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Demand analysis of medicinal plants in Himachal Pradesh

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ABSTRACT

The medicinal plant market in Himachal Pradesh is oligopsonic in nature where a large number of small buyers controlling buying side make medicinal plant market a buyer's market. Therefore normal demand-price relationship could not be established in case of medicinal plants. The rarity and derived demand of these plants are the other reasons for abnormal demand-price relation. The demand analysis of medicinal plants by major industries has been presented under this background. Ten major medicinal plants have been identified based on their annual consumption recommended by National Medicinal Plants Boardn (NMPB). The analysis has shown low own price elasticity and high growth rates of Kuth, Banafsha, Kutki and Bankakdi which assure steady market for them. It has been suggested that the plants like Kutki, Kuth and Bankakdi should be given priority in commercial cultivation in view of their scarcity values. A market driven management policy is warranted for the popularization of medicinal plants in the state.

Keywords: Medicinal plants; market; demand; supply

INTRODUCTION

Advancements in phytochemistry and discovery of plant compounds effective against deadly disease has renewed the interest in herbal medicine especially during past two to three decades. The property of negligible side effects coupled with effectiveness of traditional medicine has led to shift in consumer preference towards natural medicines.

Keeping in mind the increasing gap between demand and supply and various hurdles affecting medicinal plant trade the present study has been taken up with the vision to estimate the demand for different medicinal plants based on selected pharmacies and to bring out the existing system of medicinal plant trade in the state that can form the basis for formulating suitable regulatory measures and conservation strategies. Earlier Joseph et

al (2004) has conducted demand analysis of medicinal plants in Kerala.

METHODOLOGY

Himachal Pradesh being hilly state has a rich medicinal plant diversity and herbal based product sector is emerging at a faster pace. It comprises of 1.7 per cent of the India's geographical area. The trade of 165 species has been carried out from the state. Out of 100 medicinal plants transported from the country 24 are found in the state. About 90 odd pharmacies are there in the state out of which 87 are in private and 3 in government sector and out of the total about 50 per cent (47 out of 90) of the pharmacies are found in Solan district alone. Hence district Solan was purposively selected to estimate the demand as well as trade of medicinal plants. From the selected units the data on plant/plant part used, quantity/value of important plants purchased and unit purchase prices of important medicinal plants were gathered. The personal interview method was used for data collection. This mainly involved contacting the managers/owners, marketing managers, market functionaries, purchase managers and workers in the unit etc. Each unit was personally visited 3-5 times on an average to obtain the desired information. However some firms enthusiastically cooperated while others were reluctant to reveal the required information.

In the study simple arithmetic tools like percentages and simple weighted averages for the presentation of aspects like extraction and nominal and real prices of medicinal plants were mainly adopted. The growth in the consumption of medicinal plants was estimated through linear growth function through SPSS. The results were derived through computer programme Excel.

Linear growth rate: For evaluating the trends in production/extraction and nominal and real prices of medicinal plants linear growth rates (LGR) were used for evaluating the trends in the production/ extraction/prices estimation. The following linear equation was used to estimate growth rates:

$$Y = a + bt$$

where

Y= Quantity extracted /produced/ prices of medicinal plants

t = Time variable in year (1, 2, ….. 18)

a= Constant

b= Rate of change

The linear growth rate was calculated as:

$$\text{Linear growth rate} = \frac{b}{\bar{Y}} \times 100$$

where

b= Regression coefficient

$\bar{Y}$= Mean value of the quantity extracted/ produced/prices for the medicinal plants

$$\text{SE (linear growth rate)} = \frac{100}{\bar{Y}} \times \text{SE (b)}$$

where

$\overline{Y}$ = Mean value of the quantity extracted/ produced/prices for the medicinal plants

