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A Review on different types of carrot and its chemical compositions.

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Abstract

The carrot (Daucus carota subsp. sativus) is a root vegetable, usually orange in colour, though purple, black, red, white, and yellow cultivars exist. Carrot is a root vegetable with carotenoids, flavonoids, polyacetylenes, vitamins, and minerals, all of which possess numerous nutritional and health benefits. Besides lending truth to the old adage that carrots are good for eyes, carotenoids, polyphenols and vitamins present in carrot act as antioxidants, anticarcinogens, and immunoenhancers. Anti-diabetic, cholesterol and cardiovascular disease lowering, anti-hypertensive, hepatoprotective, renoprotective, and wound healing benefits of carrot have also been reported. The cardio- and hepatoprotective, anti-bacterial, anti-fungal, anti-inflammatory, and analgesic effects of carrot seed extracts are also noteworthy. All are discussed in this review article. Carrot is one of the important root vegetables rich in bioactive compounds like carotenoids and dietary fibers with appreciable levels of several other functional components having significant health-promoting properties. The consumption of carrot and its products is increasing steadily due to its recognition as an important source of natural antioxidants having anticancer activity. Apart from carrot roots being traditionally used in salad and preparation of curries in India, these could commercially be converted into nutritionally rich processed products like juice, concentrate, dried powder, canned, preserve, candy, pickle, and g*azrailla*. Carrot pomace containing about 50% of β-carotene could profitably be utilized for the supplementation of products like cake, bread, biscuits and preparation of several types of functional products. The present review highlights the nutritional composition, health promoting phytonutrients, functional properties, products development and by-products utilization of carrot and carrot pomace along with their potential application.

KEYWORDS: *Daucus carota*, Chemical Composition, Antioxidants, Phytochemicals, Disease Prevention

I. INTRODUCTION

Carrots are a domesticated form of the wild carrot, *Daucus carota*, native to Europe and southwestern Asia. The plant probably originated in Persia and was originally cultivated for its leaves and seeds. The most commonly eaten part of the plant is the taproot, although the greens are sometimes eaten as well. The carrot is a biennial plant in the umbellifer family Apiaceae. At first, it grows a rosette of leaves while building up the enlarged taproot. Carrot (*Daucus carota* L.) is the most important crop of *Apiaceae* family. It is a root vegetable that has worldwide distribution. Carrots were first used for medical purposes and gradually used as food. Written records in Europe indicated that carrots were cultivated prior to the tenth century. The colors of the carrot root flesh may be white, yellow, orange, red, purple, or very dark purple. The first cultivated carrots were yellow and purple fleshed cultivars. Orange carrots, today more popular, were developed in the 15th and 16th centuries in Central Europe. A rapid rise in the popularity of orange carrots was observed with the recognition of its high provitamin A content [1]. Carotenoids and anthocyanins are the major antioxidant pigments found in carrots. Cultivar differences in carrots rely in the type of pigments present. Carotenoids are the yellow, orange, or red colored phytochemicals found in most yellow and orange fleshed cultivars. The widely used orange carrot is high in α- and β-carotene and is a rich source of provitamin A. Yellow carrot color is due to lutein which plays an important J. C. Silva Dias 2148 role in prevention of macular degeneration [2] [3]. The red water-soluble anthocyanin pigment and the red water insoluble lycopene pigment present in the roots of some cultivars do not contribute to the provitamin A content. Red carrot color is due to its high lycopene content [3]. Meanwhile anthocyanin-rich carrots are purple [4].

White flesh cultivars contain very little pigments. The carotene content of the orange and yellow fleshed cultivars increases with growth. The cortical region contains more carotenes than the core. Overall

carotenoid levels, have increased dramatically in the past four decades through traditional breeding to reach levels of 1000 ppm carotenoids, on a fresh weight basis [2] [3] [5]. Besides, comparing to other vegetables, carrots can provide in the human diet significant amount of vitamin A due to the high bioavailability of carrot carotenoids [6].

