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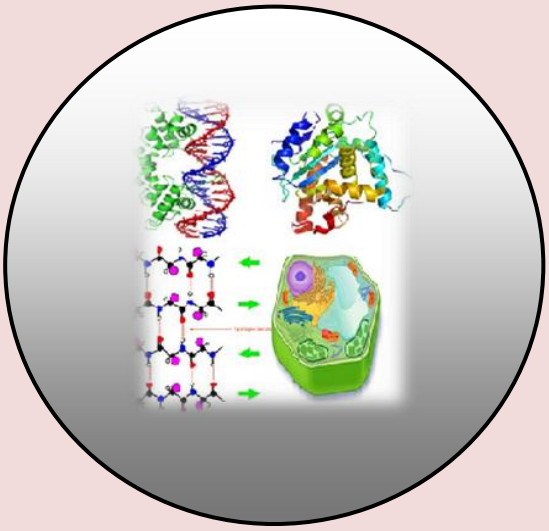

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Therapeutic and Nutritional Applications of *Wasabia japonica*

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ABSTRACT

Wasabia japonica is a member of the Cruciferae family which also includes cabbage, cauliflower, broccoli, sprouts, water cress, radish, mustard and horseradish. Recent studies have ranked wasabi as the most successful antibacterial food against E. coli and Staphylococcus aureus, which means that it can even help to prevent food poisoning. By preventing platelet aggregation, the compounds in wasabi also help to block prostaglandin, which is the neurotransmitter responsible for triggering inflammation and pain in the body. This helps to reduce the swelling related to injuries, sores, nasal blockages, and even reduces the symptoms of arthritis. The consumption of wasabi generates a powerful reaction in the nasal passages and sinuses which help to decongest and disinfect the respiratory system. This is due to the gaseous release of allylisothiocyanate, a compound which has been shown to reduce seasonal allergies, treat pneumonia, and prevent influenza. Wasabi is a powerful agent against fungal infections, which includes yeast infection, fungal meningitis, tuberculosis, and flu. It also contains powerful antioxidants, which helps to restore the balance of healthy cells and tissues in the body, ensuring that fungi cannot thrive. Wasabi contains antioxidants and minerals, such as potassium, magnesium, calcium, iron, sodium, and Vitamins A, B-6, C, and riboflavin, which makes it a highly nutritious food source that benefits the health of your entire body. Wasabi contains few calories and very little fat while offering intense flavor and plenty of fiber, which helps to promote natural weight loss. Wasabi contains compounds known as isothiocyanates that help to prevent blood platelets from sticking together, which reduces the chances of having strokes and heart attacks.

It also contains anti-hypercholesterolemic properties, which reduces the level of LDL (bad) cholesterol in the body and therefore reduces the risk of developing heart disease and atherosclerosis. Just one teaspoon of wasabi root contains 11% of the daily recommended amount of Vitamin C, which is a powerful antioxidant that helps to keep the immune system strong.
Keywords: GSLs, ITCs, 6-MITC, Glucosinolates, Nutraceutical, Antioxidants, Neurotransmitter Inflammation and cGMP phosphodiesterase.

INTRODUCTION

Wasabia japonica is one of the worlds' rarest and least understood perennial crops. *Wasabia japonica* is a member of the plant family called the Brassicaceae, formerly Cruciferae. This family includes broccoli, cabbage and cauliflower. *Wasabia japonica* is believed to be native to Japan and Sakhalin Island, north of Japan, although China now claims that it is also a native. It grows naturally in the gravel beds of mountain streams and requires a specific environment to thrive naturally in this habitat. There is another *Wasabia japonica* species that grows in swampy ground, but produces inferior quality stems. *Wasabia japonica* is traditionally cultivated in either water or soil. This gives the plant different characteristics, and affects the level of active ingredients contained within the plant. In this article we are only referring to the water grown variety which is known as Sawa, as this produces the best *Wasabia japonica* plants with the highest level of bioactive components. We shall use *Sawa Wasabi* throughout this article to differentiate it from common horseradish sushi wasabi. Outside of Japan (and even in Japan), the spicy green paste served with sushi or Sashimi is commonly called Wasabi. However, typically, this Wasabi paste is in fact European Horseradish root (*Armoracia rusticana*) and coloring, and contains very little or no part of the true *Wasabia japonica* plant. True Wasabi (*Sawa Wasabi*) is expensive and considered a rare delicacy around the world. It is traditionally grated fresh onto food, since it can lose its flavour in as little as 10-15 minutes. In Japan, *Sawa Wasabi* has not only been considered a food delicacy that adds a pungent flavour to food, but it is also believed to have powerful medicinal action. Like many aspects of a healthy traditional Japanese diet, regular use of *Sawa Wasabi* may be partially responsible for the longevity and health of the Japanese people. Currently, scientific research is investigating the folklore surrounding why *Sawa Wasabi* is regarded as both a super food and a powerful herbal medicine (Forde, 1982).