SE(b)= Standard error of b

Nominal and real average weighted prices: Weighted average price for nominal as well real prices were estimated with the following formula:

$$\text{Weighted average price } (P_w) = \frac{\sum q_i p_i}{\sum Q_i}$$

where

ΣQ_i= Total quantity of i^{th} medicinal plants procured by the sampled pharmacies

p_i= Price per unit of i^{th} medicinal plants

q_i= Quantity of the i^{th} medicinal plant procured

Nominal and real price index: Price index of major medicinal plants was calculated as:

$$\text{Price index} = \frac{Pa \times 100}{Pw}$$

where

P_a= Price paid by individual pharmacy for each medicinal plant

P_w= Weighted average nominal/real price of medicinal plant

Coefficient of variation at nominal and real prices: Variation in prices paid by the sampled pharmacies can be calculated as:

$$\text{CV (\%)} = \frac{SD}{\bar{Y}} \times 100$$

where

SD = Standard deviation of price of i^{th} medicinal plant

$\overline{Y}$ = Average nominal/real price of medicinal plant

Price elasticity of demand at real and nominal prices:

$$\text{Price elasticity of demand} = \frac{(Q_2 - Q_1)/(Q_1 + Q_2)}{(P_2 - P_1)/(P_2 + P_1)}$$

Q_2= Quantity purchased at P_2 (nominal/ real prices) during 2011-12

Q_1= Quantity purchased at P_1 (nominal/ real prices) during 2004-05

Scarcity ratio for medicinal plants: The increase in real price of the resource over time indicates the economic scarcity of medicinal plant (Suneetha 1998).

$$\text{Scarcity ratio} = \left[\frac{\frac{SP_t}{CPI} - SP_o}{SP_o}\right] \times 100$$

where

SP_o= Selling price of medicinal plant in 2004-05

SP_t= Selling price of medicinal plant during 2011-12

CPI= Consumer price index for 2012 with 2004 as base year

A positive scarcity ratio implies the economic scarcity of medicinal plant.

RESULTS and DISCUSSION

Ayurvedic industry exhibits a promising market which uses a large quantum of medicinal plants that are mainly procured from wild. The quantity of raw materials procured by each pharmacy showed an increasing trend year after year except a few like Kuth, Safed Musli and Bankakdi. Highest negative growth (6.60%/annum) was estimated in Bankakdi whereas it was -4.03 per cent/annum in Kuth and -2.24 per cent/annum in Safed Musli. The medicinal plants such as Amla, Daru rind and Kutki showed no significant growth. Coefficient of quantity variability showed highest variability in the consumption of Bankakdi and lowest in Amla. It is interesting to note that CV for all the medicinal plants varied between 3.94 to 23.51 per cent indicating high variability in the consumption of medicinal plants by the sampled pharmacies.

The growth rate and coefficient of variation for selected medicinal plants consumed by sampled pharmacies in Himachal Pradesh (1994-2012) are given in Table 1. The trends in prices paid by the pharmacies in the purchase of selected medicinal plants were also estimated both at current (nominal) as well as constant (real) prices and it was found that average current prices for the selected medicinal plants were found higher as compared to average real prices except Amla and Kalmegh. The real prices of these two herbs were increased. Further it can be seen from the Table 2 that the real prices showed a decrease of 28.80 per cent to 1.80 per cent in the prices of selected medicinal plants whereas real prices of Amla and Kalmegh increased by 3.60 and 8.38 per cent respectively. Further the linear growth rate of nominal and real prices showed that nominal prices of almost all the selected medicinal plants showed a positive and significant growth. Coefficient of variation varied from 68.31 in Kutki to 2.06 per cent in Banafsha.

The price analysis for the selected medicinal plants was carried out by considering their real prices. Current/ nominal prices are deflated by the consumer price index to estimate the real prices. The linear growth rates of real prices of medicinal plants consumed by the selected pharmacies were estimated and it was found that almost all the selected medicinal plants showed positive and significant growth except Banafsha which showed a negative and significant growth (5.11%/ annum) implying that the real prices of Banafsha are decreasing over the years. Coefficient of variation varied from 51.14 per cent in Bankakdi to 11.80 per cent in Daru rind.

