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Eliciting and valuing market preferences with traditional food crops: the case of chickpea in India

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Abstract

During the past decade the Indian chickpea industry underwent a dramatic structural shift following the implementation of market-oriented policies by the Government of India. This paper examines consumer attitudes to quality characteristics of chickpea in India. A linear hedonic price model is estimated using auction price and quality data of chickpea samples obtained from major markets in India. Empirical results indicate that specific physical quality characteristics and purity standards are important factors influencing the price of chickpea in India. Thus, there may be an incentive for domestic producers and sellers of chickpea—and exporting countries—to improve the quality of their product, if improvements in specific physical characteristics and purity can be obtained cost effectively. As trade prospects grow for regionally important food crops like chickpea and other pulses, it is essential that food managers, commodity exporters, and crop breeders have access to critical market information in order to assess the relative economic importance of preferred quality traits and plan their strategies accordingly.

JEL classification: D12; Q13

Keywords: India; Chickpea; Quality characteristics; Consumer preferences

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1. Introduction

Like many other rapidly developing countries in the world, India is undergoing fundamental economic and social transformation. Economic liberalization has opened up trade and removed a number of domestic policy constraints. Agriculture, too, has been affected significantly. Policy reforms have already had major effects on agricultural production and demand for food in India. While a number of studies have examined the impact or potential impact of government policy on agricultural production and productivity (e.g., Gulati & Kelley, 1999; Gulati, Sharma, & Kohli, 1996), very few studies have examined the effects of these reforms on changing food demand and quality preferences of traditionally untraded commodities. With greater access to previously isolated and poorly developed markets, the need for eliciting information on preferred quality characteristics and associated price premiums becomes evident.

This study looks at the case of chickpea, the most important pulse crop in India, and one which, until recently, was traded relatively little internationally. Domestic policy restrictions also inhibited chickpea trade across states within India to a large extent. India is the world's largest producer and consumer of chickpea and until the mid 1990s, virtually all domestic demand was met by domestic production. Before 1990, access to India's chickpea market was limited by trade restrictions that had been in place for almost 40 years, largely to conserve precious foreign exchange. Tariff rates on agricultural imports varied from 40 to 100%. Coupled with this was the complex licensing system for imports (Kelley, 1999). These policies reduced the impact and importance of the price mechanism in the chickpea market. In the last decade, the Government of India (GOI) embarked on a policy of economic liberalization and backed by the International Monetary Fund. The stringent controls on imports and industrial licensing were gradually relaxed, stimulating industrial growth and reduction in the level of unemployment. In addition, the GOI expanded antipoverty schemes, especially rural employment schemes. These policies resulted in substantial income changes, and, consequently, dramatic growth in demand for food. Food preferences were also changing, however.

Relative to other commodities, such as wheat, rice, vegetables, oils, and milk products, demand for chickpea (and pulses generally) has actually weakened in India over time. Some of this can be explained by the paucity of technological progress in pulse production in India relative to advances in production of cereals, oilseeds, and milk production resulting in much lower growth rates in prices for the latter (Kelley, Parthasarathy Rao, & Grisko-Kelley, 2000). In addition, changing economic and social conditions, the effect of urbanization and the changing tastes and preferences associated with widespread availability of many highly preferred food items, also contributed to this trend (Kelley, 1999). Despite the slackening in per capita demand for chickpea (and all pulses) over time, frequent shortfalls in domestic production of chickpea in India—and under conditions of a more liberal trade policy environment—opened up interesting possibilities for surplus chickpea producing countries. In particular, Canada, Australia, Turkey, and Myanmar are now actively competing in the growing global chickpea market, primarily focused on the Indian sub-continent. But despite the size and potential of this market (5–6 million metric tonnes of chickpea consumed annually in India alone), little is known about preferred quality characteristics and associated price premiums for this commodity.

The issues of improving the quality of chickpea in the Indian market has been discussed widely by groups associated with the pulse industry. The common thread of the debate centers on the impact of quality characteristics on the price paid by consumers for chickpea and to what extent, if any, the major market participants in India discriminate between chickpea varieties by offering price premiums or discounts for chickpea having specific quality characteristics.