The health benefits of wasabi include providing a reduced risk of cancer and heart disease, as well as anti-inflammatory properties for joints and muscles. It also helps to defend against bacterial infections in the body and mouth, and can even reduce the irritating effects of seasonal allergies. This potent plant can be used to treat respiratory problems. Wasabi's wealth of antioxidants helps to boost the immune system and remove harmful toxins from the body. Although it may be overlooked as just any other condiment, wasabi in its various forms can be a powerful addition to your diet. It contains fiber, protein, and energy. In terms of minerals, it contains calcium, iron, magnesium, phosphorus, potassium, sodium and zinc, which are all natural and necessary elements in our balanced diet. It is rich in vitamin C, thiamin, riboflavin, niacin, folate, vitamin A and vitamin B6.

Figure 1-4.

The plant also has high levels of certain antioxidants, like isothiocyanates, and it is low in cholesterol! Overall, if wasabi is integrated into a diet with some frequency, it can boost your necessary nutrient intake, and positively affect your overall health in a surprising number of ways!

Wasabi not only has a powerful taste but also powerful effects on our overall health! It is a plant closely related to cabbages and horseradish, and is a member of the Brassicaceae family in taxonomic classification. It is commonly known as Japanese horseradish, although that is a slight misnomer because it is not from a species of horseradish. It does, however, have the strong flavor or "kick" of horseradish. Although it does have a strong, spicy taste, it is different than the taste of *capsaicin*, the chemical found in chili peppers that gives them their hot or spicy flavor. While capsaicin gives the sensation of "burning" on the tongue, wasabi affects the olfactory sense, releasing chemical vapors that affect the nasal passage (Palmer, 1990). The potent taste of wasabi is similar to hot mustard, and it is most commonly used as a condiment. Since its unique flavor is not oil-based as it is with chili peppers, the strong or uncomfortable sensation of eating wasabi does not last very long, and some people actually find it pleasant and invigorating! The powerful smell is derived from a specific part of the plant's chemical makeup, the high levels of allylisothiocyanate, while the taste comes from closely related isothiocyanate compounds.

These chemicals work as a defense mechanism against predators who try to consume the plant, but it hasn't worked too well on humans! These isothiocyanate chemicals also have a strong impact on the health benefits of wasabi, which will be discussed in the next section.
It is usually found in Japanese cuisine, and it is a traditional staple of that country. It is also primarily grown there because it is very difficult to cultivate. Even in Japan, there are only a few areas of the country where large-scale cultivation of wasabi takes place, mainly in mountainous river valleys or stream beds. In North America, it has only been successfully grown in two places, North Carolina and the province of British Columbia. Fresh *Sawa Wasabi* contains protein, fibre, vitamins B6 and C, and the minerals calcium, magnesium, potassium and manganese. *Sawa Wasabi* also contains a stable group of compounds called glucosinolates. These compounds are changed by enzymes to the bioactive unstable isothiocyanates (ITCs) if water is present when the cells are torn apart by being chewed or ground up.

