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**Review Article**

# Medicinal, Nutraceutical Values and Consumption Pattern of Onion (*Allium cepa*) in India: An Over View

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**A B S T R A C T**

Onion is one of the oldest cultivated plant species consumed worldwide usually thought of onion as a vegetable but it is also has a long history of medicinal use. Medicinal properties of onion are known since ancient times, onion extracts have been intensively investigated for antimicrobial activities controlled gram positive bacteria. Onion fresh juice is often recommended in the folk medicine of various countries for pain and swelling after bee or wasp stings. The observed high efficacy of this treatment for this so called late cutaneous allergic reaction led to the discovery of various compounds in onion with anti-inflammatory and antiasthmatic activity. That is probably because onions contain generous amounts of the flavonoid quercetin and chemicals known as organo sulfur compounds that have been linked to lowering blood pressure, cholesterol levels and protects against cataracts, cardiovascular disease, and cancer. Using of onion regularly in the diet it offsets tendencies towards angina, arteriosclerosis and heart attack, gastrointestinal disorders and it will also strengthen the appetite. Therefore in this article we have tried to review the nutraceuticals, medicinal properties and consumption pattern of onion in rural and urban areas of India with in a simple manner. We also emphasized the advanced research of onion medicinal properties in ovarian cancer to empower and understanding the common man especially onion growing farmer should now the importance of onion for human health.

## Introduction

The onion is one of the important vegetable crops in India and is an integral component of Indian culinary. Being an essential food item, it is also a highly politically sensitive commodity because it is one of the major export potential, therefore, it is very pertinent to assess the performance of onion products export in post liberalized regime in order to take corrective measures and devise future strategies to achieve greater levels of export. India ranks second in global onion production after China and with an annual production of 16 to 17 million ton accounts for around 20% of global production. In overall cropping pattern, onion occupies about 0.1 per cent of gross cropped area and about 7 per cent of total area under all vegetable crops. Onion production has shown a steady upward trend, in response to increase in planted area and to a lesser account due to improvement in productivity. Onion consumption patterns in India works out by National Horticultural Research and Development Foundation (NHRDF) that consumption pattern extensive sample survey covering 12 states with sample of

about 6975 rural (52 districts) and 5330 urban (53 districts) families, are summarized in this article.

## Medicinal importance of onion

Onions are primarily used as a food source, in cooking as the start off ingredient in cooking, in making onion soups and chutneys, raw in salads and as pickles in vinegar. Apart from this, onions are being used for the treatment of many ailments as mentioned in Ayurveda. There are more than 500 varieties of onions are identified, commonly available onion varieties *i.e*. Yellow Onions are the sweetest in taste with golden coloured outer skins and pale yellow coloured inner flesh. They are the best for cooking and used in soups. Yellow onions have high sulfur content, high sulfur content makes yellow onions too strong to eat as raw. The sulfur is also creates tears when chopping. This variety is good for caramelizing. Red Onions are the most pungent of all the varieties having a red outer skin and red white rings inner flesh. They are used in salads and sandwiches in traditional cooking. The flavor is mild, sweet and the texture is crisp. They are used to add color to dishes. They can also be grilled or lightly cooked with other foods. White Onions have white outer skins with the inner flesh too, being white. White onions are sweeter than yellow onions. This variety has a clean, sharp flavor and firm texture. White onions can add a sweet flavor to other foods. They can be eaten as raw and are good in heated dishes. Green Onions/ Spring Onions normally available are basically immature onions. They are also eaten raw.

When it comes to which type of onion is healthier? Both types of onions are powerful super foods with anti-carcinogenic, antiviral, antibacterial, and antioxidant properties. Many of think that the only difference is the appearance and taste, but when you examine the nutritional differences of red onions *vs*. white onions, one contains more health benefits than the other. Red onions have a deep purple layer of outer skin and are most often used raw, in salads, sandwiches. White onions have a milder flavor and an off white or white colored skin. They both also provide about 10 percent of the daily value for Vitamin C and the same amount of calcium per serving. Although white onions contain 5 more grams of fiber and a higher amount of sulfur, red onions have been found to contain a higher amount of many other beneficial nutrients. In general, the rule is that onions with a sharply strong taste, such as red onions, contain a higher amount of antioxidants. Red onions also win in the category of cancer prevention and blood thinning properties. Additionally, red onions contain less sugar compared to white onions, which is where they get their sweet taste from.