Carrots have also a unique combination of three flavonoids: kaempferol, quercetin and luteolin [7]-[9]. They are also rich in other phenols, including chlorogenic, caffeic and p-hydroxybenzoic acids along with numerous cinnamic acid derivates. Among hydroxycinnamic acid and its derivates, chlorogenic acid represents 42.2% to 61.8% of total phenolic compounds detected in different carrot tissues [10] [11]. Bioactive polyacetylenes, such as falcarinol (synonymous with panaxynol), and falcarindiol are found in carrots. The concentration of falcarinol in fresh carrots depends on carrot tissue cultivar and water stress [12]. Falcarinol is the most bioactive phytochemical of the carrot polyacetylenes. It is though that this compound may stimulate cancer-fighting mechanisms in the human body. The mode of action behind the favorable effect of falcarinol may be due to its hydrophobicity and its ability to form an extremely stable carbocation with the loss of water thereby acting as a very reactive alkylating agent toward proteins and other biomolecules [13]. Besides other sesquiterpenes, which presence has also been found in various biochemical analyses, daucuside and daucuso are sesquiterpenoids recently isolated from carrot seeds and that have cytotoxic effect against human gastric cell lines [14] [15]. The presence of coumarins has also been demonstrated in various biochemical analysis. A bitter coumarin compound is formed when carrots are stored [16]. Among 39 fruits and vegetables carrots have been ranked 10th in nutritional value [17]. Carrot is a good source of dietary fiber and of the trace mineral molybdenum, rarely found in many vegetables. Molybdenum aids in metabolism of fats and carbohydrates and is important for absorption of iron. It is also a good source of magnesium and manganese. Magnesium is needed for bone, protein, making new cells, activating B vitamins, relaxing nerves and muscles, clotting blood, and in energy production [18]. Insulin secretion and function also require magnesium [19] [20]. Manganese is helpful in carbohydrate metabolism, in coordination with enzymes in the body [2] [3]. Manganese is used by the body as a co-factor for the antioxidant enzyme, superoxide dismutase. Potassium and magnesium in carrots help in functioning of muscles.

Varieties of carrot (21-24)

Nantes Carrot Varieties : 'Nantes' varieties are usually the easiest carrots for home gardeners to grow. They produce sweet, crisp, 6-7" (15-18cm) cylindrical carrots, with blunt tips. Nantes carrots perform better in heavier, rockier soils where other carrot types twist and fork.

'scarlet Nantes' (65-75 days) is a sweet, versatile Nantes-type carrot that forms uniform, 6-8" (15-20cm) carrots that are perfect for fresh eating or storage.

'Nelson' (58 days) is another early Nantes that produces 6-7" (15-18cm) carrots with a 1" (2.5cm) shoulder. Sweet, uniform, deep orange color. Grows well in heavy soils.

'Yaya' (60 days) is similar to 'Nelson', but a little less sweet. Holds well in the ground—good for fall sowing.

'Napa' (63 days, resistant to Alternaria Blight and Powdery Mildew) produces 7-8" (17-20cm) carrots with a 1 ½" (4cm) shoulder, deep orange color, and sweet, crisp taste. Performs well even in heavy soils.

'Parano' (65 days) is an early Nantes type that produces beautiful, 6-7" (15-18cm) carrots that are great fresh, cooked or juiced.

'Kaleidoscope Mix' (60-70 days) is a multicolor mix of red, purple, yellow, and orange 7-8" (18-20cm) carrots. Contains equal parts of 'Atomic Red', 'Bambino', 'Cosmic Purple', 'Lunar White', and 'Solar Yellow' seeds. A Burpee Seeds customer favorite.

'White Satin' (70 days) produces crisp, white, 8" (20cm) carrots. A Nantes variety that adds a different color to the carrot rainbow.

'Merida' (240 days) is a storage-type Nantes variety bred for overwintering in the ground. Plant in September or October. Can be grown with no cover in Zones 6 and up. Cover with 6-12" (15-30cm) of straw in colder zones. Sweet, 7-8" (17-20cm) carrots with 1 ½" (4cm) shoulders.

'Purple Dragon' (70 days) produces 8-10" (20-25cm), tapered carrots with purple skin and a bright orange core. A throwback to the original carrot. Color fades when cooked. A phytochemical gold mine for the body.

'Cosmic Purple' (73 days) produces 7" (17cm) carrots that are violet on the outside and orange in the middle. Unlike most purple carrots, this one retains some color on cooking.

Imperator Carrot Varieties :

Imperator' carrots are the classic long, tapered roots you see in stores. Soil has to be prepared to fine tilth at least a foot deep to grow Imperator carrots. A light, sandy loam soil is ideal for growing Imperator carrots. Choose shorter varieties if your soil is heavy or rocky.

'Autumn King' (70 days) produces long, 10-12" (25-30 cm) roots.

'Atomic Red' (65-75 days) has slim, tapered roots that reach 11" (30cm). Best when cooked. Retains its red color after cooking.

