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Research Article

PRESENT STATUS OF VEGETABLE PRODUCTION AND THEIR IMPACT IN HUMAN NUTRITION

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Abstract- This research work is a synthetic view of present status of vegetable production in India and their effect on human nutrition. Food production is increasing so it is essential to sustain increased production to meet the nutritional standard of people. To enhance the vegetable productivity by using new innovative method and technology is best alternate to sustain the food security. Based on earlier research, it has been studied that vegetables gave four to ten time's higher yield as compared to cereal crop. During 2015-16, it has been observed that total vegetable production in country was 166.6 MT with 9.6 M ha area while average productivity remained 17.4 t/ha.

Vegetables constitute about 59% of total horticulture production. During the period (2007-08 to 2015-16), area and production of vegetables increased by 22% and 29% respectively. Vegetable production in the country, have led to increase per capita availability of vegetables from 264 gm/ person/day in 2004-05 to 355 gm/person/day in 2015-16. India has first rank in pea (*Pisum sativum*) and okra (*Abelmoscus esculentus*) production while 2nd rank in tomato (*Solanum lycopersicum*), cauliflower (*Brassica oleracea*) potato (*Solanum tuberosum*) onion (*Allium cepa*) and brinjal (*Solanum melongena*)

During 2015-16, total vegetables exported from India was of INR 4,866.91 crores and the major importers of Indian vegetables are UAE, Bangladesh, Malaysia, Netherland, Sri Lanka, Nepal, UK, Saudi Arabia and Qatar, accounting for around 55% of the total vegetable exports. Vegetable production with area under production, total production and productivity of vegetable crops of the country has been gradually increasing from 1991-92 to 2014-15. It is mainly due to an increase in area under production and larger increase in productivity with farmers' positive approach towards vegetable cultivation. During this period, the area under horticulture crops grew by about 2.7 percent per annum, productivity increased by 37 per cent between 2004-05 and 2014- 15. As a result, India has maintained its second rank in the global production of vegetables after china.

Keywords- Production, Vegetable, Nutrition, Effect, Phytochemicals.

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Introduction

Vegetables are rich and comparatively cheaper source of carbohydrates, proteins, vitamins and minerals can supplement the main cereals of the country. We get many specific chemical substances from vegetables required to our body for growth, reproduction and for maintenance of health.

Vegetable containing food product provide not only nutrient but also change flavor and palatability which act as appetizer and digestible fiber present in vegetable can be helpful in treating constipation. Vegetables are also important in stabilizing the hydrochloric acid in stomach which overall help indigestion and also provide valuable roughages which help in movement of food in intestine. In 2010 the global vegetable seed market was estimated at US $4.1 billion, of which 36% were for solanaceous, 21% for cucurbits, 13% for roots and bulbs, 12% for large seed, 11% for brassicas, and 7% for leafy and others vegetables [1].Vegetable plays great role in human 's daily balance diet and they consist antioxidants such as sulphoraphane (broccoli), nasunin (brinjal), allicin (onion) and diosgenin (yams) are used to treat different type of disease by protecting against free radical damage, by modifying metabolic activation and detoxification of carcinogens. Vegetables in all their many forms ensure an adequate intake of most important vitamins and nutrients, dietary fibers, and phytochemicals which can bring a much-needed measure of balance back to diets contributing to solve many of these nutrition problems. The promotion of the healthy functionality of food has coincided with consumer interest. Because each vegetable contains a unique combination of phyto-nutriceuticals, a great diversity of vegetables should be eaten to ensure that individual's diet includes a combination of phytonutriceuticals and to get all the health benefits. This article makes a review and discusses the nutritional quality and health benefits of the major groups of vegetables. To know the specific function of different type of phytonutriceuticals the cooperative research work from different disciplines such as agriculture, medical science and food science are required. It has been studied that vegetables make up a major portion of the diet of humans in many parts of the world and play a significant role in human nutrition, especially as sources of phyto- nutriceuticals: vitamins (C, A, B1, B6, B9 and E), minerals, dietary fiber and phytochemicals [2]. It has been studied that a high vegetable diet has been associated with lower risk of cardiovascular disease in humans [3]. Sharma *et al.* (2013) revealed that green leafy vegetables have been playing a very important role in our diet and nutrition and most readily available sources of carbohydrates, fats, important proteins, vitamins, minerals, essential amino acids, and fibers [4]. These vegetables are also rich in most essential compounds having anti- microbial [5], anti-diabetic [6], anti-histaminic [7], anti-carcinogenic [8] and hypo-lipidemic properties [9] and possess preventive or curative properties against cardiovascular disease, ageing, obesity, hypertension, insomnia, and ageing. Vegetables as medicinal plants