Knowledge about the influence of quality characteristics on the price of chickpea is of critical importance to breeders, producers, exporters and policy makers. If relevant chickpea quality characteristics can be identified and the contribution to price quantified, breeders could more accurately assess trade-offs between yield and quality characteristics and/or between characteristics and therefore anticipate future market changes. This, in turn, would provide guidelines for establishing selection criteria in chickpea varietal development. It is therefore imperative to understand consumers' willingness to pay based on empirical assessments, as this will provide strategic information to commodity exporters, crop producers and even breeders in developing cultivars with the required quality characteristics that produce greater market value. Much work has been done on the impact of quality characteristics on the price of agricultural products (see, e.g., Ahmadi-Estafani & Stanmore, 1994; Espinosa & Goodwin, 1982; Samikwa, Brorsen, & Sanders, 1998; Wahl, Shi, & Mittelhammer, 1995). However, to-date, little empirical work has been conducted to quantify the value of quality characteristics of a traditional food crop like chickpea, a commodity for which the export market has, until recently, lacked adequate potential and interest.

The aims of this paper is to bridge the knowledge gap by estimating the implicit value of quality characteristics of chickpea in India and testing the hypothesis of premiums/discounts associated with specific quality characteristics of chickpea in India. This study is based on the hedonic pricing model (HPM), which postulates that the price of a good is a function of the quality characteristics of that good. That is, consumers' demand is derived from the levels of characteristics that the good possesses (Rosen, 1974). The HPM is applied to auction price of chickpea obtained during market surveys conducted in May 1999 and quality data determined at the ICRISAT laboratory in India.

The rest of this paper is organized as follows. The HPM employed in the analyses is described, followed by a discussion of the data used in the analyses. The empirical results are reported and discussed. The summary and conclusion follow.

2. Model specification

2.1. Theoretical framework

We begin with a recap of the tenets of the theory of hedonic markets. On the demand side, consumers or buyers are assumed to demand a good based on the utility it provides where the utility depends upon a vector of characteristic Z of the good. Assume that the consumer has a fixed income M and faces a price function $P(Z)$ where the price of the good is a function of the embodied characteristics. Assume further that the consumer maximizes utility subject to a budget constraint. The preferences of the consumer can be represented by the utility function

$$u = u(Z, Y, \alpha) \tag{1}$$

where $u(\cdot)$ is the utility derived by the consumer from consuming the good; Z is a vector of embodied characteristics, Y is the quantity of composite product consumed by the consumer and α is a vector of observed and unobserved parameters, which characterize the preferences of the consumer.

Based on economic theory of consumer behavior, an optimizing consumer will consume the good with characteristic Z by solving this utility maximizing problem

$$\max_{Z,Y} u(Z, Y, \alpha) \tag{2a}$$

subject to

$$M \geq P(Z) + Y. \tag{2b}$$

The Lagrangean can be expressed as

$$L = u(Z, Y, \alpha) - \lambda(M - P(Z) - Y). \tag{3}$$

The first-order conditions for this problem is

$$\frac{\partial L}{\partial Z} = \frac{\partial u(Z, Y, \alpha)}{\partial Z} + \lambda \frac{\partial P(Z)}{\partial Z} = 0 \tag{4a}$$

and

$$\frac{\partial L}{\partial Y} = \frac{\partial u(Z, Y, \alpha)}{\partial Y} + \lambda = 0. \tag{4b}$$

From Eqs. (4a) and (4b),

$$\frac{u_Z}{u_Y} = P_Z \tag{5}$$

where $u_Z = \partial u(\cdot)/\partial Z$, $u_Y = \partial u(\cdot)/\partial Y$ and $P_Z = \partial P(Z)/\partial Z$.

The buyer's bid function[1] can be expressed, following Wahl et al. (1995), as

$$\theta(\cdot) = \theta(Z_1, Z_2, \ldots, Z_m; Y, \alpha) \tag{6}$$

where $\theta(\cdot)$ is the buyer's bid function, $Z(Z_1, Z_2, \ldots, Z_m)$ is a vector of the characteristics of the good, and the other variables are as defined above. From Eqs. (5) and (6), it can be shown that the derivative of the bid function with respect to a characteristic, $\partial\theta/\partial Z$, in Eq. (6) is equal to the hedonic price in Eq. (5).

On the supply side, assume that a producer supplies a heterogeneous good with a cost function given by $C(\cdot)$. The profit function of the producer can be expressed, following Sheppard (1997), as

$$\pi = P(Z)N - C(Z, N, \gamma) \tag{7}$$

where $\pi(\cdot)$ is profit earned by the producer, Z is the characteristics of the good, N is the amount of good supplied and γ is the parameters which characterize each producer.

From Eq. (7), an optimizing producer will supply the good with characteristics Z by solving this profit-maximizing problem

$$\max_{Z,N} P(Z)N - C(Z,N,\gamma) \tag{8}$$

where the variables and parameters are as defined above.