Chantenay Carrot Varieties

Chantenay carrots are short and stout, with broad 1 ½- 3" (4-8cm) crowns tapering quickly to a rounded point 6" (15cm) away. Before Nantes varieties were developed, these cone-shaped carrots were the only choice for gardeners growing carrots in heavy or rocky soils. They're still a favorite among home gardeners, but older carrots develop a woody core, so harvest Chantenay carrots at 6-7" (15-18cm).

'Red-Cored Chantenay' (60-70 days) produces 7" (18cm), deep-orange carrots with 2" (5cm) shoulders and the classic cone shape of Chantaney carrots. Grows well in heavy soils, stays sweet in storage.

'Hercules' (65 days) produces 6-7" (15-18cm) carrots with broad shoulders. Good for rocky of clay soils where other carrots perform poorly.

Mini Carrot Varieties

"Mini" and **Radish-style** carrots are bred to be grown in shallow root zones and harvested small. These are the best varieties for growing carrots in containers. They also perform well in heavy or rocky soils.

'Babette' is a "baby" carrot variety that can be harvested at 3-4" (7-10cm), or allowed to grow larger. Often served whole, with the tops still attached at high-end restaurants.

'Romeo' is a radish-style carrot variety that produces 1-2" (2-5cm) spherical carrots the size of small beets. Beautiful in cross-section, with a delicious carroty richness.

Carrot production by country, top 20 producers(Source: FAOSTAT of the United Nations) (25-26)

Table-1

Rank	Country	Production(MT)
1	China	8395500
2	Russian Federation	1730000
3	United States of America	1601790
4	Poland	935000
5	Ukraine	706500
6	United Kingdom	677144
7	Italy	641558
8	Japan	630000
9	Germany	555000
10	Netherlands	430000
11	France	417800
12	Turkey	380000
13	Mexico	378517
14	India	350000
15	Belgium	320000
16	Indonesia	308675
17	Belarus	306000
18	Australia	302560
19	Canada	301450
20	Morocco	300000

Nutrition(27-30)

The antioxidant beta-carotene gives carrots their bright orange color. Beta-carotene is absorbed in the intestine and converted into vitamin A during digestion.

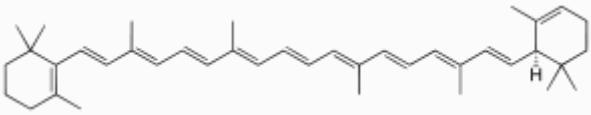
According to the U.S. Department of Agriculture (USDA), one cup of chopped carrots, containing 128 grams (g) of carrot provides: **Table-2**

calories	carbohydrate	sugar	protein	fat	iron	Fiber	Vit A	Vit C	calcium	magnesium	phosphorus	potasium	sodium	zinc	Folate	Vit K
52	12.26 gm	3gm	1.19gm	0.31gm	0.38mg	3.6gm	1069mcg	7.6mcg	42 mg	15mg	45mg	410 mg	88 mg	0.31mg	24 mcg	16.9 mcg

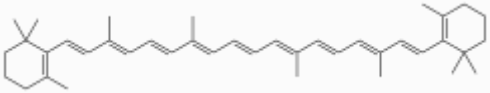
Chemical composition

The moisture content of carrot varies from 86 to 89%. Carrots are a good source of carbohydrates and minerals like Ca, P, Fe and Mg.The chemical constituents of carrot as moisture (86%), protein (0.9%), fat (0.2%), carbohydrate (10.6%), crude fiber (1.2%), total ash (1.1%), Ca (80 mg/100 g), Fe (2.2 mg/100 g) and p (53 mg/100 g).**(31-34).**

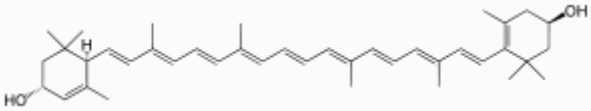
whereas, the values for most of these parameters are different i.e. moisture (88.8%), protein (0.7%), fat (0.5%), carbohydrate (6%), total sugars (5.6%), crude fiber (2.4%), Ca (34 mg/100 g), Fe (0.4 mg/100 g), P (25 mg/100 g), Na (40 mg/100 g), K (240 mg/100 g), Mg (9 mg/100 g), Cu (0.02 mg/100 g), Zn (0.2 mg/100 g), carotenes (5.33 mg/100 g), thiamine (0.04 mg/100 g), riboflavin (0.02 mg/100 g), niacin (0.2 mg/100 g), vitamin C (4 mg/100 g) and energy value (126 kJ/100 g)**(35).** The edible portion of carrots contains about 10% carbohydrates having soluble carbohydrates ranging from 6.6 to 7.7 g/100 g and protein from 0.8 to 1.1 g/100 g in 4 carrot cultivars **(34).** 1.67–3.35% reducing sugars, 1.02–1.18% non-reducing sugars and 2.71–4.53% total sugars in 6 cultivars of carrot**(36**). The crude fiber in carrot roots consist of 71.7, 13.0 and 15.2% cellulose, hemicllulose and lignin, respectively**(37**). Trace amounts of succinic acid, α-ketoglutaric acid, lactic acid and glycolic acid have also been reported **(38).** . Caffeic acid is the predominant phenolic acid in carrots. Thiamin, riboflavin, niacin, folic acid and vitamin C are present in appreciable amounts in carrot roots**(34, 39)**



