

# Medicinal Use of Sunflower Oil and Present Status of Sunflower in Pakistan: A Review Study

MUHAMMAD ARSHAD AND MUHAMMAD AMJAD

*Oilseeds Research Program, National Agricultural Research Centre, Islamabad, Pakistan.*

## Abstract

Sunflower (*Helianthus annuus* (L.)) contributes 30% in domestic edible oil crop and has become the most important oil crop. A case study was planned to examine and review the current status of its production in Pakistan and sunflower oil use in medicine and nutrition. This study deals with the medicinal values of its oil with regards to its benefits and side effects. Sunflower seeds contain 20-30% protein as well as iron, B vitamins, vitamin A, calcium, nitrogen and phosphorus. The constituents of the seeds are a volatile oil, carbonate of potash, tannin and excellent sources of the B vitamins (B1, B3 and B6) including niacin and pantothenate. Sunflower oil is high in the essential vitamin E and low in saturated fat. Two common types of sunflower oil are linoleic and high oleic. Linoleic oil has high levels of polyunsaturated fat. It is also known for having a clean taste and low levels of *trans* fat. High oleic sunflower oils are classified as having monounsaturated levels of 80% and above. The iron-rich sunflower seeds are, by weight, 47% fat and 20-30 % protein. The seeds have more than 48 calories/teaspoon. Sunflower seeds have more iron than any other food except for liver and egg yolk. Sunflower seeds are more commonly eaten as a healthy snack than as part of a meal. The seeds can also be sprouted and eaten in salads. However, eating expired sunflower seeds may cause stomach irritation, such as bloating or diarrhea, due to the rotting of the seeds.

**Keywords:** Sunflower, *Helianthus annuus*, Sunflower oil and Food quality.

## Introduction

The sunflower, [*Helianthus annuus* (L.)], belongs to the family *Compositae* ( $2n = 34$ ). Many other useful plants belong to the sunflower family, such as *echinacea*, lettuce, marigolds, dandelion, chicory, *Chrysanthemum peruvianum* and thistle. The sunflower plant is tall (5-20'), and it produces large brilliant yellow flowers and edible seeds. The sunflower head with its bright yellow petals radiating from a dark hub of seeds can reach up to 12 inches in diameter. This tall, rangy plant earned its name because its flowers resemble the sun and twist on their stems to follow the sun throughout day.

The seed itself is edible and its oil is used throughout the world for frying and cooking. It is also used as poultry feed. The seed has been used by Native Americans for more than 5,000 years and was introduced in Europe by the Spanish conquerors. Sunflower oil composition consists of 90% oleic and 10% linoleic acids or vice versa. Protein contents of the seed ranged from 20-30%.

Sunflower is the fourth biggest source of vegetable oil after soybean, palm and rapeseed. In Europe, Sunflower oil is the second most widely used oil after rapeseed. Around the world, sunflower production is 31.1 m tonnes, with more than 26 Mha under sunflower cultivation. Major sunflower growing countries in the world are Russia, Ukraine, United States, France, Canada, Hungary, Romania, CIS, Argentina, Bulgaria, Europe, Turkey, Serbia, South Africa, China and India (FAO, 2005).

There are two types of sunflower seeds produced: oilseed and confectionary. Sunflower seeds can be dried or roasted and used as a medicine in South America. Sunflower oil has cleansing properties: it is both a diuretic and an expectorant. Sunflower seeds are very rich in protein and in essential fatty acids. These nutrients are essential for the good health of the nerves, brain and eyes and for the general health. More than half a sunflower seed is made up of the valuable and highly nutritive Sunflower oil. The

present paper reviews and examines sunflower oil use in medicine and nutrition and the current production status of its in Pakistan. The study deals with the medicinal values with regards to its benefits and side effects of its oil in human health.

### Current Status of Sunflower in Pakistan

Pakistan is facing crucial deficiency (>65%) of edible oil in the country is met through imports and local production that meets only 30-35% of the country's requirements (Anonymous, 2009-10). Cotton is the major source of edible oil in the country which contributes more than 65% of the domestic production; sunflower is the second important oil crop contributing more than 30% to domestic oilseed production followed by rapeseed mustard with 12% contribution in year 2009-10 (Fig. 1). For the last three decades, domestic edible oil production from all sources has grown at the rate of 2.56% annually whereas consumption is increasing at an annual rate of about 8%. The indigenous edible oil production thus could not meet the demand of the growing population. The rapid expansion of domestic oilseed production has been the major concern for decision makers because of mounting import bills. Amongst oilseeds, sunflower is one of the important oil crops, due to its higher yield potential, wider adaptability and shorter growth period. In Pakistan, sunflower was introduced in early seventies and now has become the second most

important cash crop in the country (Arshad et al., 2010). Its area has been increased by 353,000 hectares with the production of 554,000 tonnes and average yield of 1569 kg/ha during 2009-10 (see Fig. 2) (Anonymous, 2009-2010). National average yield in the country is 1,520 kg/ha. However, potential yield is 4,000 kg/ha. In Pakistan, the crop is grown with 100% imported hybrid seed by various multinational seed companies. A limited quantity of seed has been imported to test its adaptability, yield potential, maturity time and reaction to different biotic and abiotic stresses whereas permission is granted to grow large quantity on commercial scale.