The first-order conditions of this problem are

$$\frac{\partial \pi}{\partial Z} = \frac{\partial P(Z)N}{\partial Z} - \frac{\partial C(Z,N,\gamma)}{\partial Z} = 0 \tag{9a}$$

and

$$\frac{\partial \pi}{\partial N} = P(Z) - \frac{\partial C(Z,N,\gamma)}{\partial N} = 0. \tag{9b}$$

From Eqs. (9a) and (9b),

$$P(Z) = C_N \text{ and } P_Z = C_Z \tag{10}$$

where $C_N = \partial C(\cdot)/\partial N$, $P_Z = \partial P(Z)/\partial Z$ and $C_Z = \partial C(\cdot)\partial Z$.

The expressions in Eq. (10) indicate that a profit-maximizing producer equates the marginal cost of each characteristic to its hedonic price and continues to increase production until the marginal cost of producing an additional good is equal to the value of the good.

The seller's offer function[2] can be specified, following Wahl et al. (1995), as

$$\varphi(\cdot) = \varphi(Z_1, Z_2, \ldots, Z_m; N, \gamma) \tag{11}$$

where $\varphi(\cdot)$ is the seller's offer curve, N is the output quantity of good, z is a vector of good characteristics and γ is the parameter vector whose value reflects factor prices and production technology. The derivative of the supplier's offer function in Eq. (11) with respect to any characteristic, $\partial\varphi/\partial z_i$, yields the seller's marginal implicit offer for an additional amount of that characteristic.

Based on economic theory, the hedonic market reaches equilibrium when the buyer's marginal bid equals the seller's marginal implicit offer for the good. The equilibrium is represented as a locus of tangencies between a series of marginal cost curves and the bid curves, referred to in the hedonic literature as the *hedonic price function* (Sheppard, 1997). The hedonic price function can be expressed as

$$P(Z) = f(Z_1, Z_2, \ldots, Z_m) \tag{12}$$

where $P(Z)$ is the price of a good and $z(z_1, z_2, \ldots, z_m)$ is a vector of quality characteristics of the good.

2.2. Empirical model specification

The quality characteristics of chickpea may impact on its price and this would include seed weight, foreign matter content, splitting recovery, color, shape, texture, protein content, ash content and moisture content of seed, among others. The empirical hedonic price model for chickpea in India is specified as:

$$P_k = \alpha_{0k} + \alpha_{1k}\,\mathrm{SWT} + \alpha_{2k}\,\mathrm{FORE} + \alpha_{3k}\,\mathrm{DHAL} + \alpha_{4ki}\sum_i \mathrm{CID}_i + \alpha_{5k}\,\mathrm{SID} + \alpha_{6kj}\sum_j \mathrm{LID}_j + \alpha_{7k}\,\mathrm{TID} + \alpha_{8k}\,\mathrm{PROT} + \alpha_{9k}\,\mathrm{ASH} + \alpha_{10k}\,\mathrm{MOIS} + \varepsilon_k \qquad (13)$$

where P_k is the price in Australian dollars per tonne of the kth type of chickpea, and where $k = 1, 2$ is for desi-type chickpea and kabuli chickpea, respectively; SWT, the seed weight of chickpea types; FORE, the foreign matter content; DHAL, the splitting recovery rate; CID_i, color, with a base color of brown, and where $i = 1, 2, 3$ is for greyish-brown color, orange-brown color and orange color, respectively; SID, the shape of seed; LID_j, chickpea market surveyed with a base location Mumbai (Bombay), and where $j = 1, \ldots, 5$ is for Aurangabad, Delhi, Indore, Jalgaon, and Bhopal, respectively; TID, texture of seed; PROT, the dry weight basis percentage protein content of chickpea type; ASH, the dry weight basis percentage ash content of chickpea type; MOIS, the moisture content of seed; α, the parameters to be estimated; and ε_k, the error term.

With inverse demand models, such as the hedonic price model used in this study, sensitivities are typically measured by flexibilities. The price flexibility measures how the market price responds to a finite (percentage or unit) change in the product characteristic. Following Wahl et al. (1995), price flexibility with respect to a continuous characteristic is defined as the percentage change in the price with respect to a 1% increase in the characteristic. For a 0–1 discrete characteristic, the price flexibility is defined as the percentage change in the price due to the presence of the characteristic relative to its absence.

3. Data sources and description

Chickpea, along with rice, wheat, and other pulses are important ingredients in the Indian diet. India is the largest importer of chickpea in the world, importing more than 100,000 tonnes of chickpea, on average, between 1990 and 1999. In terms of chickpea trade, about 95% of the total chickpea traded in India is channeled from the main producing areas in Madhya Pradesh, Maharashtra, and Rajasthan. Major chickpea exporting countries—Australia, Canada, Turkey, Mexico, Tanzania—supply the remaining 5% of chickpea.