CHEMICAL CONSTITUTION

Sawa Wasabi differs from other brassicas in that it has significantly higher concentrations of ITCs, especially long-chain ITCs. These long-chain ITCs (6-methylsulfinylhexyl isothiocyanate or 6-MITC, 7-methylsulfinylheptyl isothiocyanate and 8-methylsulfinyloctyl isothiocyanate) also give *Sawa Wasabi* its unique flavour. These long chain ITCs are not found in other plants. The enzyme responsible for converting the inert glucosinolates to ITC is myrosinase, a very unstable molecule. If *Sawa Wasabi* is air-dried, its myrosinase breaks down, and the ITCs that produce the characteristic heat, flavour and biomedical activity of *Wasabia* are not formed. This is why traditionally only fresh rhizomes and leaves were used. A process pioneered by Michel Van Mellaerts in New Zealand, of freeze-drying *Sawa Wasabi* to stabilise the activity of the myrosinase until exposed to water or digestive fluids, has removed this requirement for using fresh product. It is also the basis of the Wasabi based Nutraceutical products that are becoming common on the health food shop shelves. There is a tremendous amount of ongoing research, especially in Asian countries, on *Sawa Wasabi* and its medicinal and health benefits. Current research is focused on the ITCs that provide the majority of activity. Many scientists have concentrated on 6-MITC, of which *Wasabia japonica* contains a high concentration. It has been found to be 40 times more effective than other ITCs found in other Brassicas. However, all of *Sawa Wasabi*'s many ITCs (20 or more) likely contribute to the medicinal action in a symbiotic manner. Isolating one particular ITC without the others is likely to cause more harm than good. Combined with traditional knowledge, new research on *Wasabia japonica* is providing insights into the actions of *Sawa Wasabi* in the body. Scientific evidence suggests that there are many potential biomedical and health applications for the natural components found in *Sawa Wasabi* (Douglas and Follett, 1992).

FLAVOUR CONSTITUENTS OF *Wasabia japonica*

Isothiocyanates (ITCs) are a group of naturally occurring sulphur compounds responsible for the characteristic flavour of *Wasabia japonica*. The compounds are volatile in nature and are evolved from plant tissues when they are disrupted, e.g. in the preparation of food, grating, cutting, chewing etc. However, plant tissues do not contain ITCs, but contain Glucosinolates which are the precursors of ITCs. Glucosinolates (GSL) are a group of glucosides, (i.e. they contain glucose in the structure), stored within the cell vacuoles of all *Crucifereae* plants.

Glucosinolates are a complex group of _-D thioglucose compounds synthesized from amino acids. They contain a sulphonic group which is usually bound to sodium or potassium, making then anionic. The sulphate in the sulphonic group is attached through a C=N bond and different side groups (R) give a wide range of related glucosinolates. Each one has its own characteristic odour or taste. Due to the presence of the glucose in the molecule glucosinolates are hydrophilic, non-volatile compounds. When plant tissues are mechanically disrupted or injured (e.g. by chewing, crushing or grating in the preparation of food or insect attack), the myrosinase is released from the cell wall and in the presence of adequate moisture, myrosinase rapidly hydrolyses the GSLs to yield glucose and a aglucone. Some of the intermediate steps have not been fully described. The organic aglucone is unstable and undergoes Lossen Rearrangement to produce sulphate and a variety of other products.

The nature of the products is dependent on the number of factors, including the structure of the GSL side chain, the reaction conditions (e.g. pH), the presence of cofactors (e.g. metal ions, specific proteins), temperature and duration as well as the age and condition of the plant tissues. Isothiocyanates (ITCs) are formed from GSLs under neutral and alkaline conditions. However, GSLs that contain a _-hydroxyl group in their side chain, give rise to ITCs that spontaneously cyclize to form oxazolidinethiones. Some aromatic and heterocyclic GSLs produce ITCs which are unstable at pH 7 or higher and break down to release the corresponding alcohol and inorganic thiocyanate ions.

However, once formed, ITCs are more stable under acidic conditions. In weakly acidic pH or in the presence of Fe+2 and/or endogenous nitrile factor, nitriles are produced from aglucone by autolysis instead of ITC, with the liberation of elemental sulphur. The relative proportion of ITC to nitriles can vary widely depending upon the conditions of autolysis. Thiocyanate formation is believed to involve a cofactor, which may also be a protein, since it has been shown to be labile to both heat and polar organic solvents. Most of the sulphur containing end products formed by the enzymatic and non-enzymatic reactions of GSLs are volatile. Several ITCs have been reported from previous investigations into *Wasabia japonica* and each ITC has a specific flavour profile with the complete taste of *Wasabia japonica* being derived from the combined tastes and odours of all the ITCs present.

Allyl ITC has the main effect on the overall taste of *Wasabia japonica* because it is the ITC found in highest concentration in the rhizomes and other plant tissues .Ally l ITC is also found in the highest concentration in horseradish. While Ally l ITC is the main flavour component of *Wasabia japonica* due to its pungency, other ITCs, e.g. 6-methylthiohexyl ITC and 7-methylthioheptyl ITC, by giving their characteristic fresh greenish flavour, do contribute significantly to the total taste profile of *Wasabia japonica* (Sultana et al., 2000).