Onion is usually thought of as a commonly using vegetable in food, It is also has a long history of medicinal and highly valued for its therapeutic properties. Mainly the fleshy bulb that grows below the ground is used medicinally as well as for food but other parts of the plant also used in the traditional medicines. Medicinal properties of onion probably because contain generous amounts of the flavonoid quercetin. Quercetin is a potent antioxidant flavonoid found in shallots, yellow and red onions, which is found on and near the skin and is particularly linked to the health benefits of onions. The flavonoids in onion tend to be more concentrated in the outer layers of the flesh. To maximize your health benefits, peel off as little of the fleshy, edible portion as possible when removing the onion's outermost paper layer. Even a small amount of "over peeling" can result in unwanted loss

of flavonoids. For example, a red onion can lose about 20% of its quercetin and almost 75% of its anthocyanins if it is "over peeled." Onion also rich content of sulphur is a constituent of secondary compounds that is, allin, cycloallin and thiopropanol. These secondary compounds not only govern the taste, pungency and medicinal properties especially healing of wounds but are also important for resistance against pests and diseases. Compared with other fresh vegetables, it is relatively high in food value. There is considerable variation in composition between different varieties and it also varies with the stage of maturity and the length of storage. Onion is one of the vegetables which have the best keeping quality.

## Nutritional profile of onion

Nutritional value of onions varies from variety to variety. Its major value is in its flavor and medium in calorific value. Information on a full array of nutrients, including carbohydrates, sugar, soluble and insoluble fiber, sodium, vitamins, minerals, fatty acids, amino acids are given in Table 1.

## Onions for specific health beneficial for the human body

Onion although is a valued a nutritive agent and have been used in folk medicine for the relief of coughs, colds and catarrh, especially asthma, but more recently some of their curative properties have been attributed to a compounds that are responsible for their pungent odors and for many of their health-promoting effects. A wide variety of allyl sulfides are found in onion, including the four major diallyl sulfides: diallyl monosulfide, diallyl disulfide, diallyl trisulfide, and diallyl tetrasulfide. Also present are a wide variety of sulfoxides, including (+) S-methyl-L-cysteine sulfoxide, (+)-S-(1-propenyl)-L-cysteine sulfoxide, S-methyl-l-cysteine sulfoxide, S-propyl-l-cysteine sulfoxide, and S-propenyl-l-cysteine sulfoxide. Onions are an outstanding source of polyphenols, including the flavonoid polyphenols. Within this flavonoid category, onions are a standout source of quercetin (Griffiths *et al.*, 2002) a potent antioxidant flavonoid linked to the health benefits of onions. Some of the many health benefits of onions are listed below:

Onion is an effective remedy for cholera. Mixture of 1 part lemon juice, 1/2 part mint juice and 1/2 part onion juice, when taken relieves. Eating raw onions with salt inactivates the tuberculosis bacteria in the body. Onion juice or raw onions increases blood hemoglobin due to the high content of Iron. Crush onions and inhale the vapours for relief in cough, throat and respiratory diseases and lung affections. Add honey to onion juice and lick this for relief in asthmatic cough.

Eat one onion daily in morning & evening to get relief. In another process take 1/2 cup juice of white onion. Add little jaggery and ground turmeric mix and drink in morning and evening. Onions increase insulin in the body and also treat diabetes by controlling the sugar levels in the blood. Eating raw onion relieves sneezing and running nose. Three to four tea spoons of onion juice taken with honey in equal measure controls cold, cough and flu symptoms.

Onion consumption increases appetite and helps in digesting food. It also improves the functioning of liver and spleen, removes accumulated wind and relieves pain and bloating of the stomach. Heat an onion bulb in fire and take out its juice. Add some salt and drink for relief by increasing the release of digestive enzymes. Onion juice mixed

with a little water taken early morning regularly relieves fits. Take this for at least 40 days. Making a person who is in a fit smell onion juice brings him back to consciousness. One tea spoon onion juice taken every two hours kills worms and relieves indigestion. Red onion with lemon juice reduces dyspepsia. In Dysentery**:** In mucus and bloody stools, add one onion cut finely cut, to fresh curd made of cow's milk. Grind onion and apply on the navel for control of loose motions. Onion juice consumption helps in reducing the effects of intoxicating drinks. Mix the white onion cut in small pieces in curd reduces acidity. Onion juice prevents and relieves nose bleed and throat infection. Mix equal parts of onion juice and ginger juice reduce vomiting. Protecting against heart failure-consumes a plateful of boiled or fried onion pieces in breakfast every day; it helps in preventing heart attacks. The onions prevent the formation of blood clots in the coronary arteries. Eat one raw onion daily with food helps in regulating blood circulation (Slimestad *et al.,* 2007). Eating raw onions with salt helps in cases of bites due to honey bees, poisonous insects, scorpions etc. Crush onions finely add honey and apply on the bite; it prevents and checks bacterial infection. Apply onion juice and massage on the bald areas regularly reported that enhances new hair grow and stop hair loss and grind onions and apply in hair turns hair black in colour.