contain none or less toxic effects and have a great role to sustain the body immunity through different medicinal value [10] and chemical present in theme have resistant properties (anticancer, antimicrobial, antibacterial, anticarcinogenic) against different type of physiological and biological diseases [11]. Fasuyi *et al.,* (2006) revealed that vegetables are rich source of carotene, ascorbic acid, riboflavin, folic acids and minerals like calcium, iron and phosphorus which help in growth and development of different parts of body [12]. According to the 2007 World Health Report unbalanced diets with low vegetable intake and low consumption of complex carbohydrates and dietary fiber are estimated to cause some 2.7 million deaths each year, and were among the top 10 risk factors contributing to mortality [13]. Diet is the primary therapy source for this type of diabetes and bitter gourd play particularly critical role when pharmaceuticals are not available. Vegetables are major dietary source for phytochemicals with potential anti-obesity properties, with various types and levels between species and even cultivar [14,15]. A world vegetable survey showed that 402 vegetable crops are cultivated worldwide of 69 families and 230 genera [16]. Different types of vegetables have different specific nutritive values such as carbohydrates (leguminous vegetables, sweet potato, potato, onion, garlic and methi) proteins (peas, beams, leafy vegetables, and garlic). Vegetables are also consisting some essential vitamins and sometime their deficiency can cause disorders such as blindness (vitamin A deficiency), berry-berry (vitamin B deficiency), Scurvy (Vitamin C deficiency and rickets (vitamin D deficiency. Therefore, the present work was done to study the present status of vegetable production and their impact in human nutrition.

Current scenario of vegetable production

It is a matter of satisfaction, we are second largest producer of vegetables in the world and our presence in global market is significant. Exports of fresh vegetables (such as peas, potatoes) have been on the rise. However, export of fresh onion has declined from 17 to 12.4 lakh tonnes over the last three years. The development achieved in the horticulture sector is indicative of the fact that there is growing demand for vegetable produce. The experience has been rewarding for enhanced output from the investment. Timely availability of information in this sector will certainly improve the socioeconomic conditions of Indian citizens by providing self-reliance besides environmental protection. According to USDA, National Agricultural Statistics Service, in 2016, the Nation's production for the 26-estimated vegetable and melon crops totaled 780 million cwt. Total utilized productions for 2016 vegetable crops totaled 775 million cwt. and area harvested for vegetable crops was 2.57 million acres. India is second largest producer of vegetable crop after China. India shares about 10.6% of total vegetable production of the world. Horticulture in the country, have led to increase per capita availability of vegetables from 264 gm/ person/day in 2004-05 to 355 gm/person/day in 2015-16.

