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Inter-regional variations and future household demand and production of major spices in India

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Abstract

India is the largest producer, consumer and exporter of spices in the world with around 52 spices under the purview of Spices Board. The present paper diagnoses the consumption and production pattern of the major spices in India both spatially and temporally and projects their demand and production in future using statistical tools. Spices basket was found to be dominated by dry-chilli and there exists wide regional variations in their consumption across the country. Production of spices follows the same pattern with dry-chilli occupying maximum area under cultivation. Projected figures confirmed domination of dry-chilli in future also. Region specific consumption as well as production of spices necessitates region specific production policies along with the suitable marketing strategies to increase the welfare of both producers as well as consumers.

Keywords: consumption pattern, demand projections, inter-regional variability, production pattern and forecast

Introduction

Spices sector is one of the key areas in which India has an inherent strength to dominate the global markets on account of innumerable varieties and cultivars suitable for different agro-climatic conditions, huge domestic consumption and the strong tradition of using spices and their derivatives in various recipes, medicine and cosmetics. The importance of spices in India can be realized by its amazing contribution to the national economy. According to Central Statistical Organisation (CSO), the value of all spices together can be estimated to be Rs. 209.05 billion during the triennium ending (TE) 2007–08 which is around 3.57% to the total value of output from agriculture. About 91% of spices produced in the country is used to meet the domestic demand and only 8.9% is exported. However, about 48% of total volume and 44% of total value of world spices trade is contributed by Indian exports. The present paper diagnoses the

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consumption and production pattern of major spices produced in India across different regions and projects their future demand and supply with the objective of devising suitable policies to increase the welfare of both producers as well as consumers.

Materials and methods

Consumption pattern of major spices was diagnosed temporally (over the time) as well as spatially (across regions) using households level consumption data from 43rd (1987–88) and 61st (2004–05) rounds of consumption expenditure survey conducted by National Sample Survey Organisation (NSSO). Regional variations in spices consumption was studied by dividing India into five geographical regions *viz*., Northern (Uttar Pradesh, Punjab, Haryana, Delhi, Chandigarh, Himachal Pradesh, Uttarakhand and Jammu and Kashmir), Western (Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Goa, Dadar and Nagar Haveli and Daman and Diu), Southern (Karnataka. Kerala, Tamil Nadu, Andhra Pradesh, Puducherri, Lakshyadweep and Andaman and Nicobar), Eastern (West Bengal, Bihar, Odisha, Jharkhand and Chattisgarh) and North-East (Assam, Arunachal Pradesh, Manipur, Nagaland, Sikkim, Meghalaya, Mizorum, Tripura) regions. Unit level data regarding consumption of spices during last 30 days was extracted and per household monthly consumption of spices and its share in total spices budget was estimated across different regions and rural and urban sectors.

Future household demand of major spices was projected for the year 2016–17 (end of the 12th Five Year Plan) under different scenarios for each region and both the rural and urban sectors separately using the following expression;

$$D_t = d_0 * N_t \left((1 + y * e)^t\right) \quad (1)$$

where, D_t= household demand of spices in year t; d_0=per capita demand of the spices in the base year; y=growth in per capita income; e=expenditure elasticity of demand for the spices; N_t=projected population in year t.