Kidney disorders- add sugar to onion juice and make syrup. Drinking this breaks the stones and removes them. In other method take 50 g onion juice in the morning on an empty stomach daily. It breaks the stones and removes them. For urinary problems- Put 50 g onion pieces in one liter of water boil and strain this water, add honey drink 3 times daily. It brings on urine without pain. It also relieves the problem of frequent urination and helps in bringing on urine in cases of retention of urine. Abscess - Grind onions. Add turmeric, wheat flour, water, pure ghee and cook on fire for some time. Make a poultice and tie it when warm on the boils. It opens up the boil and relieves. Eating raw or cooked onions is beneficial in sick looking and pale skin and improves the colour of the skin. Onion has the bactericidal properties; if a person consumes one raw onion every day by thorough mastication protects from a host of tooth disorders and kills all the germs in the mouth with toothache by placing a small piece of onion on the bad tooth or gum. Oral cancer – frequency use of onion reduces risk of several common oral cancers (Galeone *et al.,* 2006). Periodontitis - onion extracts possess an effect on all types of bacterial strains (Kim, 1997). Bone health – onion inhibit bone resorbtion by 20% when consumed at 1g per day per kg of body weight (Jaime *et al.,* 2001). Putting 5-6 drops of warm onion juice in the ear gives relief from pain, pus and whistling sounds. Drink juice of red onions whether they are raw, boiled or steamed reduces insomnia. Regular use improves vision. Headaches and Headaches due to sunstroke-grind onions and apply on the soles of the feet. Increasing Strength- Take one tsp onion juice mixed with two 2 tea spoons honey daily. Increasing Mother's Milk- Eat raw onion with meals. Heat Stroke/Sunstroke- Apply onion juice to temples and chest and massage. Also, drink onion juice. Eat raw onions daily with meals and keeping one in the pocket prevents sunstroke. Sexual Debility - White onion mixture acts as an excellent aphrodisiac tonic if taken regularly with a spoon of honey on an empty stomach.