Weighted average prices for major medicinal plants were calculated at both current and constant prices. When the linear growth rates were calculated it was found that both for current and constant weighted prices growth rates showed similar trends except in case of Daru rind whose real

weighted price showed declining trend ie the prices of Daru rind were not increasing in the real sense.

Weighted average prices for the major medicinal plants were estimated and compared with the percentage quantity procured by the sampled pharmacies to establish the normal price demand relationship. Contrary to normal market behavior the relationship between price and quantity demanded could not establish the normal demand curve in this case because demand for the medicinal plants is derived demand based on the demand for the finished products ie Ayurvedic medicines. Derived demand means demand for a factor of production or intermediate good occurs as a result of the demand for another intermediate or final good. Therefore despite of increasing prices of certain medicinal plants their demand also showed an increasing trend due to huge demand for drugs where these herbs were used.

The trends in prices paid by the pharmacies in the purchase of selected medicinal plants were also estimated both at current (nominal) as well as constant (real) prices and it was found that average current prices for the selected medicinal plants were found higher as compared to average real prices except Amla and Kalmegh. The real prices of these two herbs got increased. Further it can be seen from the Table 2 that the real prices showed a decrease of 28.77 to 1.81 per cent in the prices of selected medicinal plants whereas real prices of Amla and Kalmegh increased by 3.58 and 8.38 per cent respectively. Further the linear growth rate of nominal and real prices indicated that nominal prices of almost all the selected medicinal plants showed a positive and significant growth. Coefficient of variation varied from 68.31 in Kutki to 2.06 per cent in Banafsha.

Nominal weighted average price and real weighted average price of the selected medicinal plants consumed by the sampled pharmacies during 2004-05 to 2011-12 are given in Table 3.

The normal demand-price relationship was not shown by the medicinal plant market due to various reasons. An effort was made to study the response or elasticity of quantity demanded to price change and results have been presented in Table 4. The arc elasticity method was used to estimate the own price elasticity of medicinal plants. As expected the values were positive for all the medicinal plants. The own price elasticity for plants like Kuth, Banafsha, Daru rind, Kutki and Bankakdi was found less than one ie the proportionate increase in price brings about a less than the proportionate change in quantity demanded which indicated that demand for these medicinal plants was highly inelastic and rest of the plants showed high elasticity.

Since the medicinal plants like Banafsha, Daru rind, Kutki and Bankakdi had high growth rates and low price elasticity

of demand so the steady market for these medicinal plants was expected. The market for Ayurvedic drugs exhibited a steady growth rate hence demand for the medicinal plants showed a steady increase despite of increasing prices.

The negative price elasticity in all medicinal plants indicated positive demand-price relationship which could be because of oligopsonic market for medicinal plants. A small number of large buyers controlling the buying side results in the dominance of buyers thus making medicinal plants market a buyers' market. Such type of market mainly prevails in the input market and medicinal plants are also input for the pharmacies. Oligopsony market exhibits interdependence between the perspective buyers like pharmaceutical firms as their decisions on prices affect each other ie on-price competition so they compete with one another through improved working conditions and merging of two buyers' results in greater control over the market and cooperation through secret collusion to agree to control prices. The other reason for the positive demand-price relationship was that demand for the medicinal plant not only depends upon the price of the medicinal plant but it may be the result of combination of other factors like priority of the pharmacy for the finished products and ultimate demand for the finished products. The rarity of medicinal plants may possibly be other reason for positive demand-price relationship.

The real increase in the price of the resource over a period of time indicates the economic scarcity of the resource (Suneeta 1998). Considering this rule the scarcity ratios for the selected medicinal plants were estimated by comparing the change in their real prices between 2004-2012. The plants which showed a positive ratio were considered as scarce. Kutki, Kuth and Bankakdi showed positive scarcity ratio implying thereby that these plants were highly scarce. The scarcity ratio was found highest (2.73) in Kutki followed by Kuth (1.25) and Bankakdi (1.18). Hence the availability of these three medicinal plants was becoming scarce over time period. Other selected medicinal plants showed negative ratios indicating their availability in nature.