RESEARCH REALM OF *Wasabia japonica*

The medicinal value of chemicals extracted from *Wasabia japonica* were first documented in the Japanese medicinal encyclopaedia during the 10^{th} century. Recently, medical research interest in ITCs has become more intense because of their potential to have a wide variety of medicinal, pharmacological or industrial applications. These exciting applications are at an early stage of investigation, most likely because of *Wasabia japonica*'s high present commercial value and scarcity. Because of this scarcity and the fact that the useful ITCs are natural (and can't therefore be patented), more effort is being put into trying to synthesize the ITCs for commercial gain instead of increasing the natural levels found in the wasabi plant.

Sawa Wasabi may be useful for controlling seasonal allergies and asthma. ITCs are effective agents for inflammation based on their rapid action and the low levels needed. 6-MITC can inhibit lipoxygenase, cyclooxygenase and cAMP phosphodiesterases that are involved in inflammation. Isothiocyanates of *Sawa Wasabi* and other crucifers are anti-inflammatory testing ITCs that they made the following statements: "The anti-inflammatory effects and inhibition of platelet aggregation by omega-methylthioalkylisothiocyanatesis perhaps of more interest given the rapid action of the compounds and the low levels at which they are effective." This could potentially be used to counter inflammatory conditions such as allergies, asthma, eczema or even anaphylaxis. The ability of the *Sawa Wasabi* isothiocyanates to inhibit platelet aggregation (blood clotting) could also have medical and health applications, particularly in the treatment of heart attacks. Further work on the pharmacology of these compounds and their possible medicinal use, as well as other medicinal properties of *Sawa Wasabi*, seems warranted. A growing experience from natural health practitioners suggests that *Sawa Wasabi* can be an effective treatment for seasonal allergies as well as asthma and eczema (Sultana et al., 2003).

ITCs have an inhibitory effect on several strains of bacteria, yeast and mould. It is believed that *Wasabia japonica* was first introduced into the raw fish diet of the Japanese for its anti-microbial properties. Isothiocyanat evapours inhibit the growth of several strains of bacteria, yeast and mould. Several scientific studies have shown that 6-MITC from *Sawa Wasabi* extracts have potent anti-bacterial properties against *Staphylococcus aureus* (Golden Staph) and *Escherichia coli* (*E. coli*). Isothiocyanates in *Sawa Wasabi* have demonstrated an inhibitory effect against *Streptococcus mutans,* the bacterium responsible for dental cavities. These results may lead to *Sawa Wasabi* extracts being used in a variety of products (i.e., toothpastes and mouthwashes) for cavity prevention (Adachi, 1987).

More recent research has proven *Sawa Wasabi* extracts inhibit mutant strains of the *Staphylococcus* bacterium. Another biomedically important bacterium that *Sawa Wasabi* and ITCs inhibit is *Helicobacter pylori*. This bacterium is known to be responsible for gastric ulcers and ensuing stomach cancers. *Sawa Wasabi* extracts kill the bacterium, even if it has entered cells lining the stomach. The inhibition of blood clots forming in the bloodstream is important for protection against heart attacks and strokes. The 6-MITC of *Sawa Wasabi* has been found to inhibit platelet aggregation a property useful in the elderly, where preventing excessive clotting is vital. Platelet aggregation is a major factor in cardiovascular diseases. 6-MITC inhibits platelet aggregation by a number of different mechanisms, including the inhibition of lipoxygenase, cyclooxygenase, cAMP phosopodiesterases and cGMP phosphodiesterase (Delaquis and Mazza, 1995).

There is a growing base of evidence on how ITCs work against cancerous cells. Isothiocyanates act to inhibit enzymes that cause pre-carcinogenic compounds to turn into carcinogenic ones (Phase I enzymes). They also can induce detoxifying Phase II enzymes like glutathione S-transferase possibly through gene expression and inhibit initiation of cancerous growths. 6-MITC has also been shown to block the cell cycle of cancerous cells and to affect protein production in cancerous cells. Metastasis, a critical stage in spreading cancer beyond the local site, can be blocked by ITCs and in particular 6-MITC. It has been shown that 6-MITC from *Sawa Wasabi* suppressed dissemination or metastasis of certain tumour cells.An important point is that ITCs are effective against the cancerous cells but do no harm to healthy cells.

