besides, market forces are also capturing young minds with junk food using multi-media strategy and as a result, fruits are getting marginalized and being ousted from mainstream menu. According to the latest National Sample Survey Organisation (NSSO) report, out of 1000 households in India, fruits consumption was reported by 608 (rural) and 777 (urban) households.

It is necessary to study the determinants of selection and consumption of different fruits among rural and urban population which influence fruit consumption pattern. The existing studies in India have largely emphasized on the magnitude of changes in the consumption pattern of food commodities, but none of these studies is focused on the factors affecting food consumption transition at household level (Bansil, 1999). Only a few studies have comprehensively looked into the impact of price and per capita income by estimating demand elasticities in India (Kumar *et al*., 2014; Kumar *et al*., 2011; Mittal, 2007; 2010). This paper focuses on filling this gap in knowledge by analysing their relationship which is crucial for policy formulation. This study has identified the determinants of preference and amount of consumption of fruits among various income groups in both rural and urban population in India.

Data and Methodology

The household data on dietary pattern and consumer expenditure, collected by the National Sample Survey Organization (NSSO), Government of India at national level, pertaining to the periods 2004-05 and 2011-12, were used in this study to capture the temporal and spatial variations in prices of commodities and income, taste and preferences of consumers. These comprehensive National Sample Survey (NSS) data with a sample size of over 100,000 households covering both rural and urban areas have a high acceptance in research and policy.

Methodology

In our study, Heckman sample selection function was employed to accommodate zero consumption or non-participation problem encountered in the consumer expenditure survey data on fruits. Following the notations from Yen and Rosinski (2008), the Heckman sample selection model can be written as follows:

$$\log y = x'\beta + v \quad if \;\; z'\alpha + u > 0 \qquad \ldots(1)$$

$$y = 0 \qquad if \;\; z'\alpha + u \le 0$$

where, y denotes the dependent variable of the model; x and z represent the vectors of independent variables which explain the dependent variable; β and α denote conformable vectors of parameters; u and v are the error-terms which are distributed as bi-variate normal with zero means and a finite covariance matrix:

$$\begin{bmatrix} u \\ v \end{bmatrix} \sim N\left\{\begin{matrix} 0 \\ 0 \end{matrix}\right\}, \begin{bmatrix} 1 & \sigma\rho \\ \sigma\rho & \sigma^2 \end{bmatrix} \qquad \ldots(2)$$

where, σ denotes the standard deviation of v, and the correlation between u and v is represented by ρ. The standard deviation of u is not known, thus it is a set at unity, given that the selection outcomes are observed as binary, which means that the value is either 1 or 0.

The sample likelihood function is given by Equation (3):

$$L = \prod_{y=0}[1 - \Phi\;(\;z'\alpha\;)]\prod_{y>0}\Phi$$

$$\left[\frac{z'\alpha + \rho\;\;(\log y - x'\beta/\sigma}{(\;1 - \rho^2\;\;)^{1/2}}\right] y^{-1}\;\frac{1}{\sigma}\phi\left(\frac{\log\;-x'\beta}{\sigma}\right) \qquad \ldots(3)$$

where, y^{-1} is the Jacobian transformation from log y to y, and ϕ (·) and Φ(·) are the standard normal probability density function (pdf) and cumulative distribution function (cdf), respectively. When the errors are independent (ρ = 0), Equation (3) reduces to that of a two-part model, in the case where the log-likelihood function is separable in parameters α and [β,σ] and therefore, estimation can be broken down to a probit model (to estimate α) using the whole sample and a linear regression of log y on x (to estimate β and α) using only the on-limit observations.

There is a continued interest in the marginal effect calculation in the sample selection model. Based on the procedure given by Yen and Rosinski (2008), the conditional mean of the dependent variable y is given by Equation (4):

$$E(y|y>0) = \exp(x'\beta + \sigma^2/2)\,\Phi(z'\alpha + \sigma\rho)/\Phi(z'\alpha) \quad \dots(4)$$

The marginal probability of a positive observation is given by Equation (5):

$$\Pr(y>0) = \Phi(z'\alpha) \quad \dots(5)$$

and the unconditional mean of y is given by Equation (6):

$$E(y) = \exp(x'\beta + \sigma^2/2)\,\Phi(z'\alpha + \sigma\rho) \quad \dots(6)$$