To make demand projections, in the simulation, two alternate scenarios of income growth rate were used. First scenario i.e. Business as Usual (BAU) was built by estimating the growth rate in gross domestic products (at 1999–2000 prices) from the year 2003–04 to 2007–08 for different regions of the country. Alternatively, high growth rate (9% per annum) in income scenario was used. The growth rates in per capita income under alternative scenarios were worked out by subtracting the population growth from income growth. The projected population estimates were taken from the Registrar General of India for the year 2016. Expenditure elasticity of spices, depicting the response of change in income of the household on spices consumption were estimated using multi-stage (three stages) budgeting framework for each region and rural and urban sector separately (Thomas 1987; Blundell *et al.* 1993; Mustapha *et al.* 1994; Fan *et al.* 1995; Tiffin & Tiffin 1999). In the first stage, household makes decisions on the proportion of total income (expenditure) to be allocated for food consumption. In second stage, household allocates a portion of food expenditure on aggregated commodities like cereals, pulses, fruits, vegetables, non-vegetarian products, spices, etc and then, finally in third stage, a portion of respective food group (spices) expenditure is allocated to disaggregated commodities (individual spices). Almost Ideal Demand System with Linear Approximation (LA-AIDS) using household specific Stone Price Index for respective commodity was attempted in the third stage to estimate the expenditure elasticity (Dey *et al.* 2008). Specification of the complete demand system is given below.

First stage: $F = f(Y, P_f, Z)$ (2)

where, F=log of monthly per capita food expenditure; Y=log of monthly per capita total expenditure; P_f =log of the prices of food; Z=demographic variables *viz*., age, household size, child proportion and education.

Food prices are unit price derived by dividing total value of food by food quantity consumed after converting different food items into a

common unit (kg). The above model was estimated using ordinary least square technique (OLS).

Second stage: $$CG_i = f(P_i, P_j, \hat{F}, Z) \quad (3)$$

where, CG_i stands for expenditure on i^{th} commodity group i.e. spices; P_i= prices of the i^{th} food group (spices); P_j=prices of related food groups (cereals, pulses, fruits, milk, etc); $\hat{F}$ =predicted value of food expenditure from eq.(2).

Third stage: $$S_i = a_i + \sum_j b_{ij} P_i + C_i\left(\frac{\hat{C}G}{I}\right) + Z_i + e_i \quad (4)$$

where, S_i=share of expenditure on i^{th} spice, i = 1, 2, 3, …..8; P_i=price of i^{th} spice; P_j=price of other spices; $\hat{C}G$=predicted value of spices expenditure from eq 3; I=stone price index of the spices

$$I = \sum_i v^1 \ln P_1 \quad (5)$$

where, v_i is the mean of the expenditure share of the i^{th} spice.

The expenditure elasticity was estimated by:

$$n_i = 1 + C_i / v_i \quad (6)$$

Income elasticity of demand for an individual food commodity i.e. spices (n_i^y) was calculated as the product of commodity group (spices) expenditure elasticity of individual item (n_i), commodity group (spices) elasticity with respect to food expenditure (n_i^g) and food expenditure elasticity with respect to total income (n_i^f):

$$n_i^y = n_i \times n_i^g \times n_i^f \quad (7)$$

Production pattern of major spices was studied by comparing the share of an individual spice's area (production) in area (production) under total spices and by estimating compound growth rate (CGR) in their area, production and yield during 1991 to 2008. The production of major spices was forecasted using Holt's method of exponential smoothing for the year 2016–17. This method is most acceptable, simple and easy to interpret. General form of Holt's method of Exponential Smoothing is given below;

$$L_t = \alpha Y_t + (1-\alpha)(L_{t-1} + b_{t-1}) \quad (8)$$

$$b_t = \beta(L_t - L_{t-1}) + (1-\beta) b_{t-1} \quad (9)$$

$$F_{t+m} = L_t + b_t m \quad (10)$$

$$0 \le \alpha \le \text{ and } 0 \le \beta \le 1$$

where, L_t=level of the time series in period t; b_t=slope of the time series; F_{t+m}=forecast in the period m; α, β=parameters to be estimated.