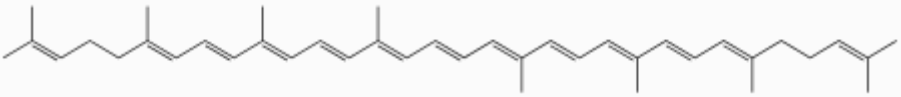
Alpha carotene



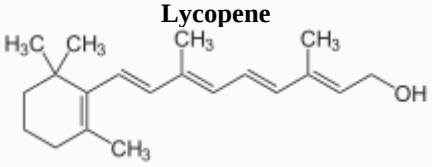
Beta carotene



Lutein



Lycopene



Retinol

Fig:1 Basic structure of Carotenoids

Health Benefits of Carrots

Antioxidant : Like many other colored vegetables carrot is a gold mine of antioxidants. The presence of high concentration of antioxidant carotenoids especially β-carotene may account for the biological and medicinal properties of carrots. Carotenoids, polyphenols and vitamins present in carrot act as antioxidants. Carotenoids widely distributed in orange carrots are potent antioxidants which can neutralize the effect of free radicals.

Flavonoids and phenolic derivates, present in carrot roots play also an important role as antioxidants. They also exert anticarcinogenic activities, reduce inflammatory insult, and modulate immune response**.(2, 10)**

Anticarcinogen, and Immunoenhancer : A variety of dietary carotenoids have been shown to have anti-cancer effects, due to their antioxidant power in reducing free radicals in the body. Studies have found a possible link between diets rich in carotenoids and a lower risk of prostate cancer. A meta-analysis published in 2008 found that people with a high intake of a variety of carotenoids had a 21 percent lower risk of lung cancer. Studies have shown that the consumption of carrots can reduce the risk of lung cancer, breast cancer and colon cancer. This is because carrots are rich in the poly-acetylene antioxidant, falcarinol, which fights against cancers by destroying the pre-cancerous cells in the tumors. In this way, carrots possess anti-carcinogenic properties that inhibit the growth of cancer cells in the colon and support the health of the lower digestive tract. This is one of the best health benefits of carrots. Carrots contain a variety of nutrients and antioxidants along with vitamin C, and these will boost your immune system. The regular consumption of carrots creates a protective shield for our body **(40).**
The immunomodullatory effect of carrot-extracted assessed on carotenoid using 24 albino rats. The percentage variation in lymphocytes, eosinophils, monocytes and platelet count was evaluated. Interestingly, carotenoid administered rats showed a significant increase in lymphocytes, eosinoplils, monocytes and platelet concentration. The beneficial effect was due to carrot's α- and β-carotenoids. A deficiency in vitamin A can cause eye's photoreceptors to deteriorate, which leads to vision problems. β- carotene (the carotenoid with the most provitamin A activity) in carrots helps to protect vision, especially night vision and also provides protection against macular degeneration. Carrots are one of the richest sources of provitamin A and a hight intake of carotenoids linked with a significant decrease in post-menopausal breast cancer **[41,42].** β-carotene and other carotenoids, carrots contain vitamins such as vitamin C and K, thiamin (B1), riboflavin (B2), pyridoxine (B6) and folates (B9), necessary for metabolism of carbohydrates, proteins and healthy growth **[43**]. Vitamin C promotes the absorption of non-heme iron and is required for fighting infections and vitamin K helps preventing bleeding. Thiamin (B1) has highly beneficial effects on our nervous system and mental attitude; riboflavin is necessary for cell respiration, and red blood cell formation, pyridoxine inhibits the formation of homocysteine and reduces the risk of heart disease; and folates may reduce the risk of heart attack by lowering homocysteine levels **(2 ,3).**
Wound Healing Benefits: Carrot has good wound healing properties**.** That animals treated with topical cream of ethanolic extract of carrot root, formulated at different concentrations, showed significant decreases in wound area, epithelization period and scar width when compared to control group animals in an excision wound model. Meanwhile, rate of wound contraction significantly increased. Moreover, there were also significant increases in wound tensile strength, hydroxyproline content and protein content in animals treated with the topical cream formulation of ethanolic extract of carrot seeds**[44]**.