There are two main chickpea markets in India—terminal markets and primary/secondary markets. The chickpea traded in the terminal markets come mainly as surpluses from the major chickpea producing regions in India and as imports from abroad. The chickpea traded in the primary and secondary markets are mainly the domestically produced chickpea. The terminal markets surveyed were Calcutta, Chennai (Madras), Delhi, Mumbai (Bombay), and the primary/secondary markets surveyed were Aurangabad, Bhopal, Indore, and Jalgaon. Chickpea are marketed through an auction system. The auctioneer begins his chant by setting the minimum price for a 100-kg seed lot, and trader's bid for the seed lot. This process continues until no trader offers a higher price, at which point, the price of a 100-kg seed lot is established. Consequently, all traders buy the seed lot at this price. Although desi-

Table 1
Description and means of variables used in the analysis

Variable	Description	Desi[a]				Kabuli chickpea				Other chickpea[b]			
		Mean	Min	Max	Standard deviation	Mean	Min	Max	Standard deviation	Mean	Min	Max	Standard deviation
PRICE	Price per tonne (AUS$)	483.33	415.00	630.00	59.73	974.04	432.00	1333.00	256.91	591.56	396.00	852.00	123.59
SWT	50-kernel weight	15.19	12.60	22.70	1.76	37.03	11.40	70.02	15.64	20.80	15.10	26.25	1.27
DHAL	Splitting recovery (dhal)	77.17	71.09	81.61	1.97					79.59	75.51	83.38	2.06
FORE	Foreign matter content	0.43	0.00	3.68	0.68	0.47	0.00	5.00	1.20	0.44	0.00	4.04	0.90
PROT	Protein content	19.90	16.80	23.10	1.57	21.48	18.70	24.10	1.02	19.07	15.40	20.80	1.27
ASH	Ash content	2.83	1.90	3.50	0.34	2.93	2.30	9.13	0.46	2.71	2.00	3.40	0.30
MOIS	Moisture content	7.11	4.00	9.20	1.15	7.66	5.30	9.13	0.90	7.51	5.70	9.50	1.02
SCOAT	Seed coat thickness	15.61	12.30	18.54	1.31	5.21	3.54	10.86	1.47	12.45	10.08	16.12	1.75
CID	Color dummy	9.81	1.00	11.00	2.71	2.56	1.00	11.00	2.04	6.10	1.00	11.00	4.33
TID	Texture dummy	1.57	1.00	3.00	0.91	1.98	1.00	2.00	0.14	1.00	1.00	1.00	0.00
SID	Shape dummy	1.00	1.00	1.00	1.00	2.00	1.00	3.00	0.20	1.10	1.00	3.00	0.45

[a] Denotes desi and kantewala.
[b] Denotes Gulabi, G4, Green Gram, Mosambi and Annigeri.

type chickpea traded in India are not graded, traders bid for the seed lot based on the quality characteristics of chickpea, and this is done by visual inspection. Due to the uniform size of kabuli chickpea traded, it is often priced on the basis of its size and foreign matter content.

The data used in the analyses consist of cross-sectional data of auction price and quality data of randomly selected chickpea samples collected during market surveys conducted in May 1999. The data comprise of 180 chickpea samples—52 kabuli chickpea and 128 desi-type chickpea. For each chickpea sample, quality indicators of chemical and physical characteristics and purity standards were determined at the laboratory in ICRISAT, India. The chickpea quality evaluation procedure was based on laboratory techniques outlined in ICRISAT Laboratory Manual (ICRISAT, 1991). Seed weight is expressed as grams per 50-kernels. Protein content of seed is measured on a percentage basis and determined as the amount of ammonia liberated. Ash content is measured on a percentage basis after moisture content is standardized by igniting the 50-kernel seed to 600 °C to burn off all organic matter. Seed coat thickness is measured as the difference between the seed weight and weight of endosperm, and expressed as a percentage of 50-kernel seed weight. Splitting recovery is measured as the weight of endosperm expressed as a percentage of 50-kernel seed weight. Foreign matter content of seed is measured as the sum of the weights of immature seed, shriveled seed, damaged seed and other impurities such as sticks and mud, and expressed as a percentage of 50-kernel seed weight. Seed texture, color and seed shape are determined according to ICRISAT descriptor classification (ICRISAT, 1991).

In this study, the term desi chickpea refers to chickpea other than kabuli chickpea, while desi refers to both desi and kantewala. The term other chickpea refers to chickpea other than desi and kabuli chickpea, and includes Mosambi, Annigeri, G5, Green Gram, and Gulabi.