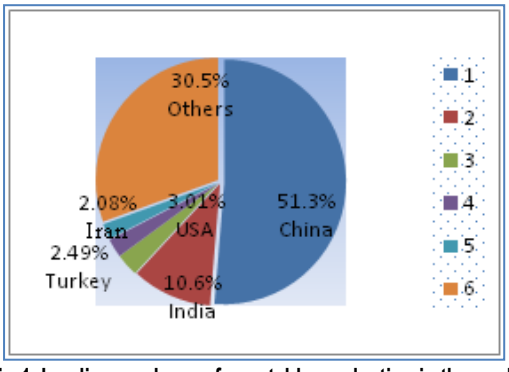

Fig-1 Leading producer of vegetable production in the world

Source-FAO STAT data 2015

Vegetables occupy 38.9% of area and 61% of total horticultural area and production of country respectively (National Horticulture Board 2014-15). Developments in the areas of state-of-the-art cold chain infrastructure and quality assurance measures have been taken to improve the post-harvest management system in the country. The private sector, public sector has also taken initiatives and with APEDA's assistance several Centers for Perishable Cargoes and integrated post-harvest handling facilities have been set up in the country. All these efforts can enthusiasm to the farmers for their large vegetable production as a result vegetable production increase up to that extent where we will be ensuring to provide good quality food to the future generation.

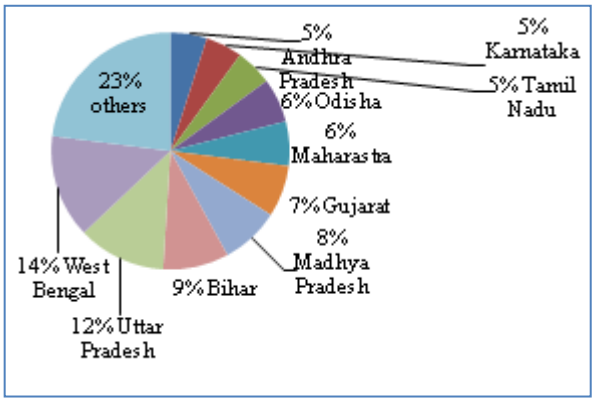

Fig-2 Leading producer of vegetable production in the country

Source: Horticulture Statistics Division, DAC&FW

During 2014-15, potato had the largest share in vegetable production followed by onion, tomato, brinjal, cabbage, cauliflower, peas and others. Uttar Pradesh (29 %) and West Bengal (26 %) are top potato producing states which together produce more than half of the total potato produced in the country.

Health benefits of vegetables

Vegetable are great source of all essential component of balance diet, which includes carbohydrates, fat, minerals, vitamins, and some other chemical which help in growth, development, and reproduction of human being. There are different group of vegetable crop which have some specific type of nutrient factors.

Bulb vegetables (Allium)

Allium is monocotyledon family and it include several widely cultivated species are. - Onion, garlic, leek, shallots, and chives are all produced by plants in this family. These vegetables have most valuable sulfur-containing compounds (onion odor due to Allyl Propyl Disulfide). They are rich in a wide variety of thiosulfide, which have been linked to reducing various chronic diseases and they contain 1% to 5% non-protein sulfur compounds, on a dry weight basis [17]. Significantly variability has been observed in the total thiosulfide (0.02% to 1.3% fresh weight) content in these compounds when grown under identical conditions [17]. There is huge difference among total thiosulfide contents in green onion leaves, chive, and onion bulb were 0.2, 0.72, and 1.02 g/kg fresh weight, respectively. The type of thiosulphide has been found in these vegetables are also variable. For example, on- ion bulbs contained 34% methiin, 5% ethiin, 6% propiin, 5% alliin, and 49% isoalliin [80], while garlic cloves contained about 92% alliin, 8% methiin, and trace amounts of ethiin, propiin, and isoalliin [18].

Onions are a rich source of dietary fibers and especially of insulin, which help in digestion of sugar [19]. It has prebiotic properties which modify the harmful bacterial mycoflora of the intestine in less abundant [20]. Recently observed neokestose, another fructan found in onion is an excellent source of the growth of beneficial bacteria [21] and also promote the absorption of calcium that is useful in the prevention of osteoporosis [22]. High fructan diets have minimum concentration of colesterol, tryacylglycerol, phospholipids, glucose and insulin in the blood of middle-aged men and women [23]. The presence of prebiotic polysaccharides (insulin) helps in the digestion of sugar and presence of flavonoids in onions play important role as it possesses antidiabetic potential [24]. Sharma *et al.,* [93] observed that onions had antihyperglycemic effects [25]. To assess the effect of a diet having onions and green beans on serum glucose levels, an experiment was conducted and observed that consumption of 20 g fresh onion three times daily significantly reduced blood sugar levels [26]. Bioactive

