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## *Introduction*

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# INTRODUCTION



***'Leave your drugs in the chemist's pot***

***If you can heal the patients with food'***

**- Hippocrates**

Variety is the spice of life and enjoying a variety of herbs and spices may help us to lead a healthier life as well. Spices have been used to preserve food, enhance their flavour and as remedies for a long list of ailments. Herbs and spices have been used to treat various diseases and ailments over thousands of years. With the rise in allopathic medicine, much of the folk wisdom fell out of favour and spices were replaced with prescription drugs. There is now a much renewed interest in these alternative medicines, with many new medicinal uses of spices and herbs coming to light. Today the pendulum is swinging back and researchers are confirming what herbalists have known all along that the spice rack can be as potent as a medicinal chest.

Spices are derived from roots, barks, buds and fruits of plants. Herbs are usually taken from the leaves of various plants. They are commonly divided into the categories of spices, spice seeds and herbs. Both herbs and spices are referred to as herbal remedies and are excellent antioxidants, which work to neutralize the attacks made by free radicals against the body. Spices also contain phytonutrients, which may prevent the mutation of healthy cells into cancerous cells. "Spices are the powerhouse of pleasure and health" quotes Zak (2006), the author of *The Magic Teaspoon*.

A great advantage that the use of herbal remedies has over commercial drugs is the reduced side effects, since the concentration of active ingredients in herbs is much lower. There is another advantage as well. Flavouring food with more spices and less butter, oil, cream and salt can help improve health and make weight management easier. An average person consumes over 1.5 kilos of spices annually. Much of it includes chillies, pepper and mustard seed (Healthbits, 2007).

A growing body of research has demonstrated that the commonly used herbs and spices such as garlic, black cumin, cloves, cinnamon, ginger, thyme, allspice, bay leaves, mustard and rosemary possess antimicrobial properties that in some cases can be used therapeutically. Other spices such as saffron, a food colorant, turmeric, a yellow coloured spice, tea, either green or black, ginger and flaxseed do contain potent plant substances including carotenoids, curcumins, catechins and lignan respectively which provide significant protection against several chronic health conditions including cardiovascular conditions and tumour prevention (Sahelian, 2006).

Cayenne (*Capsicum annum*) is the red hot mana of healing spices. It is great for warming and as an all round body tonic. Coriander (*Coriandrum sativum*) has been a favourite remedy for anxiety and insomnia and has tension taming properties. Stir a teaspoon of coriander powder into half cup of honey for an uplifting afternoon treat explains Zak (2006) or mix it with hot water, tea or hot cereal. Coriander is a most popular spice in Indian and Mexican cuisine; it is rich in protective phytochemicals and is a good source of iron, magnesium and manganese.

Ginger (*Zingiber officinale*) boosts an antioxidant power equal to vitamin C and reported health benefits include easing arthritis pains, improving digestion and treating cold, cough and flu. Ginger is also more effective in combating motion sickness. Reducing inflammation and fighting against bacteria and viruses are good reasons to include oregano (*Origanum vulgare*) in favourite foods. Rosemary (*Rosmarinus officinalis*) fights the formation of blood clots and reduces inflammation, making it a powerful ally against heart disease. Even the fragrance of this powerful antioxidant has healing properties.

Saffron (*Crocus sativus*) is one of the world's most cherished spices. It is also a potent antioxidant, packing more punch than vitamin E. On the health front, saffron has been shown to protect against cancer and treat depression.

Saffron spice is a great rejuvenator and circulatory tonic. If your spirit needs lifting, saffron is for you says Zak (2006).

Cinnamon (*Cinnamomum zeylanicum*), a bushy evergreen tree of the Laurel family (Lauraceae) is light brown in colour and has a delicately fragrant aroma and warm, sweet flavour. Ground cinnamon is the most common baking spice. Cinnamon was once more valued than gold. In ancient Egypt, cinnamon was used in embalming process. Pliny wrote that 350 g of cinnamon was equal in value to 5 kg of silver. In Hoodoo, it is a multipurpose ingredient used for purification, luck, love and money (Scott, 2001).

In medicine, cinnamon acts like other volatile oils and once had a reputation as a cure for colds. It has also been used to treat diarrhoea and other problems of digestive system (Charles, 1998). Cinnamon had traditionally been used to treat toothache and fight bad breath and its regular use is believed to stave off common cold and aid in digestion (Archer, 1988). Cinnamon has been reported to have remarkable pharmacological effects in the treatment of type 2 diabetes (Agricultural Research Magazine, 2000) and also used as an insect repellent. Half teaspoon of cinnamon per day can lower LDL cholesterol (Khan *et al.*, 2003). Cinnamon has shown an amazing ability to stop medication resistant yeast infections ([www.herbwisdom.com](http://www.herbwisdom.com)).