### Sunflower Seed

Sunflower seed is more correctly described as an achene, a specific type of indehiscent fruit. Individual seeds are approximately 10 to 15mm long (Vaughan, 1970). The seed is used as food and poultry feed worldwide. Its oil is used for frying and cooking. The iron-rich sunflower seeds are, by weight, 47% fat and 24% protein. Sunflower seed proteins are characterised by a moderately low level of albumin and high level of globulin proteins. The globulins represent 55 to 60%, albumins 17-23%, glutelins 11 to 17%, Prolamines, 1 to 4% and the combined non-protein nitrogen and insoluble residue is less than 11% of the total nitrogen in the meal (Dorrel, 1978).

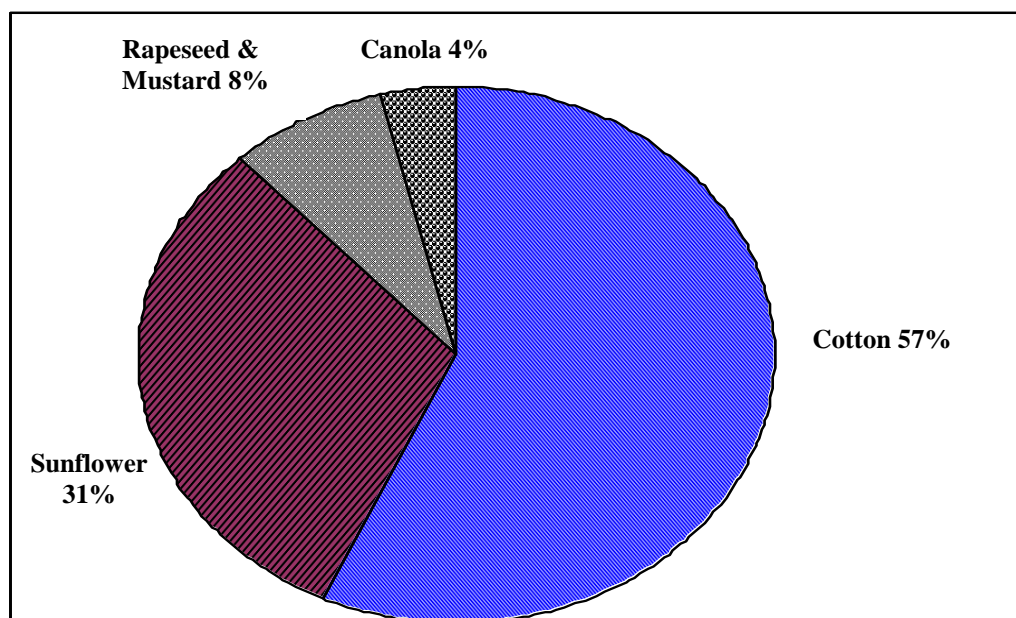


Fig. 1. Share of different oilseeds crop in domestic edible oil production

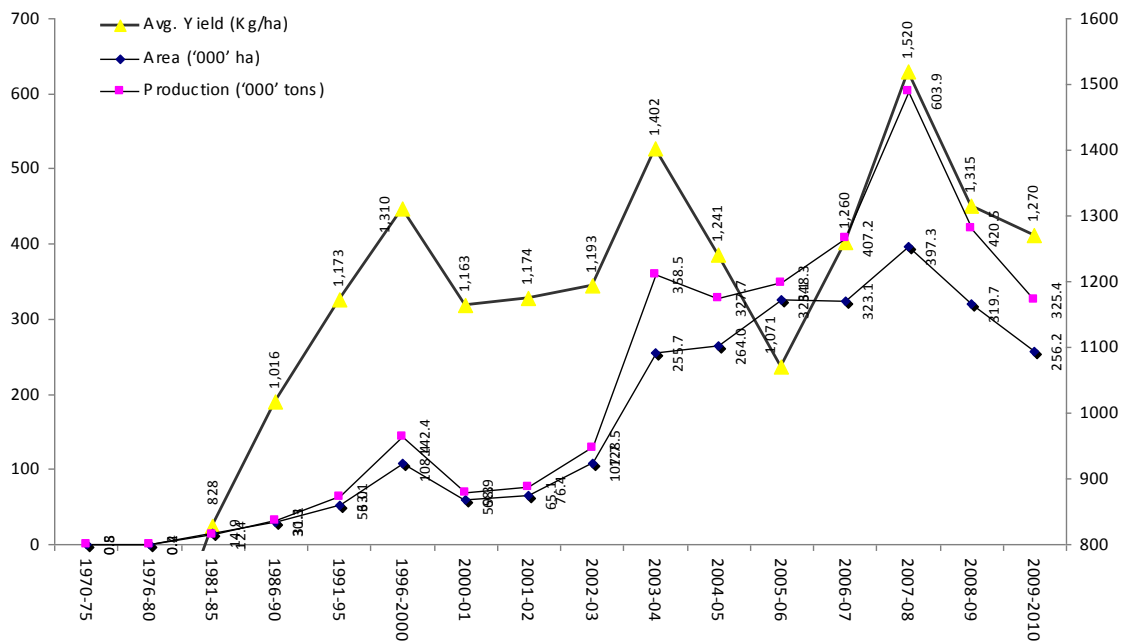


Fig. 2. Average area, production and yield of sunflower since 1970 in Pakistan. First six curves are average of 5 years and others are yearly data.

**Sunflower Oil Extraction**

Sunflower oil is derived from sunflower seeds and has a range of certain physical characteristics and has the maximum permissible levels for quality parameters and contaminants as recommended by the Codex Alimentarius Commission, American Oil Chemists Society, 1974. This oil, made by pressing the sunflower seeds, is often used as a source of unsaturated fat in the diet.

**Nutritional Aspect of Sunflower Seed and Oil**

Sunflower oil is mainly triglycerides (fats), typically derived from the fatty acids linoleic acid (which is doubly unsaturated) and oleic acid (Table-1). Several types of sunflower oils are available in the market, such as high linoleic, high oleic and mid oleic. Mid-linoleic sunflower oil typically has at least 69% linoleic acid. High oleic sunflower oil has at least 82% oleic acid. Variation in unsaturated fatty acids profile is strongly influenced by both genetics and climate. In the last decade, high stearic sunflower lines have been developed in Spain to avoid the use of partially hydrogenated vegetable oils in the food industry.

Sunflower oil also contains lecithin, tocopherols, carotenoids and waxes. Sunflower oil's properties are typical of vegetable triglyceride oil. Sunflower oil is produced from oil type sunflower seeds. Sunflower oil is light in taste and appearance and has high vitamin E content. It is a combination of monounsaturated and polyunsaturated fats with low saturated fat levels.