Species-wise description of the medicinal plants

Withania somnifera (Ashawagandha) is a bushy plant, erect in nature and is found in higher altitudes of Kashmir and Himalayan forests and is common in Himachal Pradesh. Its commercially important part is root which is bitter in taste and is main constituent of *Ashwagandha dichurana* and *Balyaand vajkara*. The plant is used in curing impotency, rheumatism, leucoderma, ulcer, fever, cough etc. The average nominal price paid by the sampled pharmacies was Rs 80 per kg while the average real price was found Rs 78.55 per kg. Its annual linear growth in consumption by the sampled

Table 1. Growth rate and coefficient of variation for selected medicinal plants consumed by sampled pharmacies in Himachal Pradesh (1994-2012)

Plant	Common name	Linear growth rate (%/annum)	CV (%)
Withania sominifera	Ashwagandha	2.01* (0.57)	6.44
Saussuria lappa	Kuth	-4.03* (0.58)	11.95
Viola serpens	Banafsha	0.61 (1.78)	13.89
Emblica officinalis	Amla	0.47 (0.62)	3.94
Punica granatum	Daru rind	1.12 (0.63)	4.34
Picrorhiza kurrooa	Kutki	-0.35 (1.46)	9.19
Chlorophytum borivilanum	Safed Musli	-2.24* (0.90)	13.72
Podophyllum hexandrum	Bankakdi	-6.60* (1.12)	23.51
Andrographis paniculata	Kalmegh	1.65** (0.76)	6.40
Berberis aristata	Kuth	-4.03* (0.58)	11.95

Figures in the parentheses are the standard errors of the linear growth rates
*,**Significant at 5 and 10 per cent level of significance respectively

Table 2. Growth and variability in nominal as well as real prices of selected medicinal plants (2004-05 to 2011-12)

Plant	Nominal price			Real price			
	Mean	Nominal price growth rate (%)	CV (%)	Mean	% increase/ decrease over nominal price	Real price growth rate (%)	CV (%)
Ashwagandha	80	5.32* (0.85)	14.03	78.55	1.81	13.47* (1.42)	17.55
Kuth	138.25	18.52* (1.50)	46.26	135.35	2.10	17.91* (0.67)	49.88
Banafsha	943.83	3.41 (2.06)	2.06	745.29	21.04	-5.11* (1.95)	17.15
Amla	43.33	8.70* (1.08)	22.34	44.88	-3.58	19.65* (0.87)	19.32
Daru rind	24.65	3.45* (0.81)	9.76	19.48	20.97	3.37* (0.56)	11.80
Kutki	803.96	26.78* (3.18)	68.31	572.69	28.77	19.90* (2.02)	50.22
Safedmusli	967.29	9.46* (3.79)	32.48	746.48	22.83	2.81 (3.98)	24.84
Bankakdi	2124.17	17.03* (0.73)	41.95	2033.02	4.29	11.96 (38.49)	51.14
Kalmegh	31.38	10.36* (2.23)	42.91	34.01	-8.38	16.75* (2.00)	25.73
Daruhaldi	62.42	10.25* (2.47)	29.40	34.01	45.51	7.37* (3.01)	25.73

Figures in the parentheses are the standard errors of the linear growth rates
*,**Significant at 5 and 10 per cent level of significance respectively

Table 3. Nominal weighted average price and real weighted average price of the selected medicinal plants consumed by the sampled pharmacies during 2004-05 to 2011-12