Differentiating Equations (4), (5) and (6) we get marginal effects on probability, conditional mean and unconditional mean of a common element of x and z (say $x_j = z_j$):

$$\partial \Pr(y>0)/\partial x_j = \phi(z'\alpha)\,\alpha_j \quad \dots(7)$$

$$\partial E(y|y>0)/\partial x_j = [\Phi(z'\alpha)]^{-2} \exp(x'\beta + \sigma^2/2)\{[\Phi(z'\alpha)\,\phi(z'\alpha+\sigma\rho) - \phi(z'\alpha)\,\Phi(z'\alpha+\sigma\rho)]\,\alpha_j + \Phi(z'\alpha+\sigma\rho)\,\beta_j\} \quad \dots(8)$$

$$\partial E(y)/\partial x_j = \exp(x'\beta + \sigma^2/2)[\phi(z'\alpha+\sigma\rho)\,\alpha_j + \Phi(z'\alpha+\sigma\rho)\,\beta_j \quad \dots(9)$$

These marginal effects can be evaluated at data points of interest, such as the sample means of explanatory variables.

Variables Selection

The Heckman sample selection model was estimated for each fruit and vegetable consumption individually. The quantity consumption of a fruit (in kg) was taken as the dependent variable rather than expenditure. Based on Equation (1), the dependent variable refered to the natural logarithm of the amount of fruit consumed by a consumer in one year. The independent variables were: prices of fruit and other food groups (in rupees), monthly per capita income (in rupees), household size (in numbers), age of household-head (in years), dummy variables were added for education level, gender of household-head (1 for woman - headed households and 0 for man-headed households), presence of dwelling units (1 for owning dwelling units and 0 for non-owning), presence of regular salary earners (1 for having regular salary earners and 0 for not having), dummy for own production of fruit (1 for own production of fruit and 0 for others), possibility of having food away from home (FAFH) (1 for FAFH and 0 for others), dummy for time period (1 for the households in 2011-12 and 0 for households in 2004-05) and dummy for economic classes.

The price response was obtained on the basis of unit values. The unit price for different food groups was derived by dividing the value of these food items by total quantity consumed by a particular respondent in a region. The price for those food items which were not consumed by any respondent in a region, was given the average price of the corresponding region. The use of the unit value as a price for a food item has been widely applied by Deaton (1990; 1997), Crawford *et al*. (2003) and Kedir (2005). The prices of the food items were deflated with consumer prices index (CPI) of respective years to convert them into real terms.

We used the total monthly per capita expenditure on food and non-food commodities as a proxy for per capita income. The education levels were classified into illiterates, non-institutional education, primary education, high schooling, higher secondary and collegiate and above. We used state-wise poverty line to classify the entire sample size as poor, middle and high income classes. For this, poverty estimates, released by the Planning Commission, Government of India for 2004-05 and 2011-12 were used for each individual state. Accordingly, the 'poor' income class comprised of households who had income level below the poverty line (BPL), between BPL and 150 per cent of BPL were grouped as 'middle income' and households having per capita income above 150 per cent of BPL were categorized as 'higher income' group.

Choosing independent variables is one of the empirical issues in the estimation of Heckman regression model. As in the other sample selection models, we used exclusion conditions to identify the

Table 1. Consumption profile of different fruits in rural India: 2004-05 and 2011-12

(kg/capita/year)