Cardio- and Hepatoprotective Benefits: Carrots contain a variety of antioxidants and polyacetylenes which, together, provide a protective shield to the heart. Studies have shown that the consumption of foods high in carotenoids lowers the risk of heart disease. Besides being extremely rich in beta-carotene, carrots also contain alpha-carotene and lutein. The regular consumption of carrots protects your heart from oxidative damage, plaque formation and bad cholesterol elevation. This is because they contain soluble fibers which bind with bile acids. The carrot seed extract offers cardioprotection and muscle contraction regulation in isoproterenol-induced myocardial infarction in rats by maintaining membrane bound enzymes. From
these results investigators concluded that the carrot seed extract might have inotropic effects. Notably, levels of serum aspartame transaminase, alanine transaminase and lactate dehydrogenase were significantly lower in carrot seed extract fed rats **[45]**. The hypolipidemic activity of carrot seeds in rats. It was observed that rats fed with carrot seeds showed a reduction in the total cholesterol and triglyceride HLD and VLDL as compared with the control group of rats **[46]**.

Anti-Diabetic : The antioxidants and phytochemicals in carrots may help regulate blood sugar. The American Heart Association (AHA) recommend consuming a fiber-rich diet and increasing potassium while reducing sodium intake to protect against high blood pressure and heart disease. Carrots offer a good balance of these nutrients. According to these investigators higher blood glucose levels, as well as higher fasting levels of insulin, were observed in study participants with lower level of carotenoids. Carotenoid levels also decreased as the severity of glucose intolerance increased. These findings suggest that carrot and vitamin A-rich carotenoids might help diabetics to manage their condition **(47, 48).**

Dental Health: Carrots are beneficial for your teeth and mouth as they scrape off plaque and food particles. Carrots stimulate the gums and facilitate the formation of a lot of saliva. Saliva is alkaline in nature and balances

the acid-forming and cavity-forming bacteria. The minerals present in carrots kill the harmful germs in the mouth and prevent tooth decay.

Anti-Bacterial and Anti-Fungal Benefits: reported that the essential oil obtained from aerial parts of the wild carrot showed inhibitory action against the enteropathogen Campylobacter jejuni. Also phenylpropanoids, such as methylisoeugenol and elemicin, from essential oil also exerted antimicrobial effect against Campylobacter coli and C. lari strains **[49]**. Carotol significantly inhibited the growth of the fungi and reduced the colony radial size. Meanwhile, the inhibitory effect produced by daucol was comparatively less than carotol. No effect was exerted by β-caryophyllene. The results suggested that carotol is the main agent responsible for the anti-fungal activity of carrot seed oil extracts **(50).**

Carrots For Glowing Skin: The consumption of carrots keeps your skin healthy and vibrant as they are loaded with Vitamin C and antioxidants. Carrots can also be used to prepare an inexpensive and convenient face mask. All you need to do is to mix grated carrot with some honey and apply it as a face mask to get glowing skin.

Anti-Ageing Benefits: Carrots also contain Vitamin C that aids the collagen production in the body. Collagen is a type of protein that is vital for the maintenance of the skin elasticity. It helps prevent wrinkles and locks the process of aging. Vitamin A, being an antioxidant, also attacks the free radicals to prevent the signs of aging like wrinkles, pigmentation and an uneven skin tone.

Sun Protection: Beta-carotene, found in carrots, is a skin-friendly nutrient that is converted to vitamin A inside the body. It helps in repairing the skin tissues and provides protection against the sun's harsh rays. The antioxidants and carotenoids protect and condition the skin to increase its immunity against the sun and heal sunburns. In fact, the consumption of carrot juice in summer acts as a natural sun block **(51).**

Suitable For Dry Skin: The deficiency of potassium can lead to a dry skin. Carrots are rich in potassium. Hence, drinking carrot juice can prevent this problem and keep your skin hydrated.