Plant	Nominal price vs real price			
	Nominal price growth rate (%)	CV (%)	Real price growth rate (%)	CV (%)
Ashwagandha	5.46* (1.08)	14.87	-2.06 (-1.64)	11.09
Kuth	18.95* (1.48)	38.28	11.44* (-0.66)	28.32
Banafsha	3.33* (0.35)	15.07	-0.03 (-1.62)	8.45
Amla	8.87* (1.41)	23.35	0.84 (-1.29)	8.05
Daru rind	3.24* (0.5)	8.49	-4.74* (0.38)	11.83
Kutki	26.60* (3.07)	67.7	19.79* (2.07)	50.05
Safedmusli	9.71* (0.97)	33.97	3.61* (0.47)	25.07
Bankakdi	16.89* (0.74)	41.61	9.71* (1.67)	25.81
Kalmegh	9.79* (2.44)	28.48	1.5 (2.16)	13.5
Daruhaldi	10.88* (2.66)	31.14	7.37* (3.12)	20.04

Figures in the parentheses are the standard errors of the linear growth rates
*,** Significant at 5 and 10 per cent level of significance respectively

pharmacies was 2.01 per cent. The annual linear growth in nominal prices was 5.32 per cent per annum whereas at real prices it was found 13.47 per cent per annum. The variation in nominal prices over a period of eight years was 14.03 per cent while variation in the real prices during the period was higher (17.55 %). Ashwagandha was found to be inelastic to price changes with price elasticity of 0.32. Its scarcity ratio was -0.11 which indicated that plant was not scarce and was commonly available.

Saussurea lappa (Kuth) is a large plant which stands about 1-2 m in length and is found in mountainous areas of Kashmir and Lahul and Spiti. The official part of the plant is root which is used for various ailments like dyspepsia, asthma, bronchitis, chronic rheumatism and gout and gathered by the collectors in the autumn season. Many preparations like Kustadi-Churana and Pippalayasava are prepared of it. Its average nominal price paid by the sampled pharmacies was Rs 130.25 per kg while the average real price was Rs 135.35 per kg. The annual linear growth in consumption by the sampled pharmacies was found negative (4.03%). The annual linear growth of 18.52 per cent per annum was found in current prices whereas real prices showed a growth of 17.91 per cent per annum. The variation in nominal prices over a period of eight years was 46.26 per cent while variation in the real prices during the same period was 49.88 per cent. Kuth

was found to be price inelastic with price elasticity -0.23 where normal demand-price relationship could not be exhibited due to cumulative effects of some other factors like rarity and priority by the pharmacies. Scarcity ratio of 1.25 indicated its scarcity in nature.

Scarcity ratios of selected medicinal plants consumed by the sampled pharmacies during 2004-05 to 2011-12 are tabulated in Table 5.

Viola serpens (Banafsha) is a small perennial herb found in temperate Himalayas of Himachal Pradesh, Kashmir and Kumaon hills and its entire plant is used as expectorant, diphoeretic, antipyretic and also shows anti-fungal properties; leaves and seeds are cathartic. It is also used in Ayurvedic preparations like Banafshdi-kwath and Gulukand-banafsha. The average nominal price paid by the sampled pharmacies was Rs 943.83 per kg while the average real price was Rs 745.29 per kg. There was no significant annual linear growth in the consumption of this medicinal plant by the sampled pharmacies. The annual linear growth in nominal prices was insignificant while annual linear growth rate at constant prices was negative (5.11%).

The variation in nominal prices over a period of eight years by the sampled pharmacies was found 14.90 per cent while in the real prices during the period was 17.15 per cent. Banafsha was found to be price inelastic with price elasticity of 0.65 which was highest among the selected species. Its scarcity ratio was also found negative (0.35) indicating the availability of the plant in nature.

Emblica officinalis (Amla) is a medium sized tree ranging from 20 from 25 feet. Its official part used is fruit as diuretic, laxative, cardiac, astringent, lever disorders and leucorrhoea. It is also used in Ayurvedic preparations like Chyavanprash, Brahamarasayan, Triphala and Sanjiani-vati. Its average nominal price paid by the sampled pharmacies was Rs 43.33 per kg while the average real price was Rs 44.88 per kg. There was no significant annual linear growth in its consumption by the sampled pharmacies. The nominal prices of this medicinal plant recorded a linear growth of 8.70 per cent per annum whereas real prices recorded a higher linear growth of 19.65 per cent per annum. The variation in nominal prices over a period of eight years showed a variation of 22.34 per cent while the real prices showed a lower variation (19.32%). Amla was found to be price inelastic with a price elasticity of 0.12. Its scarcity ratio was -0.04 which indicated that this plant was not scarce in nature.