molecules present in onion can reduce the risks for cardiovascular diseases [27]. The impact of a diet rich in *Allium* vegetables, during the incidence of prostate cancer show more anti-cancer effects in men presenting localized rather than advanced forms [28]. and can also reduce the mortality rate due to prostate cancer [29]. Regular intake of *Allium* vegetables on the incidence of cancers can affect breast, endometrium, and lungs [30]. Onion and garlic are an excellent source of calcium, manganese and potassium and can also accumulate selenium in the form of selenocystein and seleno- proteins.

Solanaceous vegetables

Solanaceous vegetables are most important group of vegetable includes- potato, tomato, brinjal, chilli etc. There are significant differences in the phyto- nutreucical content present between solanaceous vegetables. Tomato consist many phytochemicals such as 60% to 64% lycopene, 10% to 12% phytoene, 7% to 9% neurosporene, and 10% to 15% carotenes [31]. Tomatoes and tomato-based foods are the world richest sources of lycopene. The average daily intake of lycopene in the human diet is about 25 mg/day; nearly 85 percent is obtained from fresh and processed tomato products [32]. Tomato contains significant amounts of carotene ranging from 0.6 to 2.0 mg/kg [33] which ranks tomato as the fourth leading-contributor of pro-vitamin A and vitamin A in the American diet [34].

Dietary intakes of tomato products or tomato extract may suppress the effect cancers, cardiovascular dis-ease, and ultraviolet light-induced skin erythema [35].

It is observed that consumption of ten or more tomato products per week can strongly reduce the effect advanced stages of cancer [36]. People consuming diets rich in tomato and tomato based products, which are rich in the carotenoid lycopene, were found to be less likely to develop stomach and rectal cancers than those who consume lesser amounts of lycopene rich vegetables [37]. The purple potato has purple skin and flesh, which becomes blue once cooked. A mutation in the varieties' P locus causes production of the antioxidant anthocyanin [38]. Potato have proteins are of a very high quality, possibly because they are rich in essential amino acids, such as lysine, and other metabolites help to enhance protein utilization [39]. Potato tubers contain a moderate amount of vitamin C (of about 10 to 104 mg/kg) depending on the cultivar and the growing season, but it declined rapidly (30 to 50 percent) during storage and cooking [40]. Antioxidants observed in potato include 0.5 to 2.8 mg/kg α-tocopherol, 0.13 to 0.6 mg/kg lutein, and 1 mg/kg *β*-carotene [41]. All fresh peppers are excellent sources of vitamins C, K, carotenoids, and flavonoids [42]. Hot peppers have amazingly high levels of vitamins and minerals. Just 100 g provides (in % of recommended daily allowance), 240% of vitamin C (ascorbic acid), 39% of vitamin B6 (pyridoxine), 32% of vitamin A, 13% of iron, 14% of copper, 7% of potassium [43]. Folic acid and vitamins can help in treatment of arthritis and asthmatic problem. Clotting of blood after injury is natural process where vitamin K changes thrombin present in blood into prothrombin which act as clot so it's deficiency can cause anemia (loss of blood) in body. Phytochemical present in Chilli (*Capsicum annum*) can be very helpful in cure of gastric ulcer, painful diabetic, toothaches, muscle pain, neuropathy, postmastectomy pain syndrome, and osteo- and rheumatoid-arthritis, bladder hypersensitivity, vasomotor rhinitis, and hyperreflexia of spinal origin [44]. Eggplant contains important phytochemical include phenolic compounds, such caffeic and chlorogenic acid, and flavonoids, such as nasunin. Nasusin or delphinidin- 3-(coumaroylrutinoside)-5-glucoside is the major phyto-chemical in eggplant. [45]. It is suggested that eggplant is effective in the treatment of high blood cholesterol [46].