Fruit	Low-income group			Middle-income group			High-income group		
	2004-05	2011-12	Change (%)	2004-05	2011-12	Change(%)	2004-05	2011-12	Change (%)
Banana	1.82	1.98	8.58	4.50	5.72	27.13	10.36	13.71	32.35
Jack fruit	0.11	0.34	212.15	0.15	0.25	64.14	0.54	0.69	27.63
Watermelon	0.37	0.31	-17.04	0.66	1.00	52.92	1.16	1.78	54.04
Pine apple	0.03	0.08	143.17	0.11	0.13	14.98	0.52	0.30	-43.15
Guava	0.56	0.49	-13.44	0.71	1.06	50.52	1.26	1.89	49.45
Water caltrop	0.08	0.08	-5.04	0.12	0.10	-15.27	0.26	0.13	-48.22
Orange	0.05	0.08	70.88	0.20	0.55	176.19	0.95	1.90	100.04
Papaya	0.05	0.22	316.12	0.16	0.58	265.67	0.59	1.56	162.40
Mango	0.68	0.62	-9.05	1.38	1.88	36.68	2.83	4.02	41.78
Muskmelon	0.13	0.12	-7.97	0.22	0.32	43.71	1.05	0.44	-58.04
Pears	0.01	0.01	-43.35	0.04	0.02	-55.72	0.10	0.06	-38.28
Berries	0.06	0.05	-13.78	0.08	0.08	1.61	0.08	0.06	-23.99
Litchi	0.02	0.01	-55.16	0.04	0.03	-21.93	0.03	0.10	199.56
Apple	0.09	0.04	-55.59	0.53	0.53	-0.48	2.07	2.72	31.22
Grapes	0.07	0.08	5.98	0.26	0.40	54.16	0.93	1.31	40.96

model parameters. Although there was no *a-priory* exclusion conditions for the current samples, we excluded the age variable in the consumption equation which was used in the selection equation. Use of such different sets of variables in the two equations ensured that the model was identified. Stata version 13.0 was used to estimate the log likelihood function of the Heckman sample selection model.

Results and Discussion

Consumption Profile of Different Fruits in India

The annual average per capita consumption of different fruits in rural India in the years 2004-05 and 2011-12 is presented in Table 1. Invariably in all the income groups, consumption of banana was noticed more. In the low and middle income group, next to banana, consumption of mango and guava was noticed more. In high-income group, after banana, mango, apple and orange was consumed. The consumption of almost all fruits increased with increase in household income and the consumption of mango, banana and apple was highly income elastic.

The percentage change in the consumption of fruits between 2004-05 and 2011-12 has indicated that in the low-income group, with the exception of banana, jack fruit, orange, pine apple, papaya and grapes, a negative growth in consumption was noticed in almost all other fruits. The positive consumption growth was noticed highest in papaya (316%), followed by jack fruit (212%) and pine apple (143%). The consumption growth was reduced in apple (55.59%) and litchi (55.16%). Unlike low-income group, in the middle - income groups, the consumption growth was noticed negative only in a few fruits (water caltrop, pears, litchi and apple). The positive consumption growth was seen highest in papaya (265%), followed by orange (176%) and jack fruit (64%). The reduction in consumption growth was higher in pears (55.72%). In the high income-group, pine apple, water caltrop, muskmelon, pears and berries have shown a negative consumption growth. Increase in consumption growth was huge in litchi (199.56%) and papaya (162.40%). Invariably in all the income groups, per capita consumption growth of pears and water caltrop has reduced in 2011-12 vis-a-vis in 2004-05.

The annual average per capita consumption of different fruits among income groups in urban India during 2004-05 and 2011-12 is shown in Table 2. It is evident from Table 2 that in all the income groups, when compared to other fruits, the quantity consumption of banana was higher. In the low-income

Table 2. Consumption profile of different fruits in urban India in 2004-05 and 2011-12

(kg/capita/year)

Fruit	Low-income group			Middle-income group			High-income group		
	2004-05	2011-12	Change (%)	2004-05	2011-12	Change(%)	2004-05	2011-12	Change (%)
Banana	2.77	2.94	6.09	6.06	7.57	24.88	11.46	15.03	31.15
Jack fruit	0.03	0.03	-19.68	0.07	0.06	-20.72	0.08	0.17	103.63
Watermelon	0.43	0.46	7.43	0.71	0.96	35.88	1.12	1.62	43.75
Pine apple	0.04	0.04	-8.12	0.13	0.16	25.67	0.47	0.69	46.60
Guava	0.52	0.65	24.65	0.77	0.95	23.33	1.20	1.47	22.32
Water caltrop	0.04	0.11	208.32	0.08	0.13	50.46	0.16	0.14	-10.25
Orange	0.09	0.14	64.81	0.45	0.94	106.54	1.68	3.14	86.37
Papaya	0.10	0.15	54.93	0.33	0.65	95.90	1.68	1.74	3.65
Mango	0.62	1.00	61.71	1.39	1.86	33.93	2.48	3.77	51.73
Muskmelon	0.14	0.18	35.01	0.26	0.26	-3.08	0.38	0.41	7.45
Pears	0.01	0.00	-62.81	0.04	0.04	-12.74	0.15	0.09	-44.21
Berries	0.06	0.01	-77.43	0.07	0.05	-24.68	0.05	0.03	-43.28
Litchi	0.01	0.02	123.88	0.03	0.06	93.11	0.12	0.17	37.48
Apple	0.23	0.12	-47.40	1.18	1.15	-2.80	4.07	4.81	18.16
Grapes	0.16	0.17	6.42	0.64	0.70	9.97	1.17	1.78	51.81