Punica granatum (Daru rind) is a small sized tree found wild in forests and in the Himalayan mid-hills. The rind of this herb is used for the cure of diarrhoea and dysentery. Its preparations are Decoctum-granati, Dadimashtakadichurna and

Table 4. Real price elasticity of demand of selected medicinal plants consumed by the sampled pharmacies during 2004-05 to 2011-12

Plant	Average quantity in terminal year in kg (Q_2)	Average quantity in base year in kg (Q_1)	Average price in terminal year (P_2)	Average price in base year (P_1)	Own price elasticity (OPE)
Ashwagandha	136.67	119.67	54.72	61.67	-1.11
Kuth	28.33	37.33	143.09	63.67	-0.36
Banafsha	14.33	13.33	680.64	1050	-0.17
Amla	146.00	137.33	33.26	34.67	-1.47
Daru rind	175.00	168.33	17.40	22.67	-0.15
Kutki	11.67	14.33	972.62	261.67	-0.18
Safedmusli	45.00	43.33	493.08	496.67	-5.21
Bankakdi	10.33	20.00	1962.64	903.33	-0.86
Kalmegh	18.33	15.67	24.75	27	-1.80
Daruhaldi	58.33	49.33	51.23	54.33	-2.85

Table 5. Scarcity ratios of selected medicinal plants consumed by the sampled pharmacies during 2004-05 to 2011-12

Period	Important medicinal plants consumed by sampled pharmacies									
	Ashwagandha	Kuth	Banafsha	Amla	Daru rind	Kutki	Safedmusli	Bankakdi	Kalmegh	Daruhaldi
2004-05	119.67	37.33	13.33	137.33	168.33	14.33	43.33	20.00	15.00	49.33
2005-06	115.00	38.33	11.33	146.00	166.67	11.00	42.00	18.00	18.00	52.67
2006-07	112.33	36.33	11.67	130.00	152.33	11.00	40.67	15.67	17.33	53.33
2007-08	122.00	33.33	9.67	135.00	161.00	12.00	37.00	13.33	18.00	56.00
2008-09	128.33	30.67	9.67	137.33	162.67	13.00	35.33	15.00	18.33	58.33
2009-10	128.33	31.67	11.33	136.67	166.00	12.33	33.33	12.67	17.33	56.67
2010-11	126.67	28.33	11.33	141.00	173.33	13.00	30.00	10.67	19.67	53.33
2011-12	136.67	28.33	14.33	146.00	175.00	11.67	45.00	10.33	18.33	58.33
Scarcity ratio	-0.11	1.25	-0.35	-0.04	-0.23	2.73	-0.01	1.18	-0.08	-0.05

Dadimaghrita. Its average nominal price paid by the sampled pharmacies was found Rs 24.65 per kg while the average real price was Rs 19.45 per kg. No significant annual linear growth in its consumption by the sampled pharmacies was recorded. The nominal prices of *P granatum* recorded linear growth of 3.45 per cent per annum whereas real prices grew at 3.37 per cent per annum. The variation in nominal prices (9.76%) was lower as compared to real prices (11.80%). Daru was found to be price inelastic with price elasticity of 0.14 with a negative scarcity ratio (0.23) implying that this medicinal plant was available in plenty in nature.