Cruciferous (*Brassica* spp.) vegetables

Crucifers are rich source of glucosinolates including broccoli, cabbage, brussels sprouts, and kale have been used to protect against lung, prostate cancer, breast cancer, and chemically induced cancers [47]. These are also rich in vitamins, with kale rated as the second highest among 22 vegetables tested [48].

It is studied that sinigrin, pro-goitrin and glucobrassican are the major glucosinolates in cabbage [49], brussel sprouts, cauliflower, kale, tronchuda and collard while in turnip and rutabagas, the predominant glucosinolates are glucoerucin, glucoraphanin, and glucobrassicin [50]. In radish, the predominant glucosinolates are glucoerucin, glucoraphanin, and glucobrassicin [51].

Dioscoreaceae vegetables

Wild yam (*Dioscorea villosa*) has anti-inflammatory properties which make it suitable for dermatologic products mainly anti-ageing products used to treat irritated or aged skins and also help to fight with skin degenerative syndromes [52].It is also suggested that diosgenin extracted from wild yam may be a good and safe health food for the aged, especially to alleviate the effects of climacteric issues and effects of diosgenin may differ according to the endogenous estrogen levels, tissue or cell types, the route of administration, the time, and level of exposure [53].Diosgenin alkaloids is commercially grown for production of sapogenin also act against depigmenting which is generally occur in skin due to synthesis of phosphatidylinositol-3-kinase[54].It is most effective alkaloid against breast tumor because it can reduce the effect of adipocyte cell function which increase the cell growth[53].

Araceae vegetables

Corm contains starch, mucilage, dihydroxysterol, fat, calcium oxalate, vitamin B, iron, *etc.* [55] and have an antifungal compound, 9, 12, 13-trihydroxy-(E)-10-octadecenoic acid, and two enzymes, lipoxygenase and lipid hydroperoxide-converting enzyme, which are responsible for the production of antifungal lipid peroxides help in suppression of cholesterol biosynthesis [56]. It may be used to arrest arterial hemorrhage, expectorant, astringent, appetizer and otalgia. It is used in treatment of ear ache and otorrhoea, and also in internal hemorrhages. Leaf stalks juice of corm with salt used as an absorbent in cases of inflamed glands and buboes. Cooked form of vegetable contains mucilage and found to be an effective nervine tonic. Decoction of the peel is given as a folk medicine to cure diarrhea and it helps in increasing body weight, prevents excessive secretion of sputum in asthmatic individuals. Juice of the corm is used in cases of alopecia. It acts as a laxative, demulcent, anodyne, galactagogue and is used in cases of piles and congestion of the portal system; also used as an antidote to the stings of wasps and other insects. Corm is used by people of the *Munda* tribe as a remedy for body ache. Results of the study showed that the plant possesses various neuropharmacological activities such as anti-depressant, anxiolytic, sedative, and smooth muscle relaxant activity [57].

Chenopodiaceae vegetables

This family gives some very important vegetables. Their leaves and stems are succulents and used as green vegetables. Some of these are: spinach, chenopodium album and garden beet. Sugar beet is good source of cane sugar. About 1/3 sugar of the world is extracted from sugar beet. Some members of this family give different medicinal products. Oil of chenopodium is used against hook worm. Singh *et al.,* (2007) prepared value-added products from dehydrated chenopodium album leaves byincorporating them at 3–15% levels in two conventional foods namely green *gram dal* and *paratha* [58]. Chenopodium album as antioxidants could be utilized by food industry [59]. Chenopodium album is most important nutrients (folic acid, iron and fibre) rich vegetable which can treat many diseases due to body stress [60]. Vegetables also have essential medicinal value as antiviral, antifungal, anti-inflammatory, antiallergic, antiseptic, antipruritic, antinociceptic, sperm immobilizing immunomodulating [61-66]. antibacterial and antifungal [67, 68] and helpful in peptic ulcer and cardiac diseases [69, 70]. It has been studied that this type of plant possesses potent spasmolytic activity which help to relieve spasm especially of smooth muscle [71]. The results obtained from their study strongly suggest that *C. album* can be a good for the development of a therapeutic drug for the treatment of muscle spasm and pain.

