Effect of Sunflower Seeds on Hypercholesterolemia, Fatty Liver, Fasting Blood Glucose in Diabetes Mellitus Type 2 Patients

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ABSTRACT

The objective of the current study was to evaluate and analyse the effect of sunflower seeds on fasting blood glucose (FBS) in patients with type 2 diabetes mellitus. In the study, 60 patients were enrolled, split between the case and the control group. For these patients, different anthropometric measurements (height, weight, blood pressure) and biochemical parameters (cholesterol, triglycerides, low-density lipoprotein [LDL], high-density lipoprotein [HDL] and fasting blood glucose [FBS]) were recorded for 6 months before and after sunflower seed supplementation. Compared with the control group, patients taking sunflower seeds showed a positive and faster decrease in their level of FBS. The blood glucose level decreased from 186.2 mg/dl to 109.9 mg/dl in the case group, while it decreased from 163.3 mg/dl to 119.2 mg/dl in the control group. As a household and natural remedy, sunflower seeds may be recommended to control blood sugar levels in patients with type 2 diabetes. It also leads to a good rise in levels of HDL (good cholesterol), which helps maintain the health of the heart.

Keywords *– Sunflower Seeds, Diabetes Mellitus, Fasting Blood Glucose, Cholesterol, Triglycerides*

INTRODUCTION

Sunflower is an annually high, erect, efflorescent plant gown. They belong to the genus Helianthus and the Asteraceae family. Since earlier times, the flower has not only been used for decorative or ornamental purposes, but its seeds often have a number of advantages. The flower head consists of numerous oils that are edible and dense in energy. The crusty sunflower seeds, together with EFAs, i.e. essential fatty acids, are an important source of calories, certain minerals and vitamins. The seeds are used globally for the extraction of edible oil. They can also be eaten because it is a delicious and delicious snack. The outer surface of the seed, i.e. the hull, has white-gray stripes on a black coat. There is a kernel present within the seed that is edible. Sunflower seeds are an opulent source of polyunsaturated oil due to the presence of high oil content.

The seeds are dense in energy; about 584 calories are found in 100 g of the seeds. They also provide different nutrients in good quantities; vitamins, minerals, and antioxidants. The seeds have been recognized as a great source of fat-soluble vitamins such as vitamin E, which serves as the body's major antioxidant. Vitamin E helps prevent damage from free radicals by neutralizing them that would otherwise harm fat-containing molecules and structures, such as cell membranes, brain cells, and cholesterol (Zabaniotou et. al. 2008). In addition to being an excellent source of essential fatty acids such as linoleic acid, tryptophan and essential amino acid, dietary fibre, and certain B vitamins are also provided by the eminent seeds. In addition, they are also a rich source of certain phytosterols known for their action to lower cholesterol. In addition, the sunflower seeds' glycaemic index was also found to be low, making it suitable for diabetic patients as a snack (Arcangelo et. al. 2002). Chlorogenic acid, quinnic acid, and caffeic acid are some of the significant poly-phenols present in sunflower seeds that are supposed to be beneficial. They help to remove the body's harmful free radicals (oxidant molecules), which are natural antioxidants, and thus help the body get rid of them (Krimer et. al. 2011). Sunflower seeds are also a phenomenal source of certain minerals that are essential. The sunflower has a wide presence of copper, zinc, iron, selenium, manganese, calcium and magnesium. Most of the seed minerals assist in the production of RBC, bone mineralization, hormone production, enzyme synthesis, skeletal regulation, and cardiac muscle metabolic activities (Wood et al. 1988). In the relative study, the effects of sunflower seeds were analysed and evaluated in patients with type 2 diabetes, hypercholesterolemia and grade I fatty liver. The effects of sunflower seeds on patients' blood sugar levels, lipid profile, and liver function tests have been assessed. Fasting Blood Glucose (FBS) is included in the blood glucose evaluations; LFT (Liver Function Test) includes Serum Glutamate Oxaloacetic Transaminase (SGOT), Glutamic Pyruvate Transaminase (SGPT).

Total Cholesterol, Triglycerides, LDL (Low Density Lipoprotein), HDLL, and HDL are the lipid profile assessments (High Density Lipoprotein). Diabetes Mellitus type 2 (non-insulin-dependent diabetes; NIDDM) is a very common metabolic disorder most frequently identified by hyperglycaemia (high blood sugar) due to insulin or insulin resistance deficiency (Kumar et al. 2005). Polyuria (recurrent urination), polydipsia (excessive thirst) and polyphagia are the principal indicators of NIDDM (constant hunger). In addition to these, in this metabolic disorder, headache, vision blurring, fatigue, delayed wound healing, and pruritus also occur. Complications such as diabetic nephropathy, diabetic retinopathy, diabetic neuropathy, stroke, cardiovascular diseases, etc. may result from prolonged hyperglycemia There are specific types of skin rash that are sometimes present in diabetes, known as diabetic dermatomes. Two main reasons for Diabetes mellitus are being overweight or obesity (Smyth et al. 2006).