Picrorhiza kurroa (Kutki) is a major income generating non-timber forest product found in alpine Himalayas from Sikkim to Kashmir. This species is in higher demand and traded illegally. The Kutki root is anti-inflammatory, anti-bacterial, hepato-protective, cardiac and also used for bronchial asthma. Its Ayurvedic preparations are Arogyavaridhini-vati, Amritarista and Tiktadi-kwath. The average nominal price paid by the sampled pharmacies was found Rs 803.96 per kg while the average real price was Rs 572.69 per kg. Kutki recorded a negative and significant growth of 4.03 per cent per annum. The nominal prices of Kutki showed a higher growth of 26.78 per cent per annum whereas real prices grew at 19.90 per cent per annum. A very high variation (68.13%) in the nominal prices of Kutki was observed. The real prices also showed 50.22 per cent variation during the same period. Kutki was found to be price inelastic with price elasticity of -0.14 showing a violation of normal demand-price relationship. This could be attributed to the cumulative effects of other factors like rarity of the species and priorities of the pharmacies. Its scarcity ratio was found to be a positive value of 2.73 which indicated the fact that Kutki was highly scarce medicinal plant in nature.

Chlorophytum borivilinanum (Safed Musli) is a herb found in some patches of forests in whole of India as well as Himachal Pradesh. Its root is the official part which is used to maintain strength and vigour and has many curative properties like aphrodiasiac and immunity improving. In order to meet out the demand for Safed Musli the farmers have started cultivating this medicinal plant and its tubers are sold in the Amirtsar, Delhi and Mumbai markets. Moreover Ayurvedic pharmaceutical companies directly contact the cultivators for its supply. The average nominal price paid by the sampled pharmacies was found Rs 967.29 per kg while the average real price was Rs 746.48 per kg. The growth in the consumption of Safed Musli by the sampled pharmacies showed negative growth of 2.24 per cent per annum. The nominal prices of the species showed a growth of 9.46 per cent whereas real prices recorded a growth of 2.81 per cent per annum. The variation in nominal prices over

a period of eight years by the sampled pharmacies was found to be 32.48 per cent while the real prices showed a variation of 2.81 per cent only. Safed Musli was found to be price inelastic with price elasticity of 0.07. The scarcity ratio of -0.01 indicated that plant was not scarce in nature.

Podophylum hexandrum (Bankakdi) is a temperate Himalayan herb found at altitudes ranging from 2800 to 3500 m and is commercially collected for its rhizome that are processed to extract 'podophyllin' derivatives of which are used in treatment of tumors. The species once known to form extensive dense populations in its natural habitat has borne the brunt of heavy exploitation over the past 50 years and has become endangered now. Since the rhizomes take 5-6 years to mature efforts to domesticate the species and cultivate it on commercial scale have proved to be non-viable. The average nominal price paid by the sampled pharmacies was found Rs 2124.17 per kg while the average real price was Rs 2033.02 per kg. Its consumption by the sampled pharmacies was found negative (6.60%) ie highly declining. The nominal prices of this herb showed an annual linear growth of 17.03 per cent per annum whereas real prices recorded a growth of 4.29 per cent per annum. A variation of 41.95 per cent was observed in the nominal prices over a period of eight years by the sampled pharmacies while variation in the real prices during this period was higher (51.14%). Bankakdi was found to be price inelastic with price elasticity -0.55. Here the normal demand-price relationship was not exhibited which could be due to cumulative effect of some other factors like rarity and priority by the pharmacies. Its scarcity ratio was found 1.18 which was second highest among scarce species after Kutki indicating its scarcity in nature.

CONCLUSION

The analysis has shown a high growth rate and low elasticity for Kuth, Banafsha, Daru rind, Kutki and Safed Musli which assures steady market for them. The plants like Bankakdi, Kutki and Kuth are to be given priority in commercial cultivation in view of their scarcity values. The normal demand-price relationship could not be established because of the reason that the medicinal plant market was oligopsonic in nature. Hence for devising an effective policy this fact should be taken care off. There is a need to develop sound database for the medicinal plants extracted/produced in the state through a nodal agency to enhance the quality of data. Since these plants are inputs to Ayurvedic industries so the source of supply should be made compulsory. Moreover a market driven management policy is warranted for the popularisation of medicinal plants in the state.

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