Treatment of Skin Ailments: Carrots are effective in the prevention and cure of various skin ailments. The antioxidants in this vegetable can treat skin conditions like pimples and acne, rashes, dermatitis and other skin problems caused due to Vitamin A deficiency. However, keep in mind not to consume carrots in excess as they can cause your skin to temporarily turn yellowish-orange in color **(52).**

Treatment Of Hair Loss: Carrots are great for combating hair loss as they provide your hair with vital vitamins, making them stronger, thicker and shinier. Drinking carrot juice makes your hair healthy. This is the best benefit of carrots for the hair.

II. DISCUSSION / CONCLUSION

We recommend carrot to be promoted as a food security and food safety crop in the future to meet the global food demands in developed as well as in developing countries. Future cultivation programmes should focus on the cultivation of carrot for its phytochemicals to improve the health of impoverished people. Cancer, cardiac issues, and ageing are currently common themes in medical science. The role of antioxidants to combat these problems is indispensable. Carrot is a multi-nutritional source of food. Its phytochemicals are excellent sources of antioxidants that can prevent the deterioration of cells in the human body. Ascorbic acid, phenolics, polyacetylenes, and carotenoids from carrot roots can provide unparalleled support to combat these global health challenges. This vegetable is available to the consumer in almost all possible forms of food on the market, i.e. raw, canned, frozen, extracted, pickled, etc. Moreover, it is available at low prices in all temperate regions throughout the globe. Hence, it is emphasised that carrot should be incorporated as an essential part of the diet for the prevention of diseases and a prolonged and healthy lifespan. Carrot must be promoted as a food security and food safety crop in the future to meet food demands in developed as well as in developing countries. Future cultivation programmes should focus on the carrot's phytochemicals to improve the health of local people.

REFERENCES

[1]. Simon, P.W. (2000) Domestication, Historical Development and Modern Breeding of Carrot. Plant Breeding Reviews,**19**, 157-190.

[2]. Dias, J.S. (2012) Major Classes of Phytonutriceuticals in Vegetables and Health Benefits: A Review. Journal of Nutritional Therapeutics, **1**, 31-62.

[3]. Dias, J.S. (2012) Nutritional Quality and Health Benefits of Vegetables: A Review. Food and Nutrition Sciences, **3**,1354-1374.

[4]. Sun, T., Simon, P.W. and Tamumuhardjo, S.A. (2009) Antioxidant Phytochemicals and Antioxidant Capacity of Biofortified Carrots (Daucus carota L.) of Various Colors. Journal of Agricultural and Food Chemistry, **57**, 4142-4147.