Conclusion

It is essential to sustain increased production besides nutritional standard of people, which will help to solve food problem as yield of vegetable crops is 4 to 10 times more than cereals. Vegetables as medicinal plants are none or less toxic and hence a great role to maintain body immune system which help to resist the disease of human being. They also have antioxidant and antimicrobial activities which can be helpful in management of oxidative stress and age related human ailment. So, increase in vegetable production can help to improve the national food security as compared to another crop.

Application of research: Antioxidant and antimicrobial activities which can be helpful in management of oxidative stress

Research Category: Vegetable Science

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References

[1] Monsanto, "Supplemental Toolkit for Investors," Mon- santo, 2011.
[2] Dias J. S. and Ryder E. (2011) *Hort Review*, 38, pp. 299-356.
[3] Mullie P. and Clarys P. (2011) *Food and Nutrition Science*, 2(10), pp. 1048-1053.
[4] Sharma R.K., Agrawal M. and Marshall F.M. (2009) *Food Chem. Toxicol.,* 47, 583-591.
[5] Hedges L.J. and Lister C.E. (2009) New Zealand: New Zealand Institute for Plant & Food Research Limited: Nutritional attributes of some exotic and lesser known vegetables. Plant & food research confidential report No. 2325.
[6] Kesari A.N., Gupta R.K. and Watal G. (2005) *J Ethnopharmacol.,* 97,247–251.
[7] Yamamura S., Ozawa K., Ohtani K., Kasai R. and Yamasaki K. (1998) *Phytochem.,* 48,131–136.
[8] Rajeshkumar N.V., Joy K.L., Kuttan G., Ramsewak R.S., Nair M.G. and Kuttan R. (2002) *J Ethnopharmacol.,* 81,17–22.
[9] Khanna A.K., Rizvi F. and Chander R. (2002) *J Ethnopharmacol.,* 82,19–22.
[10] Evarando L.S., Oliveira L.E., Freire L.K.R. and Sousa P.C. (2005) *Braz Arch Biol Technol.,* 48,234–241.
[11] Burt S. (2004) *A review. Int J Food Microbiol.,* 94(3), 223–253.
[12] Fasuyi A.O. (2006) *Afr J Biotechnol.,* 5 (1), 49–53.
[13] Dias J. S. (2011) *Acta Horticulturae*, 921, pp. 153-169.
[14] Nuutila A. M., Puupponen-Pimia R., Aarni M. and Oksman-Caldentey K. M. (2003) *Food Chemistry*, 81(4), 485-493.
[15] Singh J., Upadhyay A.K., Prasad K., Bahadur A. & Rai M. (2007) *Journal of Food Composition and Analysis*, *20*(2), 106-112.
[16] Kays S. J. and Dias J. S. (1995) *Economic Botany*, 49(2), pp. 115-152.
[17] Kubec R., Svobodovaand M. and Velisek J. (2000) *Journal of Agriculture and Food Chemistry*, 48(2), 2000, pp. 428-433.
[18] Kubec R., Svobodova M. and Velisek J. (1999) *Journal of Chromatography*, 862, pp. 85-94.
[19] Ritsema T. and Smeekens S. (2003) *Current Opinion in Plant Biology*, 6(3), pp. 223-230.
[20] Kruse H.P., Kleessen B. and Blaut M. (1999) *The British Journal of Nutrition*, 82(5), pp. 375-382.
[21] Kilian S., Kritzinger S., Rycroft C., Gibson G. R. and Du Preez J. (2002) *World Journal of Microbiology & Biotechnology*, 18(7), pp 637-644.
[22] Scholz-Ahrens K.E., Schaafsma G., Van Den Heuvel E.G.H.M. and Schrezenmeir J. (2001) *The American Journal of Clinical Nutrition*, 73(2), pp. 459-464.
[23] Jackson K.G., Taylor G.R., Clohessy A.M. and Willieams C. M. (1999) *The British Journal of Nutrition*, 82(1), pp. 23-30.
[24] Srinivasan K. (2005) *International Journal of Food Science Nutrition*, 56(6), pp. 399-414.
[25] Sharma K. K., Gupta R. K., Gupta S. C. and Samuel K. C. (1977) *Indian Journal of Medical Research*, 65(3), pp. 422-429.