Results and discussion

Consumption pattern of major spices

An Indian household consumed about 1.17 kg spices per month constituting 4.21 and 3.76% share in total food expenditure in rural and urban India, respectively in 2004–05 (Table 1). Among the spices, dry-chilli occupied maximum share in total spices expenditure followed by turmeric in both rural and urban India with per household monthly consumption of 244 and 218 g, respectively. The share of dry-chilli in total spices budget was 22 and 19% in rural and urban India, respectively, while the share of turmeric hovered around 12–13% during 2004–05. Between 1987 and 2004, dry-chilli consumption registered about 25% reduction in its share in rural India and about 17% in urban India. On the other hand, turmeric consumption registered 7–8% increase in its share in spices expenditure. Ginger, which constitutes around 7–9% share in spices budget, registered a significant growth during the same period. Tamarind and garlic lost their share to other spices during the period under consideration.

Among the regions, the share of spices in total food expenditure varied from 2.7% in urban North-East to 5.5% in rural South. The people of Western India spent the highest on dry-chilli consumption in total spices expenditure with about 32 and 25% share in total spice budget in rural and urban sectors, respectively. However, spending on dry-chilli has decreased over the years across all the regions. The share of turmeric in total spices expenditure was highest in North-East and the lowest in Southern region. But, North-East region witnessed about 14 and 21% reduction in expenditure share in rural and urban sector, respectively. On the other hand, Southern region registered about 20 and 16% increase in turmeric share in total outlay on spices in two

Table 1. Spatial and temporal consumption pattern of major spices in India

Spices	North		West		South		East		North-East		India	
	R	U	R	U	R	U	R	U	R	U	R	U
	Quantity (g household^{-1} month^{-1})											
Turmeric	220	188	149	138	82	78	198	214	202	163	146	131
	(2)	(-22)	(-4)	(-6)	(-11)	(-13)	(-4)	(16)	(-6)	(-25)	(-5)	(-7)
Dry-chilli	220	188	397	276	328	274	149	128	101	82	244	218
	(-18)	(-35)	(-31)	(-29)	(-35)	(-39)	(-4)	(-8)	(-6)	(-37)	(-31)	(-34)
Garlic	276	188	298	276	205	196	198	171	151	163	244	218
	(156)	(30)	(91)	(41)	(123)	(45)	(281)	(86)	(41)	(87)	(139)	(55)
Tamarind	0	0	0	0	411	391	0	0	0	0	98	131
	(0)	(0)	(0)	(0)	(-36)	(-33)	(0)	(0)	(0)	(0)	(-36)	(-30)
Ginger	55	141	50	138	123	117	99	214	202	204	98	131
	(2)	(45)	(-4)	(41)	(167)	(160)	(90)	(54)	(26)	(17)	(92)	(39)
Total spices	1102	1033	1142	1102	1519	1486	992	1069	806	775	1172	1178
	(14)	(-3)	(-5)	(-2)	(-19)	(-20)	(28)	(28)	(0)	(-1)	(0)	(-7)
	The share in total spices expenditure (%)											
Turmeric	18	17	11	11	6	6	19	18	25	21	13	12
	(-1)	(-1)	(8)	(4)	(20)	(16)	(-6)	(-4)	(-14)	(-21)	(8)	(7)
Dry-chilli	22	21	32	25	19	17	14	10	14	13	22	19
	(-14)	(-3)	(-18)	(-18)	(-29)	(-21)	(-35)	(-36)	(-18)	(-32)	(-25)	(-17)
Garlic	10	9	12	12	9	10	10	9	14	14	10	10
	(10)	(-3)	(-17)	(-19)	(11)	(0)	(10)	(-3)	(7)	(-2)	(0)	(-8)
Tamarind	0	0	0	0	20	19	0	0	0	0	6	6
	(0)	(0)	(0)	(0)	(-8)	(-4)	(0)	(0)	(0)	(0)	(-21)	(-18)
Ginger	5	9	5	8	6	6	10	15	13	13	7	9
	(60)	(43)	(70)	(46)	(127)	(100)	(87)	(42)	(57)	(39)	(91)	(61)
Total spices*	3.65	3.25	4.36	3.66	5.50	4.54	3.80	3.65	2.83	2.70	4.21	3.76
	(-3)	(-15)	(-4)	(-2)	(-14)	(-18)	(29)	(27)	(10)	(8)	(-2)	(-7)