[5]. Simon, P.W. and Goldman, I.L. (2007) Carrot. In: Sing, R.J., Ed., Genetic Resources, Chromosome Engineering, and Crop Improvement, CRC Press, Boca Raton, 497-516.
[6]. Van het Hof, K.H., West, C.E., Weststrate, J.A. and Hautvast, J.G. (2000) Dietary Factors That Affect the Bioavailability of Carotenoids. J. Nutr., **130**, 503-506.
[7]. Ching, L.S. and Mohamed, S. (2001) Alpha-Tocopherol Content of 62 Edible Tropical Plants. Journal of Agricultural and Food Chemistry, **49**, 3101-3105.
[8]. Lila, M.A. (2004) Anthocyanins and Human Health: An in Vitro Investigative Approach. Journal of Biomedicine and Biotechnology, No. 5, 306-313.
[9]. Horbowicz, M., Kosson, R., Grzesiuk, A. and Bski, H.D. (2008) Anthocyanins of Fruits and Vegetables—Their Occurrence Analysis and Role in Human Nutrition. Vegetable Crops Research Bulletin, **68**, 5-22.
[10]. Zhang, D. and Hamauzu, Y. (2004) Phenolic Compounds and Their Antioxidant Properties in Different Tissues of Carrots (Daucus carota L.). Journal of Food, Agriculture and Environment (JFAE), **2**, 95-100.
[11]. Gonçalves, E.M., Pinheiro, J., Abreu, M. and Silva, C.L. (2010) Carrot (Daucus carota L.) Peroxidase activation, Phenolic Content and Physical Changes Kinetics Due to Blanching. Journal of Food Engineering, **97**, 574-581.
[12]. Lund, E.D. and White, J.M. (1990) Polyacetylenes in Normal and Waterstressed "Orlando Gold" Carrots (Daucus carota). Journal of the Science of Food and Agriculture, **51**, 507-516.
[13]. Hansen, L., Hammershoy, O. and Boll, P.M. (1986) Allergic Contact Dermatitis from Falcarinol Isolated from Schaffera arboricola. Contact Dermatitis, **14**, 91-93
[14]. Ahmed, A.A., Bishr, M.M., El-Shanawany, M.A., Attia, E.Z., Ross, S.A. and Pare, P.W. (2005) Rare risubstituted Sesquiterpenes Daucanes from wild Daucus carota. Phytochemistry, **66**, 1680-1681.
[15]. Fu, H.W., Zhang, L., Yi, T., Feng, Y.L. and Tian, J. (2010) Two New Guaniane-Type Sesquiterpenoids from the Fruits of Daucus carota L. Fitoterapia, **81**, 443-446.
[16]. Czepa, A. and Hofmann, T. (2003) Structural and Sensory Characterization of Compounds Contributing to the Bitter Off-Taste of Carrots (Daucus carota L.) and Carrot Puree. Journal of Agricultural and Food Chemistry, **51**, 3865-3872.
[17]. Acharya, U.R., Mishra, M., Patro, J. and Panda, M.K. (2008) Effect of Vitamins C and E on Spermatogenesis in Mice Exposed to Cadmium. Reproductive Toxicology, **25**, 84-88.
[18]. Guerrera, M.P., Volpe, S.L. and Mao, J.J. (2009) Therapeutic Uses of Magnesium. American Family Physician, **80**,157-162.
[19]. Bartlett, H.E. and Eperjesi, F. (2008) Nutritional Supplementation for Type 2 Diabetes: A Systematic Review. Ophthalmic and Physiological Optics, **28**, 503-523.
[20]. Kim, D.J., Xun, P., Liu, K., Loria, C., Yokota, K., Jacobs Jr., D.R. and He, K. (2010) Magnesium Intake in Relation to System Inflammation, Insulin Resistance, and the Incidence of Diabetes. Diabetes Care, **33**, 2604-2610.
[21]. Ambadan, Jain NL. New blanching medium for dehydration of carrot. Indian Food Pack. 1971;25(4):10–13.
[22]. Anderson JW, Smith BM, Guftanson NS. Health benefit and practical aspects of high fiber diets. Am J Clin Nutr. 1994;595:1242–1247.
[23]. Beerh OP, Saxena AK, Manan JK. Improvement of the traditional method of manufacture of carrot murrabba. Indian Food Pack. 1984;38(4):59–63.
[24]. Zidorn, Christian; Jöhrer, Karin; Ganzera, Markus; et al. (2005). "Polyacetylenes from the Apiaceae vegetables carrot, celery, fennel, parsley, and parsnip and their cytotoxic activities". Journal of Agricultural and Food Chemistry. **53** (7): 2518–2523
[25]. Production of Carrots and Turnips (crops combined) in 2014, Crops/World Regions/Production Quantity, from pick lists". UN Food and Agriculture Organization Corporate Statistical Database (FAOSTAT). 2017.
[26]. Simon PW. 1990. Carrots and other horticultural crops as a source of provitamin A carotenes. HortScience 25:1495–9.
[27]. Rubatzky VE, Quiros CF, Simon PW. 1999. Carrots and related vegetable Umbelliferae. Wallingford , U.K. : CABI Publishing.
[28]. Nicolle C, Simon G, Rock E, Amouroux P, Rémésy C. 2004. Genetic variability influences carotenoid, vitamin, phenolic, and mineral content in white, yellow, purple, orange, and dark-orange carrot cultivars. J Am Soc Hort Sci 129:523–9.
[29]. Horvitz MA, Simon PW, Tanumihardjo SA. 2004. Lycopene and β-carotene are bioavailable from lycopene 'red' carrots in humans. Eur J Clin Nutr 58:803–11.
[30]. Phan CT, Hsu H. 1973. Physical and chemical changes occurring in the carrot root during growth. Canad J Plant Sci 53:629–34.