**Table.1** Nutritional value of onion (100 g of fresh bulb)

| Particulars | Big onion | Young onion | Canned onion | Frozen onion | Dehydrated onion | Small onion | Onion stalks |
|---|---|---|---|---|---|---|---|
| **Calories** | | | | | | | |
| Moisture (%) | 86.60 | - | - | - | 4.60 | 87.60 | 84.30 |
| Protein (g) | 0.92 | - | - | - | 10.60 | 0.90 | 1.80 |
| Fat (g) | 0.10 | - | - | - | 0.80 | 0.20 | 0.10 |
| Minerals (g) | 0.40 | - | - | - | 3.50 | 0.80 | 0.60 |
| Carbohydrate (g) | 10.11 | 5.65 | 4.02 | 6.81 | 80.67 | 12.6 | 8.9 |
| Fibre (g) | 1.40 | 3.50 | 1.20 | 1.80 | 5.70 | 0.60 | 1.60 |
| Energy (K cal) | 50.00 | - | - | - | - | 41.00 | 59.0 |
| Sugar | 4.28 | 2.10 | 2.20 | - | 35.48 | - | - |
| **Macronutrients** | | | | | | | |
| Calcium (mg) | 22.0 | 61.0 | 45.0 | 17.0 | 363.0 | 40.0 | 50.0 |
| Phosphorus (mg) | 27.0 | 33.0 | 28.0 | 22.0 | 340.0 | 60.0 | 50.0 |
| Potassium (mg) | 144.0 | 260.0 | 111.0 | 124.0 | 943.0 | - | 109.0 |
| **Micronutrients** | | | | | | | |
| Iron (mg) | 0.19 | 1.92 | 0.13 | 0.33 | 2.56 | 1.20 | 7.43 |
| Magnesium (mg) | 10.0 | 20.0 | 6.0 | 7.0 | 122.0 | - | 104.0 |
| Sodium (mg) | 3.0 | 4.0 | 371.0 | 12.0 | 54.0 | - | 2.20 |
| Copper (mg) | 0.04 | 0.06 | 0.06 | 0.02 | 0.18 | - | 0.45 |
| Manganese (mg) | 0.13 | 0.13 | 0.10 | 0.07 | 0.37 | - | 0.74 |
| Molybdenum (mg) | 0.03 | - | - | - | - | 2.29 | - |
| Zinc (mg) | 0.16 | 0.45 | 0.29 | 0.07 | 2.33 | - | - |
| Selenium (mg) | 0.50 | 0.50 | 0.30 | 0.40 | 2.10 | - | - |
| **Vitamins** | | | | | | | |
| Thiamin (mg) | 0.05 | 0.07 | 0.03 | 0.03 | 0.42 | 0.08 | - |
| Riboflavin (mg) | 0.03 | 0.14 | 0.01 | 0.03 | 0.06 | 0.020 | 0.030 |
| Niacin (mg) | 0.08 | 0.20 | 0.06 | 0.15 | 0.65 | 0.50 | 0.30 |
| Vitamin B6 (mg) | 0.15 | 0.06 | 0.14 | 0.08 | 1.22 | - | - |
| Folate-total (mcg) | 19.0 | 14.0 | 10.0 | 17.0 | 166.0 | - | - |
| Food-folate(mcg) | 19.0 | 14.0 | 10.0 | 17.0 | 166.0 | - | - |
| Folate-DFE(mcg) | 19.0 | 14.0 | 10.0 | 17.0 | 166.0 | - | - |
| Vitamin B12 (mcg) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - | - |
| Vitamin A (IU) | 2.0 | 4000.0 | 1.0 | 35.0 | 0.0 | - | - |
| Retinol (mcg) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - | - |
| Vitamin E (mg) | 0.02 | 0.21 | 0.07 | - | 0.27 | - | - |
| Vitamin K (mcg) | 0.40 | 22.70 | 0.20 | - | 4.10 | - | - |
| Vitamin C (mg) | 11.00 | - | - | - | 147.00 | 17.00 | 2.00 |
| **Individual fatty acids** | | | | | | | |
| Fat- saturated (g) | 0.03 | 0.02 | 0.02 | 0.02 | 0.18 | - | - |
| Fat-monounsaturated (g) | 0.06 | 0.04 | 0.04 | 0.04 | 0.44 | - | - |
| Fat-polyunsaturated (g) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - | - |
| Cholesterol (mg) | - | - | - | - | - | - | - |

Source: USDA National Nutrient data base, Nutritive Value of Indian Foods, NIN, Hyderabad, CFTRI, Mysore

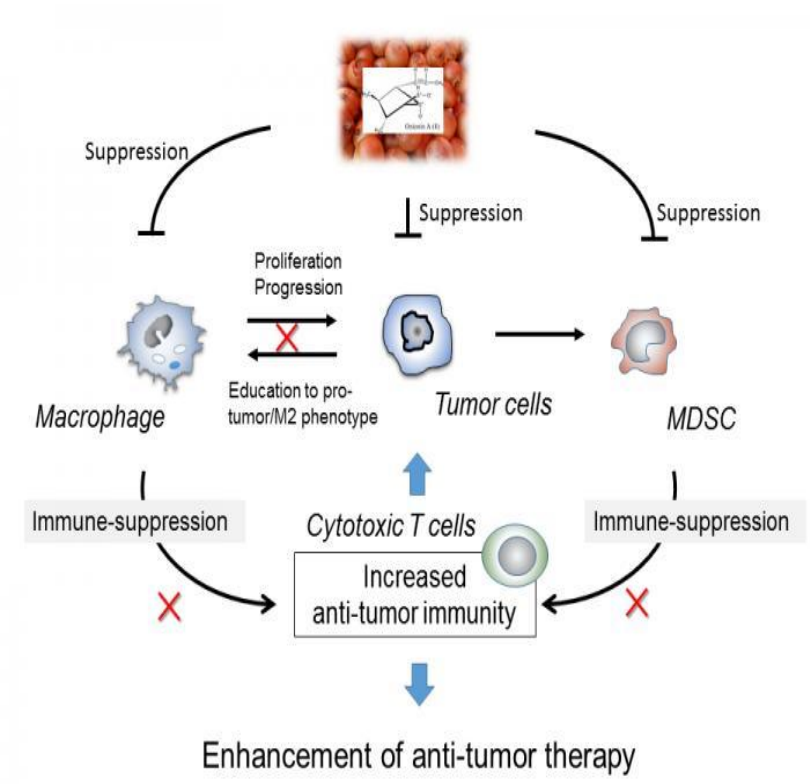
**Table.2** Onion consumption pattern in rural areas and urban areas of India