According to the 2010 census, people suffering from diabetes have seen a massive increase compared to the 1985 census. Compared to 30 million diabetic patients in 1985, around 285 million people were found to be diabetic in 2010. Patients suffering from diabetes also have poor blood flow to their limbs, resulting in surgical removal of the affected area in some cases. In addition to all of the above, ketoacidosis is another major complication that occurs in patients with diabetes (Fasanmade et. al. 2008).

Cardiovascular disease (CVD) has now become India's leading cause of mortality, similar to diabetes. In India, premature mortality rose by 59 percent from 23.2 million to (1990) 37 million in terms of years of life lost due to CVD (2010). CVD has emerged as a leading cause of death in

all parts of India, despite broad heterogeneity in the prevalence of cardiovascular risk factors across different regions (Niharika 2016). CVD occurs for long periods of time as a result of deranged serum lipid levels, also known as dyslipidemia. Therefore, the prevalence of CVD can also be controlled if serum lipid levels are taken care of (Dorairaj et. al. 2016). Cholesterol is a fat-like substance of waxy consistency that is present not only in certain foods (such as meat, egg yolk, poultry, dairy products, fish), but also in the body itself. The body requires some amount of cholesterol to produce certain hormones, build cell membranes, and produce certain compounds that are involved in the digestion of fat. Accumulation of excessive amounts of cholesterol in the blood leads to an increased risk of that person developing any heart disease (Austin et al. 2004). Patients with hypercholesterolemia are at higher risk for any cardiac disorder or cardiovascular disease. Cholesterol accumulation particularly occurs in the coronary arteries that supply the heart with blood. In the artery walls, the abnormal cholesterol build-up narrows and hardens the arteries as the plaque in it forms clumps. Clogging occurs in the arteries with the increase in the size of the clumps, limiting the blood flow to the heart, leading to angina, a form of acute chest pain, and leading to a condition called myocardial infarction, commonly known as heart attack (Austin et al. 2004). The cholesterol that is insoluble in water must be transported with lipoproteins that are specific proteins in the blood plasma. The lipoproteins can be classified according to their existing density into four types: HDL, IDL, LDL and VLDL, which can be produced as high, low lipoprotein and low lipoprotein, respectively (Wooten et al. 2004). Fatty liver disease is a health condition that can be reversed if it is in its initial stages, which is commonly known as fatty liver.

A separate hepatic condition and one of the most common causes of chronic liver disease worldwide is fatty liver disease (NAFLD). The prevalence of the disease in the general Indian population is estimated to be around 9-32 percent, with a higher incidence rate among obese and diabetic patients (Kalra et al. 2013). In this condition, as a result of steatosis, triglyceride or fat molecules are deposited in liver cells, a process that involves abnormal deposition of fats in the cell. The condition also significantly affects the body's fat metabolism (Reddy et. al. 2006). A condition known as steatohepatitis occurs in some, i.e. relative inflammation of the liver due to fat deposition in the liver (hepatitis). The health condition is known as alcoholic fatty liver disease (AFLD) or steatosis in cases where the fatty liver occurs due to alcohol intake. Other forms of fatty liver are known as non-alcoholic steatohepatitis (NASH) or alcoholic steatohepatitis (if it is not due to alcohol) (Reddy et al 2006). Early fatty liver symptoms include: tiredness, anorexia, weight loss, weakness, lethargy, nausea, poor concentration, and confusion. If not taken care of on time, critical conditions such as liver cirrhosis, hepatic coma, hepatic encephalopathy, etc. can proceed. Such diseases have clusters of fatal symptoms in them as they are (Gramlich et. al. 2004).

A variety of side effects are associated with talking about the general medicines used to treat such metabolic disorders. Avas, Lovastatin, Glycomet and so on are the most commonly used drugs. Abdominal distension, gastritis, headache, sexual problems, nausea in certain cases and, most importantly, addiction may be side effects. The word dependence can be developed as- the blood sugar or lipid profile remains under control until the medicine is consumed or otherwise the levels are distorted and the medicines have to be continued for life in some cases. Countering the epidemic, therefore, requires the development of strategies such as the development and effective implementation of evidence-based policies, health system strengthening, and treatment using both conventional and innovative techniques. A product (Cookies) was formulated using

sunflower seeds in combination with other integral products to facilitate its dispersion to patients, as per the study plan, using the available nutrition science strategies and a food-based approach. Various flour blends were used to design and develop healthy sunflower-based cookies made from these blends, keeping in mind the nutritional attributes of sunflower seeds. For the nutritional therapeutic objective, the result obtained was put to use.