In a study at Copenhagen University by Nessa (2004), patients given half a teaspoon of cinnamon powder combined with one tablespoon of honey every morning after breakfast had significant relief in arthritis pain after one week and continued to walk without pain within one month. When added to food, it inhibits bacterial growth and food spoilage, making it a natural food preservative (Shelef, 2008). Studies found that smelling cinnamon boosts cognitive function and memory. Researchers at Kansas State University found that cinnamon fights the E.coli bacteria in unpasteurised juices (Erlich, 2008). It is a great source of manganese, fiber, iron and calcium (Palmer *et al.*, 1998).

Cloves are the rich, brown, dried unopened flower buds of the clove tree *Syzygium aromaticum*. They are strong, pungent, sweet or bitter sweet. Cloves have been used for thousands of years. One of the earliest references says that the Chinese, in order to approach the emperor, had to have a few cloves in their mouths to sweeten the breath. The natives of Moluca Island planted a clove tree for each child born. They believed that the fate of the tree was linked to the fate of that child. Clove was once the most valuable spice, a kilogram costing around 7 g of gold. Cloves can be used in cooking either whole or in the ground form, but as they are extremely strong they are used sparingly. Cloves are an important incense material in Chinese and Japanese culture. Cloves have historically been used in Indian cuisine where it is often paired together with cumin and cinnamon (Dorenburg and Karen, 2003).

Cloves are used in Ayurveda called Lavang in India where the essential oil is used as an anodyne (pain killer) for dental emergencies (Alqareer *et al.*, 2003). Cloves are used as a carminative, to increase the hydrochloric acid in the stomach and to improve peristalsis (Platel and Srinivasan, 2004). Cloves are said to be a natural antihelmintic (Balch and Balch, 2000).

Garlic is the dried root of *Allium sativum*, a member of the Lily family. Garlic grows in a bulb that consists of a number of pod and each pod is protected by a layer of skin but all are held together in one larger unit by additional layers of skin. It is pungent, onion like, mildly hot to very hot; fresh granulated acceptable substitute has a distinctive spicy flavour. Greek athletes ate it to build their strength (Rivlin, 2001). Garlic has been used throughout recorded history for both culinary and medicinal purposes. Garlic is often paired with onion, tomato or ginger. Garlic along with ginger form the base for most of the Indian curries and cooked varieties of rice such as pulao, biriyani, coconut rice etc. Garlic is claimed to help prevent heart disease including atherosclerosis, high cholesterol, high blood pressure and cancer. Garlic supplementation reduced accumulation of cholesterol on vascular walls of animals (Sovova and Sova, 2004). Garlic supplementation significantly reduced

the plaque of the aortas of cholesterol fed rabbits and that supplementation with garlic extract inhibited vascular calcification in human patients with high blood cholesterol (Durak *et al.*, 2002).

Regular and prolonged use of therapeutic amounts of garlic extract lowered blood homo cysteine levels and also prevented complications of diabetes mellitus and helped to regulate blood sugar levels (Parrado, 1996). Garlic possesses cancer fighting properties (Milner, 2001). A mouthwash containing 2.5 per cent fresh garlic showed antimicrobial activity, though it was reported to have an unpleasant taste (Groppo *et al.*, 2007). Garlic is used for treatment of intestinal worms, both orally and as an anal suppository, remedy for infections, digestive disorders and fungal infections (Sivam, 2001). Garlic also has been successful in treating cryptosporidium in AIDS patients (Fareed *et al.*, 2007) and in treating toxoplasmosis, another protozoal disease (John, 1988).

Turmeric (*Curcuma longa*) a rhizomatous herbaceous perennial plant of the ginger family Zingiberaceae is deep yellow in colour commonly used as a spice in curries. Its active ingredient is curcumin and it has an earthy bitter, peppery flavor and has a mustard smell. Turmeric contains upto 5 per cent essential oils and upto 3 per cent curcumin, a polyphenol, the active principle (Araujo and Leon, 2001). Turmeric has been used for over 2500 years in India, where it was most likely to be used as a dye or as a colouring agent. It finds its application in canned vegetables, baked products, dairy products, ice-cream, yoghurt, yellow cakes, biscuits, pop corn, sweets, cake icings, cereals, sauces, gelatins etc. It is a significant ingredient in most commercial curry powders. Turmeric has been used to colour cheeses, yoghurt, dry mixes, salad dressings, winter butters and margarine.