group, next to banana, more people preferred mango and guava. The people in middle-income group preferred banana, mango and apple in that order. High-income group people preferred banana, apple and mango. With the exception of jack fruit, berries and pears, consumption of all other fruits has shown a positive correlation with respect to income. As in rural areas, the income elasticity was higher with respect to banana and apple. In the low-income group, the consumption of pine apple, pears, berries and apple has shown a negative growth. The positive consumption growth was higher in water caltrop (208%) and litchi (124%).

Table 2 shows that the consumption growth was very much condensed in berries (-77.4%) and apple (-47.4%). In the middle-income group, jack fruit, muskmelon, pears, berries and apple have shown a negative consumption growth in 2011-12. Among the fruits, orange (106%) and papaya (95.9%) witnessed a higher positive consumption growth, whereas berries (-24.6%) and jack fruit (-20.7%) have shown more negative growth. In the high-income group, only water caltrop, pears and berries have shown negative consumption growth in 2011-12 vis-a-vis in 2004-05. In this group, the elevated positive consumption growth was seen in jack fruit (103%) and orange (86%), and reduced consumption growth was higher in pears (-44%) and berries (43%). Thus, in both rural and urban India, banana and mango were noticed invariably in all the income groups in top three fruits for consumption.

Expenditure Profile of Different Fruits in India

The per-capita consumption expenditure on fruits in rural India, in the total food and non-food commodities is shown in Table 3. It is revealed from Table 3 that during 2011-12, 0.83 per cent of the total expenditure was spent on fruits in low-income group, whereas it was 1.74 per cent and 2.16 per cent in middle and high income groups. The expenditure on fruits was income elastic, higher the income, the higher was the share of consumption expenditure on fruits. Among fruits, the share of consumption expenditure on banana was higher in all the income groups in rural India.

The per-capita consumption expenditure on fruits in urban India (Table 4) during 2011-12 reveals that in low-income group about 1.2 per cent of total expenditure was spent on fruits. In the middle and high-income groups it was 2.04 per cent and 2.37 per cent of the total food expenditure, respectively. In the total expenditure, percentage share of banana was higher in

Table 3. Income group-wise consumption expenditure on fruits in rural India

(₹/capita/year)

Fruit	Low-income group		Middle-income group		High-income group	
	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12
Banana	21.73(0.53)	26.09(0.32)	61.42(0.78)	89.77(0.57)	170.86(0.70)	248.04(0.63)
Jack fruit	0.47(0.01)	1.48(0.02)	1.05(0.01)	2.26(0.01)	3.95(0.02)	5.38(0.01)
Watermelon	2.43(0.06)	2.42(0.03)	4.74(0.06)	9.67(0.06)	9.77(0.04)	20.05(0.05)
Pine apple	0.32(0.01)	0.68(0.01)	1.40(0.02)	1.79(0.01)	8.71(0.04)	5.19(0.01)
Guava	4.67(0.11)	6.82(0.08)	9.97(0.13)	17.09(0.11)	21.25(0.09)	33.75(0.09)
Water caltrop	0.79(0.02)	1.04(0.01)	1.34(0.02)	1.61(0.01)	3.13(0.01)	2.45(0.01)
Orange	1.20(0.03)	2.20(0.03)	5.94(0.08)	15.39(0.10)	33.68(0.14)	58.45(0.15)
Papaya	0.76(0.02)	2.92(0.04)	2.47(0.03)	9.68(0.06)	10.51(0.04)	30.55(0.08)
Mango	14.82(0.36)	14.30(0.18)	37.35(0.48)	55.68(0.36)	86.76(0.36)	130.72(0.33)
Muskmelon	1.08(0.03)	1.19(0.01)	2.11(0.03)	3.96(0.03)	3.75(0.02)	7.60(0.02)
Pears	0.18(0.00)	0.13(0.00)	0.76(0.01)	0.44(0.00)	3.02(0.01)	1.98(0.01)
Berries	0.90(0.02)	0.61(0.01)	1.26(0.02)	1.22(0.01)	1.56(0.01)	1.32(0.00)
Litchi	0.33(0.01)	0.41(0.00)	0.84(0.01)	1.93(0.01)	1.46(0.01)	5.86(0.01)
Apple	3.89(0.10)	2.78(0.03)	25.74(0.33)	40.98(0.26)	129.31(0.53)	233.64(0.59)
Grapes	3.34(0.08)	3.87(0.05)	12.71(0.16)	20.53(0.13)	48.99(0.20)	71.82(0.18)
Total expenditure	56.90(1.39)	66.93(0.83)	169.08(2.15)	271.98(1.74)	536.69(2.21)	856.79(2.16)