OBJECTIVES

1. To evaluate the tocopherol and phenol content of sunflower seeds.

2. To study the effect of sunflower seeds on serum lipid levels, FBS in patients with diabetes type-2 and SGOT, SGPT levels in patients with fatty liver grade 1, with and without medication.

Sunflower seeds and its composition

The world's leading oilseed crops are the sunflower (Helianthus annus L.) with good stability and an opulent PUFA content. Second-in-world production of vegetable oil. Whole kernels of sunflower can be integrated into human food formulations (Robertson et al. 1975). Tocopherols are the most important antioxidant-active compounds in sunflower seeds (Velasco et al. 2002). Sunflower has been claimed to be very important among oilseed crops and ranks among one of the best vegetable oils with a very novel nutritional quality in the world. In general, about ninety percentile of fatty acids in the general composition of sunflower oil are unsaturated. They are fatty acids which are linoleic and oleic. Myristoleic, myristic, arachidic, behemic, palmitoleic and small amounts of palmitic, stearic and other fatty acids contribute to the remaining 10 percent. Katherine et al. (2001) conducted a study on the quantification of phytosterols in the generally consumed seeds and nuts in the United States. The lipid extracts were subjected to acid hydrolysis followed by alkaline saponification. Free sterols were analysed as trimethyl derivatives with the assistance of capillary GC-FID and GC-MS. Among all, the phytosterol content was found to be highest (400-413 mg/100g) in wheat germ and sesame seeds, while Brazil nuts were the lowest (95 mg/100 gm) reported. Pistachios and sunflower seed kernels with good amounts ranging from 270-289 mg/100gm were also reported as the most frequently consumed snack foods in the US.

Effect of food processing (roasting) on the quality attribute of sunflower seeds

Roasting is a popular method of cooking that incorporates the technique of dry heat, usually practised at 140-400oC. This cooking method prepares food with radiating heat and also by condemning heat through forced air (Singh et. al. 2016). This is basically a short time and a procedure with a high temperature (Mayer et. al. 1985). Roasting leads to drying, which further leads to a reduction in the amount of moisture. At a high temperature, the moisture diffusion causes puffing and thus a crisp texture. As water activity is also reduced, the shelf life of food, seeds or grains increases with the decrease in the moisture content. The colour, flavour and odour developed in the food product during roasting give it a distinctive appearance and taste (Sharma et al. 2011). The microwave oven is one device that is found nowadays in most houses. These days, microwaves are widely used by the masses to reheat and cook certain foods. Heating through the interaction of the electrical component of the electromagnetic field with the polar

molecules is the principle used by microwaves. The heat is generated as and by the polar molecules strive to position in the oscillating field (Burfoot et. al. 1990). For industrial and home cooking, thawing, baking, pasteurisation, sterilisation, tempering and blanching, the microwave provides many advantages (Decareau et. al. 1985). Microwave power operates instantaneously with food penetration and heating (Mudgett et. al. 1989; Watanabe et al.1998).

In a study by Fozia et. al., the roasting of sunflower seeds was conducted (2005). In pyrexpetri dishes, 10 g of sunflower seeds were uniformly placed. For the experiment, they used a consumer-model microwave oven. Roasting took place at the 2450 MHz frequency for 5, 10 and 15 minutes (oven adept of generating 500 W and medium power setting). Once the roasting was completed, the seeds of the sunflower were kept to cool at an ambient temperature, after which they were intensively mixed before crushing and extracting oil. In another study, Farooq et al. (2005) studied the impact of microwave heating on the composition of the sunflower seed. The oxidative stability changes, the distribution of fatty acids and the two copherol content of sunflower oil were also explored. Two varieties of sunflower seeds, KL-39 and FH 330, were collected and extracted using n-hexane. A significant difference ($P<0.05$) in the oil content of the seeds was observed in their experiment. However, no change in the oilseed residue was shown in the protein and fibre content. Although a significant ($P<0.05$) decrease in the amount of tocopherol was found, tocopherol was detected in it even after 15 min of roasting, but still around 76-. In terms of FA composition, microwave heating led to a 17-19 percent decrease in linoleic acid and a 16-42 percent increase in oleic acid, while palmitic and stearic acid content remained unaffected. In an experiment, Yoshida et al. (1999) analysed the oxidative stability and tocopherol content of roasting whole soybeans in soybean-prepared oils. Pyrex-petri dishes measuring 12.0 cm in diameter were taken.