Table 1 presents the summary of description of statistics of the auction price and quality characteristics of desi, kabuli chickpea and other chickpea. In terms of price variability, Table 1 indicates that the price of kabuli chickpea exhibit the highest variability, followed by desi and other chickpea, in that order. The mean prices are $974.04 for kabuli chickpea, $591.56 for other chickpea and $483.33 for desi per tonne. In addition, Table 1 indicates that, except for seed weight of kabuli chickpea that exhibited a variability of 15.64, the variability of quality characteristics of desi-type chickpea in India is less than 4.3. The splitting recovery rate for other chickpea is greater than that of desi. The seed coat thickness for desi is about twice that of kabuli chickpea. The moisture content of seed appears to be the same for desi and kabuli chickpea. Dummy variables were generated for the data, where a value of 1 was assigned for the locations for which samples were obtained, and for desi to differentiate it from the other chickpea. The binary variables were included in the final model.

4. Results and discussion

There is no theoretical basis for selecting a functional form of the HPM. In this study, the *P*-test non-nested hypothesis testing procedure proposed by Davidson and MacKinnon (1981) was used to test the data compatibility of various non-nested functional forms of the hedonic price model. The models compared are linear, semilog and double-log. Table 2

Table 2
Results of non-nested hypothesis tests of functional form

Pairwise *P*-test (H_0 vs. H_a)	*t*-statistic	*p*-value	Data/model compatibility at the rate of 0.10 level
Linear vs. semilog	−0.577	0.564	Reject semilog
Semilog vs. linear	3.255	0.001	Reject semilog
Linear vs. double-log	−0.520	0.600	Reject double-log
Double-log vs. linear	2.880	0.004	Reject double-log
Joint *P*-test	χ^2-statistic		
Linear vs. semilog and double-log	0.040	0.842	Linear compatible

reports the results of non-nested hypothesis tests of the functional forms. The results indicate that each alternative model to the linear is rejected at a 10% significance level. The linear model is also judged to be data compatible at a 10% significance level in a joint test against the other two functional forms (i.e., semilog and double-log). Based on the empirical test results, the linear model was chosen to characterize the relationship between quality characteristics and price of chickpea in India.

Table 3
Parameter estimates of the hedonic price equation for chickpea in India

Explanatory variable	Parameter	Desi chickpea		Other chickpea		Kabuli chickpea	
		Estimate	*t*-ratio	Estimate	*t*-ratio	Estimate	*t*-ratio
SWT	α_{1k}	7.23	8.40	7.23	8.40	9.13	7.09
FORE	α_{2k}	−7.56	1.89	−7.56	1.89	−16.61	−3.39
FORE*D1	α_{2k1}	6.73	2.84	–	–	–	–
DHAL	α_{3k}	−3.34	−1.15	−3.34	−1.15	–	–
DHAL*D1	α_{3k1}	6.87	1.85	–	–	–	–
CID	α_{4k}	3.19	1.08	3.19	1.08	–	–
CID*D2	α_{4k1}	−13.73	7.01	−13.73	7.01	–	–
CID*D3	α_{4k2}	12.40	3.24	12.40	3.24	–	–
CID*D4	α_{4k3}	21.59	2.27	21.59	2.27	–	–
SID	α_{5k}	57.58	12.58	57.58	12.58	–	–
LID1	α_{6k1}	−135.76	−8.96	−135.76	−8.96	–	–
LID2	α_{6k2}	−84.79	−7.40	−84.79	−7.40	−124.54	−3.04
LID3	α_{6k3}	−151.87	−15.18	−151.87	−15.18	−284.24	−6.72
LID4	α_{6k4}	−132.94	−10.36	−132.94	−10.36	−246.78	−2.09
LID5	α_{6k5}	−143.93	−11.14	−143.93	−11.14	–	–
D1	α_{0k1}	−565.87	−1.96	–	–	–	–
CONST.	α_{0k}	676.97	3.10	676.97	3.10	789.13	11.49
R^2-adjusted	0.87	–		0.87			0.80
D-W	1.99	–		1.99			2.31
Chi-square	55.56	–		55.56			42.51

Note: D1 denotes dummy variable for desi. D2–D4 denotes dummy variable for greyish-brown color, orange-brown and orange color, respectively. LID denotes location dummy, and where LID1 is Aurangabad, LID2 is Delhi, LID3 is Indore, LID4 is Jalgaon and LID5 is Bhopal.