Note: Figures within the parentheses indicate percentage share of fruits in total expenditure on food and non-food items.

Table 4. Income group-wise consumption expenditure on fruits in urban India

(₹/capita/year)

Fruit	Low-income group		Middle-income group		High-income group	
	2004-05	2011-12	2004-05	2011-12	2004-05	2011-12
Banana	34.59(0.65)	43.54(0.44)	87.16(0.78)	133.37(0.64)	190.66(0.62)	307.90(0.55)
Jack fruit	0.18(0.00)	0.359(0.00)	0.59(0.01)	0.66(0.00)	0.85(0.00)	2.52(0.00)
Watermelon	3.46(0.07)	5.203(0.05)	6.82(0.06)	12.60(0.06)	12.65(0.04)	25.03(0.05)
Pine apple	0.38(0.01)	0.541(0.01)	2.33(0.02)	3.00(0.01)	10.54(0.03)	12.50(0.02)
Guava	7.44(0.14)	10.619(0.11)	13.36(0.12)	17.96(0.09)	23.82(0.08)	34.49(0.06)
Water caltrop	0.44(0.01)	1.56(0.02)	1.23(0.01)	2.60(0.01)	3.06(0.01)	2.99(0.01)
Orange	2.25(0.04)	3.69(0.04)	14.15(0.13)	27.42(0.13)	62.63(0.21)	111.82(0.2)
Papaya	1.64(0.03)	2.89(0.03)	6.37(0.06)	13.48(0.06)	32.45(0.11)	39.13(0.07)
Mango	16.15(0.31)	29.304(0.3)	46.08(0.41)	67.92(0.33)	100.51(0.33)	173.32(0.31)
Muskmelon	1.44(0.03)	2.664(0.03)	3.57(0.03)	3.96(0.02)	5.76(0.02)	8.84(0.02)
Pears	0.21(0.00)	0.116(0.00)	1.39(0.01)	1.49(0.01)	5.87(0.02)	4.68(0.01)
Berries	0.89(0.02)	0.555(0.01)	1.32(0.01)	1.31(0.01)	1.21(0.00)	0.99(0.00)
Litchi	0.23(0.00)	0.905(0.01)	1.45(0.01)	3.44(0.02)	5.71(0.02)	11.15(0.02)
Apple	11.43(0.22)	8.516(0.09)	65.81(0.59)	98.84(0.48)	257.88(0.84)	472.99(0.85)
Grapes	6.70(0.13)	7.829(0.08)	24.17(0.22)	36.26(0.17)	63.56(0.21)	108.76(0.2)
Total expenditure	87.44(1.65)	118.286(1.2)	275.79(2.47)	424.314(2.04)	777.15(2.54)	1317.09(2.37)

Note: Figures within the parentheses indicate percentage share of fruits in total expenditure on food and non-food items.

low- and middle-income groups, whereas in high-income group, people preferred to spend more on apple (0.85%) as compared to banana (0.55%). A perusal of Tables 3 and 4 reveals that the share of per-capita consumption expenditure on fruits in all the income groups was higher in urban India than rural India. Thus, it is revealed that in the total expenditure, the share of consumption expenditure on fruits has reduced in all the income groups in 2011-12 vis- a- vis in 2004-05 in both rural and urban areas of the country.