| Sr. No. | State | Population consumption (%) | | Consumption / person / day (g) | | Per cent deviation from National average | |
|---|---|---|---|---|---|---|---|
| | | Rural areas | Urban areas | Rural areas | Urban areas | Rural areas | Urban areas |
| 1 | Andhra Pradesh | 89.06 | 91.49 | 43.18 | 41.02 | -5.37 | -10.09 |
| 2 | Bihar | 83.33 | 56.98 | 41.68 | 41.87 | -8.64 | -8.23 |
| 3 | Delhi | - | 91.87 | - | 40.82 | - | -10.53 |
| 4 | Gujarat | 89.10 | 87.90 | 48.10 | 50.97 | 5.43 | 11.71 |
| 5 | Haryana | 88.59 | 90.11 | 50.90 | 52.70 | 11.56 | 15.49 |
| 6 | Himachal Pradesh | 90.02 | 89.95 | 55.88 | 56.42 | 22.46 | 23.65 |
| 7 | Maharashtra | 91.04 | 86.97 | 46.07 | 50.32 | 0.98 | 10.30 |
| 8 | Madhya Pradesh | 85.14 | 79.30 | 45.12 | 48.90 | -1.11 | 7.18 |
| 9 | Punjab | 93.88 | 90.72 | 55.70 | 58.06 | 22.07 | 27.25 |
| 10 | Rajasthan | 88.23 | 90.81 | 46.80 | 49.00 | 2.57 | 7.39 |
| 11 | Tamilnadu | 88.23 | 90.81 | 35.28 | 40.23 | -22.69 | -11.82 |
| 12 | Uttar Pradesh | 89.57 | 85.38 | 46.00 | 45.25 | 0.82 | -0.83 |
| | **Average** | **88.74** | **86.02** | **45.11** | **46.81** | **-3.49** | **-2.58** |

**Table.3** Overall production, consumption requirement and surplus / deficit of onion

| Sr. No. | State | Production (Lakh MT) | Requirement for consumption | Surplus / Defecit (Lakh MT) |
|---|---|---|---|---|
| 1 | Andhra Pradesh | 10.05 | 7.69 | 2.36 |
| 2 | Bihar | 13.04 | 15.80 | -2.76 |
| 3 | Delhi | 0.17 | 2.50 | -2.33 |
| 4 | Gujarat | 18.51 | 10.87 | 7.64 |
| 5 | Haryana | 6.72 | 4.75 | 1.97 |
| 6 | Himachal Pradesh | 0.44 | 1.40 | -0.96 |
| 7 | Maharashtra | 58.64 | 19.69 | 38.95 |
| 8 | Madhya Pradesh | 28.26 | 12.23 | 16.03 |
| 9 | Punjab | 1.85 | 5.72 | -3.87 |
| 10 | Rajasthan | 7.05 | 11.86 | -4.81 |
| 11 | Tamilnadu | 4.73 | 9.92 | -5.19 |
| 12 | Uttar Pradesh | 4.10 | 33.39 | -29.29 |
| | **Average** | **153.56** | **135.81** | **17.75** |

**Figure.1** Onion A increases anti-tumor immune response by inhibiting the immune suppression actions of macrophage and myeloid derived suppressor cells (MDSC) (Tsuboki *et al.*, 2016)



Cancer Protection Potential of Onions - Onions can protect us against cancer even when we consume it in only moderate amounts *i.e.* 1-2 times per week, even though it has been used up to 5-6 times per week. Colorectal cancer, laryngeal cancer, and ovarian cancer are the cancer types for which risk is reduced along with moderate amounts of dietary onion.

Scientist from Kumamoto University in Japan identified a natural compound found in onions may help treat the most common type of ovarian cancer *i.e.* onionin A (ONA) (El-Aasr, M. *et al*, 2010), on a preclinical model of epithelial ovarian cancer (EOC) both in vivo and in vitro. ONA suppressed pro-tumour activation of host myeloid cells. EOC is the most common type of ovarian cancer and has a five-year survival rate of about 40 per cent. ONA inhibited the pro-tumour functions of myeloid-derived suppressor cells and appears to activate anti-tumour immune responses by nullifying the immunosuppressive function of myeloid cells. It has the potential to enhance existing anti-cancer drugs while also having little to no cytotoxic effects on normal cells (Tsuboki *et al.,* 2016) (Figure 1).

