CHAPTER 1
INTRODUCTION

Sunflower is a tall, erect, efflorescent plant gown annually. It belongs to the genus, *Helianthus* and family *Asteraceae*. Not just the flower has been put to use for the decorative or ornamental purpose since the earlier times but its’ seeds also consist of an array of benefits (Albert *et al.* 1997). The head of the flower consists of numerous oils seeds which are edible and energy dense (National Sunflower Association 2011).

The crusty seeds of sunflower are an eminent source of calories, certain minerals and vitamins along with EFAs i.e. essential fatty acids. The seeds are used worldwide for the edible oil extraction. They can also be eaten as it is like tasty and delicious snack (Ensminger *et al.* 1983). The external surface of the seed i.e. hull has grey white coloured stripes on a black coat. Inside the seed is a kernel present that is edible. As a result of the presence of high oil content sunflower seeds are an opulent source polyunsaturated oil (Ensminger *et al.* 1983). The seeds are energy dense; around 584 calories are present in 100 g of the seeds. Also, they supply good quantities of various nutrients; vitamins, minerals and antioxidants.

The seeds have been known to be a great source of the fat soluble vitamins like Vitamin E that acts as a major antioxidant for the body. Vitamin E helps in preventing damage from the free radicals by neutralizing them that otherwise would damage molecules and structures containing fat, as like cell membranes, brain cell, and cholesterol (Zabaniotou *et al.* 2008). In addition to being an excellent source of some essential fatty acids like linoleic acid, the eminent seeds also provide tryptophan an essential amino acid, dietary fiber, certain B Vitamins. Additionally, they are also a rich source of certain phytosterols which are known for their cholesterol lowering action. Apart from these, the glycaemic index of the sunflower seeds have also been found out to be low, making it fit as a snack for the diabetic patients (Arcangelo *et al.* 2002).

Some of the important poly-phenols present in sunflower seeds that are supposed to be beneficial are chlorogenic acid, quinic acid and caffeic acid. They help to remove the harmful free radicals (oxidant molecules) from the body being the natural antioxidants and hence help the body to get rid of them (Krimer *et al.* 2011). The sunflower seeds also are a
phenomenal source of certain essential minerals. Copper, Zinc, Iron, Selenium, Manganese, Calcium and Magnesium are widely present in the sunflower. Most of the minerals present in the seeds help in RBC production, bone mineralization, production of hormones, enzyme synthesis, skeletal regulation, metabolic activities of cardiac muscle (Wood et al. 1988).

In the relative study, the sunflower seeds’ effects have been analyzed and evaluated on patients with diabetes type 2, Hypercholesterolemia and fatty liver grade I. The action of the sunflower seeds on the blood sugar levels, lipid profile, and liver function tests of the patients have been evaluated. The blood glucose evaluations include – Fasting Blood Glucose (FBS); LFT (Liver Function Test) include – Serum Glutamate Oxaloacetic Transaminase (SGOT), Glutamic Pyruvate Transaminase (SGPT). The lipid profile evaluations include – Total Cholesterol, Triglycerides, LDL (Low Density Lipoprotein), HDL (High Density Lipoprotein).

Diabetes Mellitus type-2 (non-insulin dependent diabetes; NIDDM) is one very common ailment of metabolism which has been most commonly identified by hyperglycaemia (high blood sugar) due to deficiency of insulin or insulin resistance (Kumar et al. 2005). The main indicators of NIDDM are Polyuria (recurrent urination), Polydipsia (excessive thirst) and Polyphagia (constant hunger). Apart from these, there also occur headache, blurring of vision, tiredness, delayed wound healings, and pruritus in this metabolic disorder. Prolonged hyperglycaemia can lead to complications like diabetic nephropathy, diabetic retinopathy, diabetic neuropathy, stroke, cardiovascular diseases etc. There are specific types of skin rash known as diabetic dermadromes occurring sometimes in diabetes. Being overweight or obesity are two major reasons that lead to Diabetes mellitus (Smyth et al. 2006).