The medicinal properties of turmeric spice have been slowly revealing themselves over centuries. Long known for its anti-inflammatory properties, recent research has revealed that turmeric is a natural wonder, proving

beneficial in the treatment of many different health conditions from cancer to Alzheimer's disease (Shankar and Srivastava, 2007).

Turmeric is one of the nature's most powerful healers. In Ayurvedic medicine, it is thought to have many medicinal properties and many in India, use it as a readily available antiseptic for cuts, burns and bruises (Phan *et al.*, 2007). The fluoride present in turmeric is essential for teeth and also used as an antibacterial agent. Asians use it as a dietary supplement which helps in stomach problems and other ailments. Curcumin is a powerful antinoceptive (pain relieving) agent. In cosmetics, turmeric is used in some sunscreens. Turmeric paste is used by some Indian women to keep them free of superfluous hair. It is applied to bride and groom before marriage where it is believed to glow skin and keeps some harmful bacteria away from the body. It is an excellent anti scarring agent when mixed with milk and applied on skin. Turmeric is commonly used in Indian clothing as a fabric dye for sarees. It is used to deter ants in gardens (Mills and Bone, 2000).

Turmeric when combined with cauliflower has shown to prevent prostate cancer and stop the growth of existing prostate cancer cells. Turmeric prevents breast cancer from spreading to the lungs in mice. It prevents melanoma and cause existing melanoma cells to commit suicide and reduces the risk of childhood leukemia. It is a natural liver detoxifier. Turmeric prevents and aids in fat metabolism and help in weight management. It is a natural treatment for arthritis and rheumatoid arthritis. It boosts the effects of chemo drug Paclitaxel and reduces its side effects. It stops the growth of new blood vessels in tumors and speeds up wound healing and assists in remodeling of damaged skin. It may help in the treatment of psoriasis and other inflammatory skin conditions (Chattopadhyay *et al.*, 2004).

The benefits of spices may extend far beyond pumpkin pie recipes. There are evidences that spices can boost insulin function and lower cholesterol. Diabetes Mellitus (DM) and Cardio Vascular Disease (CVD) share

several important characteristics. The occurrence of both conditions increases with age and both are associated with an adverse lipid profile, obesity and a sedentary life style and the risk of both can be reduced by lifestyle modifications of common risk factors (Pyorala *et al.*, 1987).

Diabetes is a potent, independent risk factor for cardiovascular disease. Industrialization, urbanization, economic development and market globalization have a significant impact on the health and nutritional status of populations, particularly in developing countries and in countries in transition. Changes in world food economy are reflected in shifting dietary patterns, for example increased consumption of energy dense diets high in fat, particularly saturated fat and low in unrefined carbohydrates. Because of these changes in dietary and lifestyle patterns chronic non communicable diseases including obesity, diabetes mellitus, cardio vascular disease, hypertension and stroke and some types of cancer are becoming increasingly significant causes of disability and premature death in both developing and newly developed countries (WHO, 2002).

It has been projected that by 2020, chronic diseases will account for almost three quarters of all deaths worldwide and that 71 per cent of deaths due to ischemic heart disease, 75 per cent of deaths due to stroke and 70 per cent of deaths due to diabetes will occur in developing countries (The World Health Report, 1998). Indeed cardio vascular diseases are even now more numerous in India and China than in all economically developed countries in the world put together (WHO, 2002).

Cardio vascular diseases are a group of disorders of the heart and blood vessels and include coronary heart disease, cerebrovascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis and pulmonary embolism. Cardio vascular diseases are the number one cause of death globally; more people die annually from cardio vascular diseases than from any other cause. By 2015, almost 20 million people will die from cardio vascular disease mainly from heart disease and

stroke. These are projected to remain the single leading cause of death (World Health Report, 2004).

The causes of cardio vascular diseases are well established and well known which include unhealthy diet, inadequate physical activity and tobacco use which are called modifiable risk factors. The effects of unhealthy diet and inadequate physical activity may show up in individuals as raised blood pressure, blood glucose, blood lipids and overweight and obesity which are called intermediate risk factors.