## Consumption pattern based on national average

An extensive survey was made by NHRDF in different states both in rural as well as in urban areas during the period 2012-13, covering 12 states of our country to estimate the daily consumption rate of onion. The states covered were Andhra Pradesh, Bihar, Delhi, Gujarat, Himachal Pradesh, Haryana, Maharashtra, Madhya Pradesh, Punjab, Rajasthan, Tamil Nadu and Uttar Pradesh. In order to arrive at concrete results, it is pertinent that the sampling methods used for selection of states, districts with-in states, villages with-in districts and finally families with in selected village coupled with the statistical method used for estimation of daily consumption rate of onion individually for rural and urban, across the lengths and breadth of our country must be systematic. The purpose of sampling is to provide statistical information of a qualitative or quantitative nature about the entire population by referring only to a few selected units. State wise consumption pattern is given in Table 2.

The consumption pattern and percent population consumes onion along with percent deviation from national average in rural areas of different states are presented in Table 2, average onion consumption in rural areas is less by 1.14% compared to national average of onion consumption 45.63 g/ person/day. Onion consumption in the rural areas of Himachal Pradesh, Punjab, Haryana, Gujarat, Rajasthan, Maharashtra and Uttar Pradesh is more than national average and it is less in Madhya Pradesh, Andhra Pradesh, Bihar and Tamil Nadu. Whereas in urban areas is more by 2.58% compared to national average of onion consumption 45.63 g/ person/day. Onion consumption in the urban areas of Punjab, Himachal Pradesh, Haryana, Gujarat, Maharashtra, Rajasthan and Madhya Pradesh is more than national average and it is less in Uttar Pradesh, Bihar, Andhra Pradesh, Delhi and Tamil Nadu.

National average onion consumption worked out 45.63 g/ person/day based on total population combined after considering percent rural and urban population as well as share of states (12 states) in total country's population. Overall average onion consumption in Punjab, Himachal Pradesh, Haryana, Gujarat, Maharashtra, Rajasthan, Madhya Pradesh and Uttar Pradesh is more than national average and it is less in Andhra Pradesh, Bihar, Delhi and Tamil Nadu.

Onion consumption in rural area of Andhra Pradesh and Uttar Pradesh is higher than urban areas.

The results obtained through the extensive sample survey covering 12 states with sample of about 6975 rural (52 districts) and 5330 urban (53 districts) families, are summarized as below: Per capita consumption of onion noted highest in Punjab 56.58 g/ person/day followed by Himachal Pradesh 55.93 g/person/day, Haryana 51.34 g/person/day, Gujarat 49.32 g/person/day and per capita lowest consumption noted in Tamil Nadu 37.68 g/person/ day, Delhi 40.82 g/person/day, Bihar 41.71 g/person/day and Andhra Pradesh 42.64 g/person/day, as against the national average of 45.63 g/person/day. The maximum production of onion was recorded in Maharashtra followed by Madhya Pradesh and Gujarat, whereas highest requirement for consumption was in Maharashtra followed by Bihar and Madhya Pradesh. Surplus of onion consumption requirement of different states under study and production in the respective states were analyzed and observed that onion production is exceeded in the states of Maharashtra, Madhya Pradesh, Gujarat, Andhra Pradesh and Haryana (Table 2). Lowest onion production and requirement was observed in Himachal Pradesh.

In conclusion, onion is very beneficial to human health. Medical properties of onion exceed those in many drugs, which normally have side effects. Several parts of the plant have a place in traditional medicines. Health benefits of Onion include substantial relief from number of diseases such as common cold, asthma, bacterial infections, respiratory problems, angina, and cough. World Health Organization confirms that onions are best for people with less appetite and those suffering from atherosclerosis. Health experts acknowledge the fact that onions do provide great respite to patients having chronic asthma, allergic bronchitis, common cough and cold syndrome. Health benefits of onion are available due to presence of sulphur compounds, quercetin and mineral components. To stay healthy and prevent the onset of these diseases, eating an onion a day can keep the doctor away by cleansing and detoxifying the body to prevent and treat ailments from diabetes to heart disease boosting your health.

Though this study is comprehensive with respect to arriving at the national consumption rate can estimate of post-harvest loss assessment coupled with the impact of emanating technologies developed for increasing crop productivity, would throw still more clear picture about the existing gaps need to be addressed in a public-private partnership mode.

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