No side effects have been encountered! Allylisothiocyanates (AITCs), another ITC in *Sawa Wasabi*, was selectively toxic toward colorectal tumor cells. It has been found in the case of leukemia that the ITCs from *Sawa Wasabi* inhibit the growth of leukemia cells but do not inhibit normal cells another study demonstrated and reported on the fact that the Unique Active ingredient 6-MITC in *Wasabia japonica* was very good at killing Lung Cancer cells. The report was published in European Journal of Medicinal Chemistry and was entitled "Sulforaphane homologues: Enantiodivergent synthesis of both enantiomers, activation of the Nrf2 transcription factor and selective cytotoxic activity". It is acknowledged that the unique natural chemical only found in True Wasabi (*Wasabia japonica*) is biologically important to human health and kills Lung Cancer cells.

HEALTH EFFECTS

In addition to the above health benefits, there is now evidence showing that *Sawa Wasabi* and its isothiocyanates provide other medical effects: It reduces diarrhea protects nephrons in diabetes patients acts as antioxidants; provides immune modulation; inhibits cancer and lessens treatment toxicities and protects cardiovascular function. *Wasabia japonica* contains another potentially exciting compound. It was found that a compound in *Wasabia japonica* leaf stalk extract has a significant stimulatory effect on bone calcification *in vitro* and *in vivo*. The authors' findings revealed that the compound was easily extracted from the plant tissue, is of small molecular weight and functions at low concentrations. It is likely that *Sawa Wasabi* will become a useful adjunct for many of the chronic health conditions that plague our world.

These include asthma, seasonal allergies, arthritis, IBS, Crohn's disease, allergic reactions, food poisoning, dental carries, gingivitis, *H. pylori*-caused infection and ulcers, heart disease, stroke, blood clots, protection against certain cancers (breast, prostate, colon, lung, pancreas, throat, bladder, leukemia and more), toxicity from chemotherapy and radiation treatment, and osteoporosis. Hopefully, *Wasabia* and the ITCs found in the whole plant will eventually prove effective against diseases that kill millions of people yearly, like heart disease, cancer, chronic inflammatory diseases and infections. Recent advances in herbal processing have made the active glucosinolates in *Sawa Wasabi* stable until mixed with digestive juices, allowing the full spectrum of fresh *Sawa Wasabi* rhizome ITCs to be available. This is indeed an exciting time to be discovering the ancient wisdom of medicinal plants. *Sawa Wasabi* has a long traditional use in the East and the potential to become a useful food, supplement and/or medicine for the rest of the world. A scientific paper has found that one of the unique Isothiocyanates (6MITC) found in *Wasabia japonica* is of significant benefit to those suffering from Type 2 diabetes, at long last maybe diabetes sufferers can move away from the insulin injections (Larsen, 1981).

Regular addition of wasabi to the diet can prevent certain types of cancer. The most notable and beneficial nutrients found are the isothiocyanates. These form from glucosinolates after the plant is harvested or cut. The various isothiocyanate antioxidants are very beneficial in eliminating free radicals throughout the body's systems. Studies have shown that one form of isothiocyanate in wasabi, 6-MITC, has been clearly shown to inhibit the expansion of leukemia and stomach cancer cells. It actually promotes apoptosis (cell death) within 24 hours of consumption. The use of wasabi may prevent the growth of tumors, even at a pre-clinical or pre-treatment size.

The most attractive thing about this type of treatment is that isothiocyanates appear to kill cancer cells without damaging the healthy, surrounding cells. Similar studies have found 6-MITC to be equally effective against breast cancer and melanoma cells, leading many researchers to support wasabi as a small preventative method against multiple types of cancer. Research regarding its strength against other kinds of cancer is still ongoing, but this powerfully flavored plant has already proven itself in the oncological community. Only genuine wasabi has the diverse isothiocyanates that can fight a wide range of cancerous conditions. Even other plants in the Brassica family pale in comparison, particularly because they are traditionally cooked before eating, which can reduce the nutritional content, and can degrade the enzymes that lead to isothiocyanate formation. Another popular reason for adding wasabi more regularly to your diet is to prevent cardiovascular issues. It has anti-hypercholesterolemic properties which help in lowering high cholesterol levels in the human body, strokes and heart attacks. The isothiocyanates in wasabi do more than preventing cancer. They also have inhibitory effects on platelet aggregation. Platelet aggregation is basically the grouping together or clumping of blood platelets into a thrombus, or blood clot. These clots are the main causes of strokes and other cardiovascular crises. By breaking down and inhibiting the formation of these clots throughout the body, it effectively reduces the risk of heart disease and stroke!