Estimates of Heckman Sample Selection Model

In this section, we have estimated the functional relationship between consumption quantity of different fruits and some major variables which affect consumption behaviour of fruits at the household level. For this, we have employed Heckman sample selection model because the data set used for the analysis consisted of zero expenditure for many households. We have employed this model to analyse the economic and demographic drivers of household demand for fruits in India. The results of maximum likelihood estimation for fruits show that the estimated error correlation coefficient (ρ) between selection and consumption equations and its corresponding covariance term (λ) are significant. Besides, the likelihood ratio (LR) test rejected the independence of error - terms of the selection and consumption equations (Table 5). This suggests the importance of selectivity correction in the present analysis. Most of the estimated coefficients in both the selection and consumption equations have been found to be statistically significant.

The effects of explanatory variables on the probability and the level of consumption are non-trivial. Further, the marginal effects on probability, conditional and unconditional levels [Equations (7), (8) and (9)] were worked out to find the impacts of household characteristics on the probability of preference and the quantity of fruit consumption. The effects on the conditional level explain what makes those consuming fruits consume either more or less, i.e. the conditional marginal effects measure how the consumption of fruits changes due to a specific independent variable for current fruit consumers. The effects on probability explain the binary decision on consumption, viz., to consume or not to consume, i.e. the marginal effects of probability measure how those consumers who are at zero consumption, may start consuming fruits due to the influence of independent variables. The effects of unconditional level provide an overall assessment of what contributes to a consumption level by increasing (or decreasing) either the probability or conditional level.

Impact of Changes in Price of Fruits on Consumption Quantity

As expected, the increase in price of fruits was inversely related to both purchase probability and expenditure on consumption of fruits. As price of a fruit increases by ₹ 10/ kg, the probability of its purchasing became 0.31 per cent less and there was a decrease in the consumption expenditure by ₹ 0.14 at unconditional level (average consumers) in India. However, there was an increase in expenditure on fruits by ₹ 12.58 at conditional level (current consumers), once the consumers started consuming the fruit while price increases by ₹ 10/kg.

Impact of Changes in Prices of other Food Groups on Fruits Consumption

The increase in prices of fish, meat and egg (FME) affected negatively the choices of fruit consumption and amount of fruit expenditure. If the price of FME increases by ₹ 10 / kg, the expenditure on fruit consumption was expected to reduce by ₹ 5.66 at conditional level and ₹ 12.48 at unconditional level. Surprisingly, the increase in prices of cereals, pulses and vegetables, increase the amount of fruit consumption at both conditional and unconditional levels.

Influence of Changes in Income on Fruits Consumption

An increase in the per-capita monthly income of the households by ₹ 1000 increased the amount on fruits expenditure by ₹ 24.79 at conditional level and ₹ 3.58 at unconditional level. In the present growing Indian economy and per-capita income, the demand for fruits would increase in the future.

Impact of Household Characteristics on Fruit Consumption

Choosing fruits for consumption was 0.52 per cent less probable when the household size was large. An addition of one member in a family was expected to

Table 5. Determinants (marginal effect) of consumption probability and demand for fruits