R=rural; U=urban; Figures within the parentheses are percent change between 1987–88 and 2004–05

*the share of total spices in total food expenditure

sectors, respectively. This reflected a structural shift in the consumption of turmeric among the regions. The share of ginger in total spices expenditure was highest in North- East region in rural sector and Eastern region in urban sector in the year 2004. In case of tamarind, the consumption was found to be highly region specific. It is mainly consumed in Southern region where it is an essential ingredient in more than 90% of households with the highest expenditure share (19–20%) in total spices expenditure. But, its share is declining particularly among urban households, which may be due to rising preferences towards other spices. The share of garlic in total spices expenditure was highest in North- East with the value of about 14% in both rural and urban sectors.

Thus, it can be summarized that spices consumption basket of Indian households is dominated by dry-chilli followed by turmeric. However, the share of dry-chilli has reduced during last two decades, while turmeric gained its share in total expenditure on spices. Though, consumption of spices is found to be region specific because of difference in taste and preference of the consumers, the importance is

changing for the spices under study across the regions.

Expenditure elasticities for major spices

Expenditure elasticity of spices explains the likely effect of income on the consumption of spices, which was estimated to be less than unity indicating less than proportionate increase in the demand of spices with increase in income (Table 2). In this context, spices can be categorized as necessary commodities, although consumed in very small quantities, which can be attributed to the smaller values of expenditure elasticities. Barring a few exceptions, expenditure elasticities of all the spices for rural households were comparatively higher than urban households. Thus, the demand for spices in future will be higher in rural areas as compared to urban areas with the rise in income of the household. Among the spices, expenditure elasticity was highest for dry-chilli followed by tamarind in both the rural as well as urban regions. Ginger was found to be most insensitive to change in income as exhibited by lowest expenditure elasticity. Further, estimated expenditure elasticities of individual spices were different for different regions of the country indicating differential response of increase in consumers' income on their demand in each region.

Demand projections for spices under different scenarios

Demand projections for the spices revealed that by the year 2016–17, demand for dry-chilli will be highest among the spices (Table 3). Further, demand of spices will be significantly higher, almost double in rural areas primarily because of higher population and expenditure elasticities. In high growth scenario, demand of the spices will be further higher as compared to business as usual scenario. Demand of tamarind and pepper will be highest in the Southern region. Turmeric and ginger will be in greatest demand in Eastern region and dry-chilli and garlic will be in greatest demand in Western region of the country.

Production pattern of spices

Total area under spices was 2160 thousand hectares (ha) in TE 1993, which had increased to 2472 thousand ha in TE 2008 with a growth rate of 2.96% per annum (Table 4). Similarly, total spices production registered 87.08% increase between 1991 and 2008 with significant growth rate of 5.71% per annum. The yield of spices in India increased from 969 kg ha^{-1} in TE 1993 to 1586 kg ha^{-1} in TE 2008 with the growth of 2.67% per annum. Almost all the states produced spices with Kerala enjoying the largest share of production of high valued spices like black pepper, small cardamom, ginger, etc. and various spices have behaved differently across the states over the period of time (Ravindran & Manojkumar 2001; Shinoj 2004). Among spices, dry-chilly contributed maximum share in area and production of total

Table 2. Estimated expenditure elasticities of major spices

Region	Sector	Dry- chilli	Garlic	Ginger	Pepper	Tamarind	Turmeric
North	Rural	0.46	0.14	0.07	0.44	0.47	0.45
	Urban	0.33	0.16	0.05	0.32	0.33	0.31
West	Rural	0.48	0.24	0.05	0.42	0.49	0.47
	Urban	0.34	0.16	0.11	0.29	0.34	0.35
South	Rural	0.43	0.22	0.09	0.43	0.46	0.37
	Urban	0.41	0.22	0.17	0.43	0.46	0.42
East	Rural	0.67	0.31	0.28	0.57	0.42	0.61
	Urban	0.52	0.31	0.22	0.55	0.49	0.51
North-East	Rural	0.59	0.33	0.30	0.48	1.05	0.57
	Urban	0.54	0.33	0.21	0.52	0.83	0.53
India	Rural	0.58	0.29	0.12	0.50	0.52	0.47
	Urban	0.44	0.24	0.06	0.36	0.38	0.37