Table 3 presents the estimated parameters and corresponding *t*-ratios of kabuli chickpea and desi-type chickpea HPMs estimated by Ordinary Least Squares method in SHAZAM Version 8.0 econometric package. Using Breusch–Pagan–Godfrey test, the null hypothesis that the error terms are homoskedastic could not be rejected at a 5% level (Table 3). Calculated Chi-square statistics are 20.17 for desi chickpea equation and 5.31 for the kabuli chickpea equation and the critical values are 23.68 and 12.59, respectively. The test for the hypothesis that there are no premiums or discounts associated with quality characteristics of chickpea involves performing a joint test of the null hypothesis that the slope coefficients have no effect on the price of desi chickpea and kabuli chickpea (i.e., H_0: all α's are zero). The null hypotheses were rejected given that the calculated Chi-square statistic of 42.51 and 55.56 for the estimated kabuli chickpea and desi chickpea equations, respectively, are greater than the critical values of 11.1 for 5 df and 26.3 for 16 df, respectively. The results demonstrate that the quality characteristics of chickpea are important factors influencing the price paid by consumers for chickpea in India.

The R^2-adjusted (goodness-of-fit measure) of the linear model is estimated to be 0.89 for desi chickpea equation and 0.82 for kabuli chickpea equation. The goodness-of-fit measure of the estimated equations shown in Table 3 indicate that the amount of variation in the price of chickpea explained by the estimated model range from 80% for kabuli chickpea to 87% for desi chickpea. These values are good considering the type of data (market survey data) used in the analyses. In this paper, given the linear specification of the hedonic price model, the coefficients of the quality characteristic variables can be interpreted as dollar premiums or discounts per unit of change in their measurement value (Ahmadi-Estafani & Stanmore, 1994). The marginal implicit values and price flexibilities with respect to quality characteristics of chickpea estimated at mean values of the continuous variables and dummy binary variables are reported in Tables 4 and 5, respectively.

4.1. Effects of quality characteristics on the price of chickpea in India

The null hypothesis that seed weight, SWT, is unimportant in influencing the price of chickpea is rejected in estimated kabuli chickpea and desi chickpea equations. Consistent with expectations, the seed weight has a positive effect on the price of chickpea. The results

Table 4
Implicit marginal value of quality characteristics of chickpea in India, evaluated at the mean

Explanatory variable	Desi	Other chickpea	Kabuli chickpea
Seed weight	7.23	7.23	9.13
Foreign matter content	−0.83	−7.56	−16.61
Color			
Greyish-brown color	−10.54	−10.54	–
Orange-brown color	15.59	15.59	–
Orange color	24.78	24.78	–
Shape	57.58	57.58	–
Splitting recovery (dhal)	6.87	0	–

Note: A positive implicit price denotes a price premium. A negative implicit price denotes a price discount.

Table 5
Price flexibility estimates of quality characteristics of chickpea and location dummies in India, evaluated at the mean

Explanatory variable	Desi chickpea	Other chickpea	Kabuli chickpea
Seed weight	0.264	0.264	0.347
Foreign matter content	−0.006	−0.053	−0.052
Color			
Greyish-brown color	−0.020	−0.020	–
Orange-brown color	0.029	0.029	–
Orange color	0.046	0.046	–
Shape	0.113	0.113	–
Splitting recovery (dhal)	1.096	0	–
Location dummy			
Aurangabad	−0.016	−0.016	–
Delhi	−0.021	−0.021	−0.044
Indore	−0.073	−0.073	−0.056
Jalgaon	−0.023	−0.023	−0.005
Bhopal	−0.025	−0.025	

indicate that, for a 50-kernel weight, every extra gram per 50-kernel is worth an extra $9.13 per tonne for kabuli chickpea and $7.23 per tonne for desi chickpea (Table 4). Holding all else constant, if the seed weight is increased by 1%, the price of desi and kabuli chickpea would increase by 0.26 and 0.35%, respectively (Table 5). Considering that that the mean price observed is $974.04 per tonne for kabuli chickpea, $483.33 per tonne for desi and $591.56 per tonne for other chickpea, the price premium for increasing the seed weight of chickpea appears substantial. The results suggest that seed weights of chickpea is valued heavily by consumers in India.

Foreign matter content of seed, FORE, has a significant and negative effect on the price of chickpea. The results reported in Table 4 indicate that, for a 50-kernel seed, every extra reduction in foreign matter content is worth an extra $7.56 per tonne for desi chickpea and $16.61 per tonne for kabuli chickpea. Table 5 indicates that, holding all else constant, a 1% decrease in foreign matter content of seed would lead to a 0.01% increase in the price of desi, a 0.05% increase in the price of other chickpea and a 0.05% increase in the price of kabuli chickpea. The relatively small value of the effect of foreign matter on the price of desi can be explained by the fact that cleaning of seed forms part of the process of making split chickpea (dhal). As a result, the foreign matter content of desi is not valued heavily by processors in their decision making process. The negative sign of the coefficient of the foreign matter content in the estimated chickpea equations indicates that consumers are willing to pay a price premium for chickpea with a lower foreign matter content and to discount one with a high foreign matter content. This finding supports earlier studies by Kelley (1999), and the Australian Grains and Legume Committee (AGLC, 1991).