Variable	Selection	Consumption	Probability	Conditional	Unconditional
tpfruits	***-0.0132 (0.0043)	***0.0239 (0.0035)	***-0.3055 (0.0010)	***12.5806 (2.1665)	ns -0.1456 (0.7623)
tpcereals	***0.2729 (0.0203)	**0.0208 (0.0091)	**6.3285 (0.0049)	***79.7919 (6.0203)	***53.6722 (3.9334)
tpFME	***-0.0760 (0.0017)	***0.0193 (0.0020)	**-1.7631 (0.0005)	***-5.6630 (0.4906)	***-12.4878 (0.4541)
tppulse	***0.0701 (0.0069)	***0.0729 (0.0054)	**1.6263 (0.0016)	***65.1241 (3.3186)	***20.4317 (1.4502)
tpvege	ns-0.0046 (0.0179)	***0.0469 (0.0108)	***-0.1058 (0.0041)	***29.8769 (6.2412)	ns 3.7472 (3.0144)
tMPCE	ns-0.0007 (0.0042)	***0.0378 (0.0072)	***-0.0152 (0.0010)	***24.7921 (4.4001)	***3.5887 (0.8029)
Age	***0.0077 (0.0004)		***0.1777 (0.0001)	***1.8552 (0.1759)	***1.4496 (0.0446)
HHS	***-0.0225 (0.0027)	***0.0400 (0.0024)	***-0.5228 (0.0006)	***-31.8860 (1.6010)	***-8.1975 (0.5349)
EDUC	**0.0109 (0.0042)	***0.0399 (0.0038)	***0.2523 (0.0010)	***28.9758 (2.3626)	***5.9781 (0.7429)
DWU	***-0.3285 (0.0174)	**0.0477 (0.0197)	ns -12.7450 (0.0073)	***-3.1526 (1.1506)	***-10.8332 (0.7586)
SEX	ns 0.0105 (0.0188)	***0.1163 (0.0167)	***0.3897 (0.0070)	***9.1177 (1.1532)	***6.2317 (0.8857)
RSE	***-0.0522 (0.0201)	***-0.0803 (0.0186)	**-1.9553 (0.0077)	***-6.4882 (1.1346)	***-5.4923 (0.8571)
FAFHD	***0.1197 (0.0205)	**0.0338 (0.0174)	**4.3305 (0.0073)	***4.8225 (1.2747)	***6.4600 (1.0562)
time	***0.0680 (0.0189)	***0.6848 (0.0202)	**2.4873 (0.0070)	***73.4667 (3.0407)	***51.2829 (2.6415)
pl2	***0.1340 (0.0153)	***0.4156 (0.0138)	**4.8312 (0.0052)	***40.9947 (2.3225)	***32.0597 (2.0612)
pl3	***0.1141 (0.0258)	***0.7472 (0.0278)	**4.1309 (0.0088)	***84.6798 (5.7930)	***61.4133 (4.7788)
ur	***-0.2238 (0.0140)	***0.0656 (0.0131)	ns -8.5926 (0.0061)	ns 0.2704 (0.8580)	***-6.0434 (0.6802)
Rho		-0.56063***(0.0338)			
Sigma		0.789313***(0.0126)			
Lambda		0.789313(0.0335)			

Notes: Figures within the parentheses indicate standard errors
** and *** indicate significance at 5 per cent and 1 per cent levels, respectively
ns= Non-significant

decrease the amount of fruit expenditure by ₹ 31.88 at conditional level and ₹ 8.19 at unconditional level. The households with dwelling units and regular salary earners have shown less consumption probability and lower amount on fruit expenditure. Regarding practices of having food away from home, the households under women management, and with higher age and education level of household-head were more likely to purchase fruits for consumption because as age and education increase, awareness towards the qualities of fruits increases.

Conclusions and Policy Implications

The study has revealed that consumption of almost all fruits has increased with increase in income in both rural and urban areas. Thus, fruit consumption in India is highly income elastic. Besides income, own price and price of other food groups also decide the consumption of fruits. The upward spiralling food prices have affected all the income groups, especially low and middle income groups in India. Any increase in price of fruits would reduce their purchase probability and expenditure on fruit consumption. In addition, increase in the prices of other high-value commodities like fish, meat and egg also reduces the consumption expenditure on fruits. On the other hand, cereals, pulses and vegetables act as complementary to fruit consumption, because as prices of these commodities increase, the consumption expenditure on fruits also increase.

The household characteristics like having food away from home, households under woman management, and higher age and educational level of household-head have depicted a positive influence on fruit consumption. The share of per-capita consumption expenditure on fruits in all the income groups has been found higher in urban India than in rural India. This could be because of higher accessibility of urban population to fruits. Among the fruits, the consumption of banana, mango and apple has been found more. The study has also shown that in both rural and urban areas, the share of consumption expenditure on fruits in the total expenditure has reduced in all the income groups in 2011-12 as compared to in 2004-05. This might be because of high market price and lower production of fruits. The government should adopt appropriate measures to increase plantation of fruit crops and should also generate awareness, especially among the younger generation about the recommended intake of fruits in daily diet so as to build a healthy nation.

Acknowledgements

The authors are thankful to the anonymous referee for valuable comments that helped in improving the manuscript. The first and second author gratefully acknowledge the University Grant Commission, New Delhi, for providing financial support under Dr S. Radhakrishnan Post Doctoral Fellowship.

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