Note: Estimated parameters from three stages of demand system could not be given due to paucity of space and can be obtained from author if required.

Table 3. Demand projections for the spices under different growth scenario for 2016–17

(000, tonnes)

Region	Sector	Dry-chilli		Garlic		Ginger		Pepper		Tamarind		Turmeric	
		BAU	HGR	BAU	HGR	BAU	HGR	BAU	HGR	BAU	HGR	BAU	HGR
North	Rural	200.8	220.7	171.5	176.5	46.2	46.2	18.0	19.7	5.9	6.5	194.9	213.7
	Urban	81.0	86.6	72.1	74.6	47.7	48.2	8.6	9.2	1.9	2.1	74.5	79.4
West	Rural	358.9	381.9	213.4	220.1	43.8	44.0	6.8	7.2	11.3	12.0	121.2	128.7
	Urban	149.3	156.1	124.5	127.2	52.0	52.8	6.5	6.7	9.8	10.2	63.7	66.6
South	Rural	266.1	279.3	137.8	141.3	65.0	65.7	24.5	25.7	371.1	390.6	62.4	65.1
	Urban	146.6	153.6	94.8	97.2	47.6	48.5	20.0	21.0	213.2	224.7	37.7	39.5
East	Rural	173.7	191.7	177.2	185.7	104.7	109.1	19.5	21.2	27.6	29.3	236.8	259.1
	Urban	35.6	38.5	48.5	50.8	48.6	50.2	6.0	6.5	5.2	5.6	59.9	64.6
North-East	Rural	16.6	19.7	24.0	26.5	26.3	28.7	1.2	1.4	1.0	1.3	30.9	36.6
	Urban	3.6	4.2	6.6	7.3	7.2	7.7	0.3	0.4	0.1	0.2	6.3	7.4
India	Rural	1094.3	1193.0	763.2	798.2	281.7	286.9	72.4	78.0	458.7	495.6	627.6	673.7
	Urban	433.4	463.5	356.4	369.8	191.9	193.8	40.0	42.2	212.3	224.8	238.2	251.8

BAU=Business as usual scenario; HGR=high growth rate scenario 9% per annum

Table 4. Area, production and productivity of major spices in India

Zone	Area ('000, ha)			Production ('000 tonnes)			Yield (kg ha^{-1})		
	TE 1993	TE 2008	CGR (1991–2008)#	TE 1993	TE 2008	CGR (1991–2008)#	TE 1993	TE 2008	CGR (1991-2008)#
Pepper	182 (8.44)	256.(10.36)	2.37**(40.49)	50(2.40)	80(2.04)	2.88**(59.24)	276	312	0.50(13.11)
Dry- chilli	875(40.50)	776(31.37)	-0.49(-11.3)	733(34.97)	1655(42.21)	4.65**(125.7)	836	2107	5.17**(152.2)
Coriander	377(17.45)	348(14.10)	-1.40(-7.56)	190(9.07)	255(6.51)	2.15**(34.37)	504	730	3.60**(44.91)
Cumin	203(9.40)	491(19.86)	5.86**(141.7)	91(4.32)	157(4.01)	3.90*(73.69)	457	329	-1.85*(-27.9)
Turmeric	123(5.70)	176(7.12)	2.07**(42.97)	374(17.87)	828(21.11)	3.54**(121.0)	3037	4701	1.43*(54.79)
Total Spices	2160(100)	2472(100)	2.96*(14.46)	2096(100)	3920(100)	5.71**(87.08)	969	1586	2.67**(63.70)