[31]. The wealth of India: raw materials. New Delhi: Council of Scientific and Industrial Research; 1952. pp. 20–21.
[32]. Gill HS, Kataria AS. Some biochemical studies in European and Asiatic varieties of carrot (Daucus carota) Curr Sci. 1974;43:184–185.
[33]. Gopalan C, Ramasastry BV, Balasubramanian SC. Nutritive value of Indian foods. Hyderabad: National Institute of Nutrition; 1991. p. 47.
[34]. Howard FD, MacGillivary JH, Yamaguchi M (1962) Nutrient composition of fresh California grown vegetables. Bull Nr 788, Calif Agric Expt Stn, University of California, Berkeley.
[35]. Holland B, Unwin JD, Buss DH (1991) Vegetables, herbs and spices: Fifth supplement to McCance and Widdowson's, London.
[36]. Kaur G, Jaiswal SP, Brar KS, Kumar JC. Physico-chemical characteristics of some important varieties of carrot. Indian Food Pack. 1976;30(2):5–8.
[37]. Kochar GK, Sharma KK. Fiber content and its composition in commonly consumed Indian vegetables and fruits. J Food Sci Technol. 1992;29:187–190.
[38]. Kalra CL, Kulkarni SG, Berry SK. The carrot—a most popular root vegetable. Indian Food Pack. 1987;41(6):46–73.
[39]. Bose TK, Som MG. Vegetable crops in India. Calcutta: Naya Prakash; 1986
[40]. Zaini, R., Clench, M.R. and Maitre, C.L. (2011) Bioactive Chemicals from Carrot (Daucus carota) Juice Extracts for the Treatment of Leukemia. Journal of Medicinal Food, 14, 1303-1312.
[41]. Ekam, V.S., Udosen, E.O. and Chighu, A.E. (2006) Comparative Effect of Carotenoid Complex from Goldenneo-Life Dynamite and Carrot Extracted Carotenoids on Immune Parameters in Albino Wistar Rats. Nigerian Journal of Physiological Sciences, 21, 1-4.
[42]. Swamy, K.R., Nath, P. and Ahuja, K.G. (2014) Vegetables for Human Nutrition and Health. In: Nath, P., Ed., The Basics of Human Civilization-Food, Agriculture and Humanity, Volume-II-Food, Prem Nath Agricultural Science Foundation (PNASF), Bangalore & New India Publishing Agency (NIPA), New Delhi, 145-198.
[43]. USDHHS (US Department of Health and Human Services) and USDA (US Department of Agriculture) (2010) Dietary Guidelines for Americans. 7th Edition, US Government Printing Office, Washington DC.
[44]. Patil, M.V., Kandhare, A.D. and Bhise, S.D. (2012) Pharmacological Evaluation of Ethanolic Extract of Daucus carota Linn Root Formulated Cream on Wound Healing Using Excision and Incision Wound Model. Asian Pacific Journal of Tropical Biomedicine, 2, S646-S655. Muralidharan, P., Balamurugan, G. and Kumar, P. (2008) Inotropic and Cardioprotective Effects of Daucus carota Linn. on Isoproterenol-Induced Myocardial Infarction. Bangladesh Journal of Pharmacology, 3, 74-79.
[45]. Sing, K., Dhongade, H., Sing, N. and Kashyap, P. (2010) Hypolipidemic Activity of Ethanolic Extract of Daucus carota Seeds in Normal Rats. International Journal of Biomedical and Advance Research, 1, 73-80.
[46]. Poudyal, H., Panchal, S. and Brown, L. (2010) Comparison of Purple Carrot Juice and β-Carotene in a High-Carbohydrate, High-Fat Diet-Fed Rat Model of the Metabolic Syndrome. British Journal of Nutrition, 104, 1322-1332.
[47]. Chau, C.F., Chen, C.H. and Lee, M.H. (2004) Comparison of the Characteristics, Functional Properties, and in Vitro Hypoglycemic Effects of Various Carrot Insoluble Fiber-Rich Fractions. Lebensmittel-Wissenshaff und Technologie, 37, 155-160.
[48]. Rossi, P.G., Bao, L., Luciani, A., Panighi, J., Desjobert, J.M., Costa, J., Casanova, J., Bolla, J.M. and Berti, L. (2007) (E)-Methylisoeugenol and Elemicin: Antibacterial Components of Daucus carota L. Essential Oils against Campylobacter jejuni. Journal of Agricultural and Food Chemistry, 55, 7332-7336.
[49]. Misiaka, I.J., Lipoka, J., Nowakowska, E.M., Wieczoreka, P.P., Mlynarz, P. and Kafarski, P. (2004) Antifungal Activity of Carrot Seed Oil and Its Major Sesquiterpene Compounds. Zeitschrift für Naturforschung, 59, 791-796.
[50]. Vasudevan, M., Gunnam, K.K. and Parle, M. (2006) Anticonceptive and Anti-Inflammatory Properties of Daucus carota Seeds Extract. Journal of Health Science, 52, 598-606.
[51]. Eskicioglu V., Kamiloglu S., Nilufer-Erdil D. (2015): Antioxidant dietary fibres: Potential functional food ingredients from plant processing by-products. Czech J. Food Sci., 33: 487–499.

XXXX. "A Review on different types of carrot and its chemical compositions." *IOSR Journal of Pharmacy (IOSRPHR),* 10(5), 2020, pp. 32-39.