According to the 2010 census there has been a massive increase in the people suffering from diabetes than as compared to the census of 1985. Very precisely around 285 million people were found diabetic in 2010 in comparison to the 30 million diabetic patients in 1985. The patients suffering from diabetes also exhibit a poor flow of blood to its extremities which in some cases result in the surgical removal of the affected area. Apart from all the above mentioned ketoacidosis is another major complication taking place in patients with diabetes (Fasanmade et al. 2008).
Similar to diabetes, cardiovascular disease (CVD) has now become the leading cause of mortality in India. Premature mortality in terms of years of life lost because of CVD in India has increased by 59%, from 23.2 million to (1990) to 37 million (2010). Despite wide heterogeneity in the prevalence of cardiovascular risk factors across different regions, CVD is emerged as a leading cause of death in all parts of India (Niharika 2016). CVD occur as a result of deranged serum lipid levels also known as dyslipidemia for long periods of time. Hence if the serum lipid levels are taken care of the prevalence of CVD can also be brought under check (Dorairaj et al. 2016).

Cholesterol: the main culprit, is a fat like substance of waxy consistency; that is not just present in certain foods (like meat, egg yolk, poultry, dairy products, fish) but also produced in the body itself. Some amount of cholesterol is required by the body to make some hormones, build membranes of cells and produce some compounds that take part in fat digestion. Accumulation of excessive amounts of cholesterol in blood leads to an increased risk of development of any cardiac disease in that person (Austin et al. 2004). The hypercholesterolaemic patients pose a higher risk of suffering from any cardiac disorder or any cardiovascular disease. The accumulation of cholesterol particularly occurs in the coronary arteries that supply blood to the heart. The abnormal cholesterol build-up in the artery walls narrows and hardens the arteries as it forms clumps known as the plaque in it. With the increase in the size of the clumps, clogging occurs in the arteries restricting the blood flow to the heart leading to angina a form of acute chest pain and proceeds to a condition called myocardial infarct commonly known as the heart attack (Austin et al. 2004). The cholesterol being insoluble in water needs to be transported in the blood plasma with lipoproteins which are specific protein particles. The lipoproteins can be classified into four types by their existing density: HDL, IDL, LDL and VLDL which can be elaborated as high, lipoprotein, low and lipoprotein respectively (Wooten et al. 2004).

Fatty liver disease which is commonly known as fatty liver is a health condition that can be reversed, if in its initial stages. Fatty liver disease (NAFLD) is a distinct hepatic condition and one of the most common causes of chronic liver disease globally. Prevalence of the disease is estimated to be around 9-32% in the general Indian population, with a higher incidence rate amongst obese and diabetic patients (Kalra et al. 2013). In this condition molecules of triglyceride or fat get deposited in the cells of liver as a result of steatosis, a process which includes abnormal deposition of fats in the cell. The condition also relatively
influences the metabolism of fat in the body (Reddy et al. 2006). As a result of fat deposition in the liver a condition known as steatohepatitis occurs in some patient’s i.e. relative inflammation of the liver (hepatitis). In cases where fatty liver occurs as a result of alcohol intake, the health condition is known as alcoholic fatty liver disease (AFLD) or steatosis. The other forms of fatty liver are termed as Non-alcoholic steatohepatitis (NASH) (if it is not due to alcohol) or alcoholic steatohepatitis (Reddy et al 2006).

The early symptoms of fatty liver include: fatigue, anorexia, loss of weight, weakness, lethargy, nausea, poor concentration and confusion. If not taken care on time it may proceed to critical conditions like cirrhosis of liver, Hepatic Coma, Hepatic Encephalopathy etc. These diseases possess clusters of fatal symptoms in it as it is (Gramlich et al. 2004).

Talking about the general medicines which are used to treat such metabolic disorders they accompany an array of side effects. The most commonly used such medicines include Avas, Lovastatin, Glycomet etc. The side effects may include abdominal distension, gastritis, headache, sexual problems, nausea in certain cases and most importantly dependency. The word dependency can be elaborated as- the blood sugar or lipid profile remain under control till the time medicine is being consumed or otherwise the levels become deranged and hence in some cases the medicines have to be continued lifelong. Hence, countering the epidemic requires development of strategies like the formulation and effective implementation of evidence based policy, reinforcement of health system, and treatment with the use of both conventional and innovative techniques.

As per the plan of the study, using the available strategies in the nutritional sciences and a food-based approach, a product (Cookies) was formulated using sunflower seeds in combination with other integral products for its easy dispersion to the patients. Keeping in mind the nutritional attributes of sunflower seeds, different flour blends were used to design and develop healthy sunflower based cookies made from these blends. The result obtained was put to use for the nutritional therapeutic purpose.