Figures within parenthesis are % of total spices, CGR=Compound Growth Rate (%); ** and * CGR significant at 1% and 5% level of significance, respectively
#Figures within parenthesis are percent change in TE 2008 over TE 1993

spices in TE 2008. The share of dry-chilli in total area and production was 31.37% and 42.21% in TE 2008. Between 1991 and 2008, dry-chilli witnessed about 11.3% reduction in its area and thus its share in total spices area reduced from 40.5 in TE 1993 to 31.37% in TE 2008. However, an increase of 125.7% in the production of dry-chilli was witnessed because of significant 152.2% increase in its yield during the period under consideration. Similarly, total area under coriander was reduced by 7.56% between 1991 and 2008 but, due to increase in yield by 44.91%, coriander registered 34.37% increase in its production during the same period. The region-wise production pattern of dry-chilli and coriander revealed that production of spices was region specific. Dry-chilli was found to be produced primarily in Southern region which constituted around 53% and 72% share in total spices area and production, respectively. South region was followed by the Western region in the area and production of dry-chilli. Coriander was primarily produced in the Western region. It is to be noted that over the years, the share of the Southern region in total coriander area and production reduced drastically, while the Western region gained its share.

Cumin was found to be the second major contributor of total area under spices with the share of 19.86% in TE 2008. Between 1991 and 2008, area under cumin increased by 141.7% with a significant growth of 5.86% per annum and production increased by 73.69% with the growth of 3.9%. The share of cumin in total spices production was about 4%. Similarly, pepper and turmeric registered more than 40% increase in area under cultivation during the same period. With this, their share in total spices area was found to be improved over the years.

Production forecast and policy options for major spices in India

Production forecast of the major spices indicated that dry-chilli and turmeric will be the major spices in 2016–17 with the production of 1412 and 1000 tonnes, respectively (Table 5). It is to be noted that care should be taken in interpretation because weight of different spices are significantly different. Thus, quantity of the spices cannot be taken as an indicator for comparison. However, production can definitely be compared with the consumption of the respective spice and the result will be the balance between demand and supply of spices excluding the trade. Turmeric will witness surplus over its consumption in future in both BAU and HGR scenarios indicating its revenue generation potential through export. However, in the light of volatility in the prices due to expected production surplus, there is a need to explore the new trading partners along with strengthening the foothold in the existing importing countries. On the other hand, pepper will witness production deficit over their consumption due to their higher household demand and low productivity (Raju 2000). For dry-chilli, higher household demand in HGR scenario will lead to production deficit which would otherwise be surplus in BAU scenario. Thus, there is a need to augment the production of these spices through improved and scientific methods of its production.

Table 5. Production forecast of major spices in India for 2016–17

(000 tonnes)

Spices	Actual production in 2007	Forecasted production in 2016–17	Surplus/deficit over consumption	
			BAU	HGR
Dry-chilli	1242	1412	20	-120
Coriander	288	381	-	-
Pepper	69	95	-16	-24
Turmeric	879	1000	112	39
Cumin	134	220	-	-

Note: Surplus/deficit of production over consumption for coriander and cumin could not be estimated because of lack of production data for these commodities

Further, region specific consumption and production of individual spices confirmed the comparative advantages of the respective regions. This necessitates region specific production policies along with the suitable marketing strategies to increase the welfare of both producers as well consumers.

Limitations of the study

The study attempted to analyze the consumption and the corresponding production pattern of the major spices in different regions of India. However, the consumption data of coriander and cumin (as these commodities are not included in NSS consumption survey) and time series production data of tamarind, garlic and ginger were not available. Thus, consumption and corresponding production pattern of the aforesaid spices could not be done. Further, production forecast of spices for different regions could also not be made because of data constraints.

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