Splitting recovery rate of seed, DHAL, is a significant factor influencing the price of desi, but not significant in influencing the price of other chickpea at a 10% level (Table 3). The result presented in Table 4 indicates that, for a 50-kernel seed, consumers are willing to pay a price premium of $6.87 per tonne for a unit increase in splitting recovery rate. Importantly, the result reported in Table 5 indicates that if the splitting recovery should increase by 1%, the price of desi would increase by 1.1%. The elastic response in price to a unit change in splitting recovery is consistent with the findings of Agbola, Bent, Rao, and Kelley (2000) and Siddique (1998), who concluded that producers value heavily the splitting recovery rate of desi used for making split chickpea (dhal). The positive sign of the marginal implicit value of splitting recovery rate variable in the estimated desi chickpea equation demonstrates that consumers are willing to pay a price premium for a desi with a high splitting recovery rate.

The shape of seed variable, SID, has a significant positive effect on the price of desi chickpea. The marginal implicit value of shape of seed variable in the estimated desi chickpea equation is positive, implying that, for a 50-kernel seed, consumers are willing to pay a price premium of $57.58 per tonne for a unit improvement in the shape of desi chickpea towards a round shape. Table 5 indicates that a 1% improvement towards a round shape would increase the price of desi chickpea by 0.11%.

The color variable, CID, has a significant effect on the price of desi chickpea (Table 3). The marginal implicit value of a greyish-brown colored desi chickpea is negative, while that of an orange-brown and orange colored desi chickpea are positive. The implication of the results is that a greyish-brown colored desi chickpea is discounted relative to a brown colored desi chickpea, while consumers are willing to pay a price premium for an orange-brown and orange colored desi chickpea relative to a brown colored desi chickpea. The greyish-brown colored desi chickpea is worth $10.54 per tonne lower than the price of a brown colored desi chickpea, while the prices of an orange-brown and orange colored desi chickpea are higher than the price of a brown colored desi chickpea by $15.59 and $24.78 per tonne, respectively (Table 4). The results demonstrate that consumers are willing to pay a price premium for a light colored desi chickpea and to discount a dark colored one. These findings are consistent with earlier studies by Siddique and Sykes (1997) and Siddique (1998).

The location dummies are significant at a 10% level (Table 3). Table 3 indicates that the price of chickpea in terminal and primary/secondary markets differ greatly. In terminal markets, the location variable for Chennai and Calcutta were not included in the estimated chickpea equations because the coefficients of the location variables were statistically non-significant at a 10% level. The results indicate that the price of chickpea in Chennai and Calcutta are similar to that of base location Mumbai. The price flexibility of location variable for Delhi reported in Table 5 is negative, implying that consumers discount the price of desi chickpea and kabuli chickpea in Delhi relative to that in Mumbai by 2.1 and 4.4%, respectively. In primary/secondary markets, the price of desi chickpea in Aurangabad, Indore, Jalgaon, and Bhopal is discounted relative to the price in Mumbai by 1.6, 7.3, 2.3 and 2.5%, respectively. The price of kabuli chickpea in Indore and Jalgaon is discounted relative to the price in Mumbai by 5.6 and 0.5%, respectively.

The chemical quality characteristics of chickpea, captured by the ash and protein content, are statistically non-significant at a 10% level. This is most likely due to the inefficiency in the Indian chickpea market, a consequence of government intervention in the Indian food market in the last decades or the cryptic nature of the chemical quality characteristics. However, as exporting countries compete with each other in a recently deregulated Indian chickpea market, they may begin to differentiate their products by promoting it as one with high chemical quality characteristics or as branded products. Alternatively, they may even resort to reputation selling based on chemical quality characteristics of seed. This suggests that the chemical quality characteristics of chickpea may become important in influencing the price of chickpea in recent changing economic conditions. Consequently, chickpea exporting countries should continually monitor the Indian market to determine whether in fact chemical quality characteristics are becoming important in order to develop marketing strategies to compete in one of the most lucrative food markets, the Indian chickpea market.