Fats, also called lipids, serve as a major source of fuel for the body's metabolic processes. Fats are obtained from food or formed in the body, mostly in the liver and can be stored in fat cells for future use. Fats are essential components of cell membranes, myelin sheaths that surround nerve cells and of bile. The two major fats in the blood are cholesterol and triglycerides. The fats attach themselves to certain proteins and form lipoproteins which can travel throughout the bloodstream. The major lipoproteins are chylomicrons, very low density lipoproteins (VLDL), low-density lipoproteins (LDL) and high-density lipoproteins (HDL). HDL cholesterol is good cholesterol while LDL cholesterol is bad cholesterol.

Abnormal levels of fats circulating in the bloodstream, especially high cholesterol, can lead to long-term problems. The risk of having atherosclerosis and coronary artery or carotid artery disease leading to heart attack or stroke increases as a person's total cholesterol level increases. Low cholesterol levels are therefore generally better than high cholesterol levels, although extremely low cholesterol levels may not be healthy either. A normal cholesterol level is probably 140 to 200 mg/dl. The risk of a heart attack more than doubles when the total cholesterol level approaches 300 mg/dl (National Cholesterol Education Program (NCEP), 2001). Getting a cholesterol test every 3 years after 45 years of age is a good idea, particularly for those who are overweight or have a history of heart disease.

Not all types of cholesterol increase the risk of heart disease or atherosclerosis. The cholesterol carried by LDL (bad cholesterol) increases the risk; the cholesterol carried by HDL (good cholesterol) lowers the risk and is beneficial. Ideally, LDL cholesterol levels should be below 120 mg/dl and HDL cholesterol levels should be above 50 mg/dl. The HDL cholesterol level should account for more than 25 percent of the total cholesterol. The total cholesterol level may be less important as a risk factor for heart disease or stroke than the total cholesterol to HDL cholesterol ratio. Whether high levels of triglycerides increase the risk of heart disease or stroke is uncertain. Blood levels of triglycerides above 250 mg/dl are considered abnormal, but high levels do not appear to uniformly increase the risk of atherosclerosis or coronary artery disease (NCEP, 2001).

Factors that increase the risk of hyperlipoproteinemia include a family history, being overweight, consuming a diet high in saturated fats and cholesterol, being physically inactive and consuming a moderate to excessive amount of alcohol (Thompson, 2004). High lipid levels in the blood usually cause no symptoms. Occasionally, when levels are particularly high, fat is deposited in the skin and tendons and forms bumps called xanthomas. Very high triglyceride levels can cause the liver or spleen to enlarge and may increase the risk of developing pancreatitis which can cause severe abdominal pain and is occasionally fatal. Low-density lipoprotein can increase the risk of heart attacks, diabetes and other health problems. People with diabetes are more likely to have and die from cardiovascular problems than those without diabetes. Some studies show that high LDL cholesterol and low HDL cholesterol in people with diabetes is a strong sign they will have a future heart attack (Drexel *et al.*, 2005).

The International Diabetes Federation (IDF), an alliance of diabetes associations in more than 160 countries has described diabetes mellitus as a “global epidemic with devastating humanitarian, social and economic consequences”. The most prevalent form of the disease accounting for

90 to 95 per cent of diabetes cases – is Type 2 Diabetes Mellitus formerly known as Non Insulin Dependent Diabetes Mellitus (NIDDM). At least 7 million people develop type 2 diabetes mellitus each year and 3.8 million people die from complications of the disease. IDF contends that awareness of the global scale of the diabetes threat remains pitifully low. Although type 2 diabetes generally starts in middle age, it is increasingly reported in childhood, especially in obese children.

Type 2 diabetes mellitus now strikes all populations. Urbanisation, sedentary lifestyles and high rates of obesity are the major contributing factors to the upsurge in diabetic cases. The IDF estimates that among adults of 20 to 79 years old, 246 million persons had type 2 diabetes mellitus in 2007 worldwide with about 80 per cent of them living in less developed countries and that by 2025, 350 million (7.1 per cent of population) would have the disease (Encyclopedia Britannica, 2008).

Many people are unaware that they have diabetes. The disease is usually discovered when there are typical symptoms of increased thirst and urination and a clearly elevated blood sugar level as defined by a day time level greater than 200 mg / dl or a fasting level greater than 100 mg / dl (Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, 2002). Untreated diabetes leads to keto acidosis, accumulation of ketones and acid in the blood. Continued build up of these products of disordered carbohydrate and fat metabolism result in nausea and vomiting and eventually the patient goes into diabetic coma.