The pungent plant, wasabi, has also been shown to reduce cases of joint swelling, inflammation, and can even subdue the effects of arthritis. Again, the powerful antioxidant isothiocyanate compounds have been shown to reduce the inflammation of joints, ligaments, and muscles that may contribute to arthritis and joint pain. Studies suggest that wasabi helps in maintaining bone integrity in humans and can help in reducing the risk of osteoporosis. In the same way that isothiocyanates can reduce platelet aggregation to protect from heart disease, they also can reduce the aggregation at weak points on the body that cause pain or discomfort. Add some wasabi to your diet and feel younger!

The powerful, natural components of wasabi have also been shown to fight off bacterial infections! In a recent study of the antibacterial properties of various foods and vegetables, wasabi ranked as the most successful antibacterial food against *E. coli* and *Staphylococcus aureus* (Staph infections). This means that food poisoning and other unfortunate conditions can be prevented by maintaining levels of isothiocyanates in the diet through the consumption of wasabi. Again, the isothiocyanates were proven to be the vital component that neutralized these potentially deadly bacteria within the body. Some companies have begun to include trace elements of wasabi extract in their antibacterial creams and gels to boost their strength and effectiveness!

Wasabi can be a strong line of defense against certain respiratory tract pathogens. The gaseous component of wasabi, which causes such a powerful reaction in the nasal passages and sinuses, is actually the gaseous release of allylisothiocyanate, which can actively inhibit the proliferation of respiratory tract pathogens like those that cause influenza and pneumonia. The smell and the sensation in your nose after eating it may be strong, but it can do a lot of good for your health and wellbeing. It “clears the sinuses” when the gaseous component reaches the nasal passage. This can often help people who suffer from seasonal allergies, or even the common cold, to stimulate the sinuses and open the nasal passageways to increase airflow.

CULINARY USAGE

Wasabi, also known as Japanese horseradish, comes from the same family of plants as mustard, cabbage, and cauliflower and offers incredible health benefits. It has been highly regarded for its medicinal properties since ancient times, which includes improving the digestive, cardiovascular, and immune systems while also reducing the risk of developing several diseases. Wasabi root is traditionally grown in streams and moist, shady areas in Japan, but is now also being commercially grown in similar areas in the US. Authentic wasabi, when grated, forms a light green, roughly textured, and pungent paste that is far more beneficial to health than any other radish or attempts at mimicking the real product. Wasabi is root vegetable which mostly found as part of Japanese cuisine offered as condiment which is also well known as Japanese Horseradish. Health Benefits of Wasabi already explored by scientist since, it give significant impact to threat some serious diseases. It is not only the aroma that is strong but also the flavor, that's why it is mostly served in the form of paste as condiment along with sushi or sashimi. Not everyone could deal with the strong flavor and aroma of wasabi but it is not a surprise that this vegetable is having amazing benefits for human's health (McGregor, 1993).

Wasabia japonica adds a unique flavour, heat and greenish colour to foods and, thus, it is a highly valued plant in Japanese cuisine. *Wasabia japonica* is described as having 'a sharp hot taste with a pungent smell' but the heat component in *Wasabia japonica* is different from chillies, and the hotness quickly dissipates in the mouth leaving an extremely pleasant mild sweet vegetable taste, with no burning sensation at all. *Wasabia japonica* adds aesthetic and culinary appeal to many foods and is considered a staple condiment in the Japanese diet. Recently, it has found widespread appeal in western cuisine due to its ability to change an ordinary dish to an extra special one by improving the taste (with addition of a spicy flavour) and eye appeal i.e. by decorative contrast of the light green colour. As a result, it has become a new culinary flavour for the rest of the world.