[26] Tjokroprawiro A., Pikir B.S., Budhiarta A.A., Pranawa S.H., Deonosepoetro M., Budhianto F.X., Wi-bowo J.A., Tanuwidjaja S.J. and Pangemanan M. (1983) *The Tohoku Journal of Experimental Medicine*, 141, pp. 671-676.
[27] Osmont K.S., Arnt C.R. and Goldman I. L. (2003) *Plant Foods for Human Nutrition*, 58 (1), pp. 27-40.
[28] Hsing A.W., Chokkalingam A.P., Gao Y.T., Madigan M.P., Deng J., Gridley G. and Fraumeni Jr J.F. (2002) *Journal of the National Cancer Institute*, 94(21), pp. 1648-1651.
[29] Grant W. B. (2004) *European Urology*, 45(3), pp. 271- 279.
[30] Challier B., Perarnau J.M. and Viel J.F. (1998) *European Journal of Epidemiology*, 14(8), pp. 737-747.
[31] Clinton S. (1998) *Nutrition Reviews*, 56(2), pp. 35-51.
[32] Rao A. V., Waseem Z. and Agarwal S. (1998) *Food Research International*, 31(10), pp. 737-741.
[33] Leonardi C., Ambrosino P., Esposito F. and Fogliano V. (2000) *Journal of Agriculture and Food Chemistry*, 48(10), pp. 4723-4727.
[34] Food and Nutrition Board (2005) Panel on Dietary Intakes for Electrolytes and Water. Potassium. Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate, National Academies Press, Washington DC.
[35] Stahl W., Heinrich U., Wiseman S., Eichler O., Sies H. and Tronnier H. (2001) *The Journal of Nutrition*, 131(5), pp. 1449-1451.
[36] Giovannucci E., Ashcerio A. and Rimm E. B. (1995) *Journal of the National Cancer Institute*, 87(23), pp. 1767-1776.
[37] Giovannucci E. (1999) *Journal of the National Cancer Institute*, 91(4), pp. 317-331.
[38] Jung C.S., Griffiths H.M., De Jong D.M., Cheng S., Bodis M. and De Jong W.S. (2005) *Tag Theoretical and Applied Genetics*, 110(2), pp. 269-275.
[39] Friedman M. (1996) *Journal of Agriculture and Food Chemistry*, 44(1), pp. 6-29.
[40] Cieslik E. (1994) *Food Chemistry*, 49(3),pp. 233-235.
[41] Lachman J., Hamouz J.K., Orsak M. and Pivec V. (2000) *Rostlinná Výroba*, 46(5), pp. 231-236.
[42] Frei B. and Lawson S. (2008) *Proceedings of the National Academy of Sciences* (*USA*), 105(32), pp. 11037-11038.
[43] Szallasi A. and Blumberg P. M. (1999) *Pharmacological Reviews*, 51(2), pp. 159-211.
[44] Noda Y., Kneyuki T. and Igarashi K. (2000) *Toxicology*, 148(2-3),pp.119-123.
[45] Jorge P.A., Neyra L.C. and Osaki R.M. (1998) *Arquivos. Brasileiros de Cardiologia*, 70(2), pp. 87-91.
[46] Brennan P., Hsu C.C., Moullan N., Szeszenia-Dabrowska N., Lissowska J., Zaridze D., Rudnai P., Fabianova E., Mates D. and Benckoet V. (2005) *Lancet*, 366(9496), pp. 1558-1560.
[47] Cao G., Sofic E. and Prior R.L. (1996) *Journal of Agriculture and Food Chemistry*, 44(11), pp. 3426-3431.
[48] Vallejo F., Tomas-Barberan F.A., Banavent-Garcia A.G. and Garcia-Viguera C. (2003) *Journal of the Science and Food Agriculture*, 83(4), pp. 307-313.
[49] Hansen M., Bengtsson G. B., Borge G. I., Berge L. and Wold A. B. (2010) *Acta Hort*, 867(5), pp. 61-65.
[50] Carlson D.G., Daxenbichler M.E., Van Etten C.H., Tookey H.L. and Williams P.H. (1981) *Journal of Agriculture and Food Chemistry*, 29(6),pp. 1235-1239.
[51] Ciska E., Martyniak-Przybyszewska B. and Kozl-owska H.H. (2000) *Journal of Agriculture and Food Chemistry*, 48(7), pp. 2862-2867.
[52] Burlando B., Verotta L., Cornara L. and Bottini-Massa E. (2010) *Herbal Principles in Cosmetics, Properties and Mechanisms of Action*. New York, NY, USA: CRC Press Taylor & Francis Group.
[53] Tada Y., Kanda N., Haratake A., Tobiishi M., Uchiwa H. and Watanabe S. *Steroids*, 74 (6), 504–511.