In a single layer, the beans were placed uniformly. They then covered the petri dishes and placed them on their glass rotating plate in the microwave oven (model R-5550; Sharp, Osaka, Japan). The beans were roasted for six, eight, twelve and 20 minutes respectively in the turntable mode. It was found to be beneficial to prepare full fat soy flour for about 6-10 minutes without any burnt odour roasting. The roasting of chickpea seeds was carried out in another study to analyse the functional and antioxidant properties of chickpea (Cicer arietinum) after its exposure to microwave roasting (Jogihali et al. 2017). The seeds were soaked at room temperature (Ratio being; water: seeds = 2:1) for 45 minutes in water. They were air-dried in the open for 10 minutes after posting this. The treated chickpeas were then roasted in a microwave oven at different strengths (450, 600 and 900W) for 5, 10 and 15 minutes. The roasted and non-roasted chickpeas were converted into flour using a hammer mill after this.

Physicochemical Composition of Biscuits and Cookies

Bengal gramme high protein biscuits were developed in a study conducted by Masur et al (2008). In order to improve the nutritional and textural quality of biscuits, wheat biscuits with Bengal flour were tried at 10, 15, 20, and 25 percent levels, along with changes in water, fat and baking powder. The height of the biscuits has been reported to remain constant with increasing levels of up to 20 per cent Bengal gramme flour and the diameter remains constant (58.5) at various levels of up to 15 per cent Bengal gramme flour. But as the proportion of Bengal gramme flour increased, the spread factor and spread ratio decreased. Another study was conducted on similar lines in which Mishra et al. (2012) prepared soybean and maize flour blended cookies in various

proportions (100:0, 90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80, 10:90 and 0:100) and assessed the physical and chemical characteristics of the cookies. The rising fraction of soy flour was seen from 16.3 to 4.9 and the spread ratio decreased significantly from 7.1 to 6.7 with an increase in maize flour concentration. With the increase in the proportion of maize flour, the protein content of cookies was also found to decrease from 39.3 to 9.9 percent. The content of fat, crude fibre and ash decreased from 27 to 16%, 4.2% to 2.1% and 7.08 to 4.58%, respectively. The outcome of the use of protein pea isolate (decorticated) on the basal baking properties of wheat biscuits was studied by Hassan et al (2009). At protein levels of 15, 20 and 25% respectively, decorticated pigeon pea isolate (DPPI) was incorporated with wheat flour. The quantity of gluten was reduced and water absorption, dough development time and dough stability increased. In addition to reducing the carbohydrate and calorific value, an increase in protein and ash content is also found. Another study conducted by Kohajdova et al. (2013) investigated the appropriateness of pea flour in the production of cracker biscuits. Refined wheat flour is replaced with various levels of pea flour (0, 10, 20 and 30 percent). The rheological characteristics and physical characteristics assessment found that the addition of pea flour resulted in increased water absorption and dough development time, while the stability of the dough was reduced. Decreases in the volume index, width and spread ratio and an increase in thickness have also been noticed. It was found that pea flour had a much higher content of protein (21.46%) and ash (3.11%) than wheat flour.

Organoleptic Evaluation

Hemenda and Mohamad (2010) prepared a 5% and 10% chick pea and soybean fortified cake. In terms of appearance, colour, cell uniformity, firmness, odour, taste, and overall acceptability, sensory assessment was performed using a 5-point semi structure scale process. The addition of 5% and 10% levels of soy flour mix to wheat flour was found to have no detrimental effect on the sensory characteristics of the end product. In a further review, Gratin et al. (2010) developed snacks focused on baked fermented legumes and cereals for school children. Cakes were prepared by using fermented and non-fermented legumes to replace 20 percent of refined wheat flour and kidney bean flour, brownies with 30 percent pigeon pea flour and cookies with 30 percent black eyed pea flour. Sensory assessment of the goods using the 7-point hedonic scale showed that the product was higher than 5 in terms of attribute, taste, colour and overall acceptability. Howard et al. (2011) performed a similar study in which they studied pasta supplemented with peanut flour for optimization of its formulation, as well as optimization of the ingredient functionality and formulation. At 30 per cent, 40 per cent and 50 per cent, peanut flour was replaced by durum wheat flour. Carrageen an was also applied to the final pasta product at a level of 2.4%, 2.65% and 2.9%, and drying temperatures (60, 70 and 88oC) were used, respectively. The sensory test was carried out where the color lightness values ranged from 42.43 to 64.01, decreasing with a rise in drying temperature along with an increase in the amount of peanut flour (becoming darker). The moisture content ranged from 56.24 percent to 68.37 percent and as the drying temperature rose, the values decreased. When dried at 60oC with 30 percent peanut flour in it, the pasta was found to be light in colour, smoother in texture and higher in moisture compared to the other relative varieties with higher percentiles of peanut flour and dried at a higher temperature.