All the plant parts of *Wasabia japonica* possess some flavour but vary in the sharpness they deliver and are, therefore, used for different purposes. Basically, *Wasabia japonica* can be used in four ways. Three of these relate to food, and the fourth relates to health. The food uses are as a condiment on the side of a dish, as a spice or herb in a dish and as *Wasabia japonica* flavour in processed foods. Rhizomes are grated using a fine grater (such as sharkskin) to prepare fresh paste to be placed in a mound on a dish next to sliced raw fish (sashimi), spread on the raw fish in sushi preparations, or served on a small dish to accompany a bowl of cooked noodles. Sometimes grated *Wasabia japonica* is mixed with other ingredients like soya sauce and vinegar to prepare a dip for use with raw fish or other dishes, according to individuals' choice. Tofu (soybean curd) is often decorated with grated *Wasabia japonica* (Chung, 2002).

Wasabia japonica petioles and leaves are pickled in sake brine or soya sauce and are popular accompaniments for white rice. Sometimes fresh leaves are used in salads and dried leaves are used to flavour cheese, salad dressings or crackers. Wasabi petioles and leaves are also used in cosmetics and for Nutraceutical use for various ailments.

In traditional Japanese cuisine, *Wasabia japonica* is prepared by grating the fresh stem against a rough surface, such as a ginger grater, in much the same way as horseradish is prepared.

The traditional method in Japan is to use sharkskin or “oroshi” as a tool for grating *Wasabi japonica* rhizome and is still regarded as the preferred method of obtaining the best flavour, texture and consistency in freshly ground *Wasabia japonica*. Using a sharkskin grater and keeping the rhizome at a 90° angle to the grating surface is reported to minimize the volatiles’ exposure to the air. It is also stated that, in this way, the volatile compounds are allowed to develop with minimal dissipation. In Japan and the rest of the world, wasabi paste is commercially prepared using mincers to finely grind the rhizomes and other parts of the plant, and then it is mixed with other ingredients depending on the end use of the paste.

The health properties of wasabi has been well known since ancient time, that’s why Japanese people always use wasabi as part of their traditional cuisine, not only as condiment but also a spicy added to sauces, salad or soups. Wasabi prepared with peas makes a great low-calorie food which is suitable for those seeking to lose weight. It is therefore a suitable substitute for other snacks such as chips which are high calorie snacks. Wasabi peas are perfect food for the intestinal tract as it gets rid of harmful toxins from the body. This has the effect of reducing the possibility of suffering from diverticulitis .it is also rich in fibers. It is most commonly known as the green paste on a sushi plate, but being a spicy root vegetable means that it can also be added to soups, salads, sauces, and alongside roasts. It has also been used as a spicy coating on peanuts, which serves as a healthy snack packed with vitamins, minerals, and antioxidants. Wasabi is an incredibly healthy condiment, which can be bought in the form of a freshly prepared paste or in its root form to be grated. Add it to rice, salads, sushi, soups, and alongside roasts to make every meal flavorful and highly nutritional (Steinmetz and Potter, 1991).

CONCLUSION

Wasabi contains antimicrobial agents which are useful for eliminating bacteria. The Isothiocynates vapors prevent the growth of various strains of bacteria, yeast and mould. Wasabi paste is an important anti-inflammatory agent as it helps eliminate inflammation in sores, injuries among others. This is despite the fact it is claimed to cause inflammation in the nasal passageways, leading to congestion. It is associated with foods such as broccoli and cabbage, which have chemicals that improve liver health. The Isothiocynates or ITCs act to block enzymes that lead to pre-carcinogenic compounds to change into carcinogenic ones, known as Phase I enzymes. The chemicals enable the liver to better neutralize some highly toxic substances that travel throughout the body, leading to cancer. Wasabi reduces the risks of your developing cancer at a later stage in life. Due to its ability to block platelet aggregation, wasabi helps to reduce chances of heart attack and stroke. Wasabi works by stopping on time, platelets from sticking together, which can be potentially fatal. Diet rich in wasabi has anti-inflammatory properties which offer relief from aching joints. It helps inhibit inflammatory pathways which lead to inflammation. In particular is the action of isothiocynates in wasabi which also prevent inflammatory bowel disease as well as asthma. Isothiocynates prevent sugars from sticking on the teeth, which lead to cavities. Wasabi has the ability to fight *E. coli* and staphylococcus as well as destroying pylori bacteria. This is because of its anti-bacterial action. Wasabi is a natural detoxifier as it helps the liver to get rid of toxins and carcinogens. Its photochemical help get rid of toxic compounds stored in the liver’s fatty tissues.

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