5. Conclusions

This study evaluates the market preferences of consumers of chickpea in India. In order to make recommendations to managers on ways to strategically position themselves in this potentially lucrative Indian chickpea market, an understanding of the seed quality factors influencing the price of chickpea is necessary. To the best of our knowledge, this important issue has not been previously examined in the literature. The empirical finding of this study broadens our understanding of which specific factors influence the price of chickpea in the market. This, in turn, should be useful to a range of market participants including producers, exporters, breeders and policy makers. At the same time, this study suggests the need to continue to monitor the Indian chickpea market since recent policy reforms in the Indian economy will have an impact on consumer and producer decisions there.

Before drawing on the empirical results, it is important to mention a major shortcoming of this study, the violation of the underlying assumption of a perfectly competitive market structure of the hedonic price model. A review of recent developments, the Indian chickpea market reveals that the market is inefficient because of government intervention in chickpea trade. Thus, the empirical findings of this study should be interpreted cautiously. Given the above caveat, the results of this study indicate that, in terms of importance, for desi chickpea, the factors influencing price are shape, color, seed weight, splitting recovery and foreign matter content. For kabuli chickpea, the most important factors influencing price are foreign matter content and seed weight.

The chemical quality characteristics of chickpea, represented by ash and protein content, appear to be unimportant in influencing the price. Such a result is consistent with expectations. This may be attributed to several reasons, including inefficiency in the chickpea market in India and the cryptic nature of chemical quality characteristics. Given that consumers are unable to measure chemical quality characteristics of chickpea nor able to discriminate or to value varieties specifically for that purpose, the chemical quality characteristics appear to have no direct effect on the price of chickpea in India. This finding sends two signals to exporters. First, if indeed, the chemical quality characteristics of chickpea is unimportant in influencing the price of chickpea, then producers and breeders in exporting countries need to adjust new products and marketing programs by improving the physical quality characteristics and purity standards to meet consumer needs. Second, with continuing reforms towards a more market-oriented food economy, the chickpea market in India may become more transparent and hence efficient, and chemical quality characteristics of chickpea could become an important attribute from the consumer point of view.

It is interesting, although not altogether surprising, to observe that there are fewer seed quality traits linked to price discriminations in kabuli chickpea—with the exception of seed-weight, which is widely known. Kabuli chickpea is more highly traded than its traditional counterpart, desi, and therefore one observes less variability in seed quality traits within the market, since the market is more highly developed and preference traits already defined, relatively speaking. This might suggest that the largest potential gains may in fact come from developing, producing and marketing higher-quality desi chickpea as seed quality variability is higher and market preferences are not yet well established.

Knowledge about implicit values of quality characteristics indicates which characteristics should be concentrated on and which characteristics could be safely ignored or de-emphasized or allowed to vary. The implicit values of quality characteristics of chickpea reported in this study are important for breeders and policymakers because this would provide strategic information and aid in the allocation of scare resources efficiently. The results from this study indicate that, for example, for desi, the most important factors influencing the price of chickpea are seed weight, seed color, seed shape and foreign matter content and splitting recovery. It is not possible to say which of these is "most important," i.e., has the highest marginal utility for improvement, because the units of improvement across 50-kernel seed weight (in grams), seed color and seed shape (both discrete descriptive quality traits), and foreign matter content (grams), are not all the same. Furthermore, this type of information is not sufficient in itself for determining which quality improvements should be targeted. That can be done only in the context of an economic assessment of the gains and costs involved for a given level of improvement in the quality of chickpea. For kabuli chickpea, the factors affecting price are foreign matter content of seed and seed weight. The most important factors influencing the price of other chickpea are seed shape, seed color, seed weight, and foreign matter content.

Finally, our study provides strong empirical evidence to support the assertion that consumers in India do indeed discriminate between varieties of chickpea based on preferred seed quality traits and purity considerations. This provides a basis and incentive for chickpea breeders and producers, both domestic and export-oriented, to improve the physical quality characteristics of chickpea and purity standards to position themselves more advantageously in the Indian chickpea market. For exporting countries, it is important to anticipate the potential reaction of market participants to changes in quality characteristics of chickpea before developing new chickpea varieties and appropriate agronomical practices. By adopting such a strategy, they can better position itself in Indian market to compete with domestic producers and with other chickpea exporting countries. The success of any marketing strategy will depend on the ability of traders and consumers to differentiate between quality characteristics whether they be imported or domestically produced. With increasing awareness of the beneficial nutritional and other non-nutritional effects from a diet rich in pulses there will be an even greater tendency for consumer discrimination of chickpea varieties in India.

Notes

1. A buyer's bid function is defined as the maximum price that the buyer is willing to pay for demanding Y units of a good having characteristics level Z.

2. A seller's offer function is defined as the minimum price that the seller is willing to accept for supplying N units of a good having characteristics level Z.

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