CONCLUSION

The current research on the effect of sunflower seeds in patients with Diabetes Mellitus type 2 on hypercholesterolemia, fatty liver and fasting blood glucose was conducted to explore the possibility of regulating different deranged parameters in some metabolic disorders such as dyslipidaemia, Fatty Live (grade 1), type 2 diabetes. As per the report, for a period of six months, the sunflower seeds were first roasted and then around 2 gm of the sunflower seeds were given to the sample patients. To find out the impact of roasting on sunflower seeds, a comparative study of phenolic, tocopherol content and antioxidant activity was performed for both roasted and non-roasted sunflower seeds. Both roasted and non-roasted sunflower seeds displayed high antioxidant capacity. A important difference between the antioxidant capacity of roasted and non-roasted seeds ($p < 0.05$) was observed. There was a slight but negligible difference between the overall phenolic content of roasted and non-roasted seeds ($p < 0.05$). The six-month dietary integration of sunflower seeds in the study patients showed visible and important reductions ($p < 0.05$) in the different relative parameters. With the statistical study, the reductions were in agreement. In this research, it was found that 2 gm dietary supplementation in sedentary men and women (aged 45-55 years) may lower serum total cholesterol concentrations, triglycerides, LDL, FBS, SGOT, SGPT not only in patients who are on medication, but also in patients who have not yet been advised to take any medication for deranged levels, respectively.

REFERENCES

[1] Abou-Zaid AA, Ramadan MT and Al-Asklany SA (2011). Utilization of Faba Bean and Cowpea flours in gluten free cake production. Australian Journal of Basic & Applied Science 5(12), pp. 441-53.

[2] Adebowale KO, Olayinka OO and Olu-Owolabi BI (2008). Effect of heat-moisture treatment on physiochemical properties of white sorghum starch. Food Hydrocolloids, 22(2), pp. 225-320.

[3] Albert A, Schneiter ED (1997). Sunflower Technology and Production. The American Society of Agronomy 35, pp. 1-19.

[4] Allain CC, Poon LS, Chan CS, Richmond W, Fu PC (1974). Enzymatic determination of total serum cholesterol. The Journal of Clincal Chemistry 20 (4), pp. 470-75.

[5] Anwar F, Quayyum HMA, Hussain AI and Iqbal S (2010). Antioxidant activity of 100% and 80% methanol extracts from barley seeds: stability of sunflower oil. International Journal of Fat Oils 61(3), pp. 237-43.

[6] Aremu MO, Olaofe O and Akintayo ET (2007). Functional properties of some Nigerian varieties of legume seed flours and flour concentration effect on foaming and gelatin properties. Journal of Food Technology 5, pp. 109-15.

[7] Artemis PS (1999). Essential fatty acids in health and chronic disease. American Society for Clinical Nutrition 3 (10), pp. 560-69.

[8] Ascaso JF, Rafael C, German C, Gregoria V, Camajo EH, Josem O, Valls JM, Bergstom M, Wallin B (1996). Effect of olive and sunflower oils on low density lipoprotein level, composition, size, oxidation and interaction with arterial proteoglycans. The Journal of Biochemistry 125, pp. 243-55.

[9] Austin MA, Hutter CM, Zimmern RL, Humphries SE (2004). Familial hypercholesterolemia and coronary heart disease: a huge association review. The American Journal of Epidemiology 160(5), pp. 421-29

[10] Awika JM, Rooney LW, Wu X, Prior RL and Cisneroszevallos L (2003). Screening methods to measure antioxidant activity of sorghum (Sorghum bicolor) and sorghum products. The Journal Agriculture and Food Chemistry 51, pp. 6657-62.

[11] Azaih NA and Noor MA (2012). Physico-chemical and organoleptic properties of cookies incorporated with legume flour. International Food Research Journal 19(4), pp. 1539-1543.

[12] Bahram HA, Khan DA, Juma S, Drum ML, Venkatesh SV, Sohn E, Derman R (1998). Whole flaxseed consumption lowers serum LDL-cholesterol and lipoprotein concentrations in postmenopausal women. The Journal of Clinical Nutrition 18(7), pp. 1203-14.