Successful treatment of controlling diabetes can be achieved through diet, exercise, drugs and education. Patients are put on diets which are designed to help them reach and maintain a normal body weight and then limit the sugar and fat intake. They are encouraged to exercise regularly and frequently. Diabetics who are unable to produce insulin in their bodies receive regular injections of the hormone which is customized according to the

individual. The objective of all forms of treatment of diabetes is to keep the blood sugar level within normal limits and thus reduce the complications primarily cardio vascular that account for most of the diabetes related deaths. Efforts should be made to prevent obesity with dietary control and regular exercise.

Diabetic diets need not be a complete deviation from the normal diet. The total intake of calories should include 60 to 65 per cent from carbohydrates, 15 to 20 per cent from proteins and 15 to 25 per cent from fats. Proteins from vegetable sources are better than from animal sources as they do not contain cholesterol and also add roughage to the diet. Fats from vegetable sources are better than those from animal sources. Diabetics, during infections and other complications, may require higher amounts of vitamins and minerals in the form of supplements.

Usually, the best treatment for people who have high cholesterol or triglyceride levels is to lose weight if they are overweight, stop smoking if they smoke, decrease the total amount of fat and cholesterol in their diet, increase physical activity and if necessary take a lipid-lowering drug. Diets can reduce cholesterol. A diet low in fats and cholesterol can lower the LDL cholesterol level. Experts recommend limiting calories from fat to not more than 25 to 35 per cent of the total calories consumed over several days. The type of fat consumed is also important.

Bulking up the diet with soy proteins, plant sterols, vegetables, almonds and legumes such as beans and peas and other high fiber sources can lower cholesterol and the risk of heart disease. Eating lots of fruits, vegetables and grains, which are naturally low in fat and contain no cholesterol, is recommended. Also foods rich in soluble fiber, which binds fats in the intestine and helps to lower the cholesterol level are recommended. Such foods include oat bran, oatmeal, beans, peas, rice bran, barley, citrus fruits, strawberries and apple pulp. A diet rich in fiber and vegetables can lower cholesterol.

An antioxidant found in blueberries and grapes appears to lower cholesterol as effectively as a commercial drug. A blueberry compound, called pterostilbene, activates a cellular structure that helps lower cholesterol (Andrea, 1999).

Regular physical activity can help to lower the LDL cholesterol level and increase the HDL cholesterol level. An example is walking briskly for 30 to 45 minutes 3 to 4 times a week. Exercise can reduce cholesterol and levels of CRP - c reactive protein. A person's cholesterol levels may depend not only on what he or she eats but also how often, according to UK researchers (Saultz *et al.*, 2007). They found that middle-aged and older adults who ate frequently throughout the day had lower "bad" cholesterol levels compared with those who tended to take one or two large meals per day. This was despite the fact that the frequent eaters, on an average, had a higher calorie and fat intake.

Plant sterols, structurally similar to cholesterol, have been shown to lower both total and LDL cholesterol in the body in therapeutic amounts. Even the FDA and the NCEP recommend phytosterols in the diet. Decaffeinated coffee may raise the risk of cardiovascular disease more than regular coffee does. High blood levels of iron coupled with high levels of very low density (VLDL) lipoprotein cholesterol appear to interact to increase the risk of cancer. Iron and lipids combine to create oxidative stress, which has a role in the development of cancer (Etherton *et al.*, 2002).

The compounds present in certain spices are more effective in controlling serum lipids and blood sugar. The botanicals available in our country have been proved to be safe and effective, through several hundred to thousand years of use. Ayurvedic physicians have treated diabetes and hyperlipidemia for thousands of years using a combination of regulated lifestyle and herbal formulations. Many actions associated with herbal supplements may help prevent or potentially alleviate hyperlipidemia and diabetes mellitus.

With this background the study on “**Effect of Selected Spices on Hyperlipidemic and Diabetic Adults**” was undertaken with the following objectives.

- ❖ To analyse the nutritive value and active principles of the selected spices namely, cinnamon, cloves, garlic and turmeric.
- ❖ To prepare the respective spice capsules.
- ❖ To supplement the diets of selected hyperlipidemics and adults with hyperlipidemia and diabetes mellitus with the spice capsules for a period of three months and
- ❖ To evaluate the effect of spice capsules on hyperlipidemics and adults with hyperlipidemia and diabetes mellitus using various parameters.