[54] Lee J., Jung K., Kim Y.S. and Park D. (2007) *Life Sciences*, 81(3), 249–254.
[55] Sheth A.K. (2005) *The Herbs of Ayurveda. Ahmedabad: A.K. Sheth Publishers*; p. 356.
[56] Anonymous (2001) *The Wealth of India: A Dictionary of Indian Raw Materials and Industrial Products. New Delhi: NISCSIR*, 2, 157.
[57] Kalariya M., Parmar S. and Sheth N. (2010) *Pharm Biol.,* 48, 1207-12.
[58] Singh L., Yadav N., Kumar A.R., Gupta A.K., Chacko J., Parvin K. and Tripathi U. (2007) *Natural Product Radiance,* 6, 6–10.
[59] Madsen H.L. and Bertelsen G. (1995) *Trends Food Sci Technol.,* (6), 271–277.
[60] Katalinic V., Milos M., Modun D., Music I. and Boban M. (2004) *Food Chem.,* 86, 593–600.
[61] Kumar R., Mishra A.K., Dubey N.K. and Tripathi Y.B. (2007) *Int J Food.,* 4, 159–164.
[62] Kaur C. and Kapoor H.C. (2002) *Int J Food Sci Technol.,* 37, 153–161.
[63] Dai Y., Ye W.C., Wang Z.T., Matsuda H., Kubo M. and But P.P. (2002) *J Ethnopharmacol,* 81, 245–250.
[64] Mousavi T., Asadi N. and Tebyanian M. (2005) *Iran Immunol.,* 23, 166–171.
[65] Giove-Nakazawa R.A. (1996) *Rev Gastro- enterol.,* 16,197–202.
[66] Garcia R., Lemus I., Rivera P. and Erazo S. (1997) *J Ethnopharmacol.,* 57, 85–88.
[67] Maksimovic Z.A., Dordevic S. and Mraovic M. (2005) *Fitoterapia.,*76, 112–115.
[68] Ruggeri P., Della C., Valle R., Fusco D. and Paladino L. (1991) *Boll Soc Ita Biol Sper.,* 67, 955–960.
[69] Kaushik P. and Dhiman A.K. (2000) *Medicinal plants and raw drugs of India. Bishen Singh Mahendra Pal Singh, Post-Box No. 137, Dehradun*, 12, 623.
[70] Prajapati N.D., Purohit S.S., Sharma A.K. and Kumar T.A. (2003) *Hand Book of Medicinal Plants: A Complete Source Book. India: Agrobios,* 2003, p.134.
[71] Ahamed N.T., Singhal R.S., Kulkarni P.R. and Pal M. (1998) *Food Nutr Bull.,* 19, 61–70.