**Types of Sunflower Oil**

Several types of sunflower oils are produced such as high linoleic, high oleic and mid-oleic. Mid-linoleic sunflower oil typically has at least 69% linoleic acid. High oleic sunflower oil has at least 82% oleic acid. Variation in unsaturated fatty acids profile is strongly influenced by both genetics and climate. In the last decade, high stearic sunflower lines have been developed in Spain to avoid the use of partially hydrogenated vegetable oils in the food industry.

Mainly, there are three types of sunflower oil available, namely Mid-Oleic, Linoleic and High Oleic sunflower oil. They all have different oleic levels, making the uses for sunflower oil vast. Sunflower oil is known for having a clean taste, a

light colour and low levels of *trans* fats. Restaurants are aware of the benefits of sunflower oil as it can be used in extremely high cooking temperatures, making it useful for frying. Consumers are also becoming aware of the benefits of sunflower oil, making it a healthy promotional tool for restaurants. Sunflower oil also helps in the food stay fresher for longer. Many common snack foods, e.g., fries, chips or crisps, contain or are manufactured with sunflower oil (Binkoshi et al., 2005).

#### Fatty acids in sunflower oil

Sunflower seed oil is characterised by a high concentration of linoleic acid, moderate level of oleic acid, very low level of linoleic acid, less than 15% of the saturated fatty acids, palmitic and stearic acids and usually less than 1% of acids with fewer than 16 or more than 18 carbon atoms (Table-1). While lauric, arachidic, behenic, lihnoceric and eicosenoic acids may be present, these acids are of little practical importance. Traces of oxygenated fatty acids also have been found in some sunflower seeds stored for a

prolonged period (Mikolajczak et al., 1968). Sunflower oil is also used as a source of unsaturated fat in the diet to replace saturated fats.

**Table 1. Fatty acids found in sunflower oil and their range.**

Fatty acids		Range
Palmitic	C16:0	5.8 %
Palmitoleic	C16:1	0.1 %
Stearic	C18:0	3.9 %
Oleic	C18:1	15.9 %
Linoleic	C18:2	71.7 %
Alpha Linolenic	C18:3	0.6 %
Gamma Linolenic	C18:3	0.1 %
Arachidic	C20:0	0.3 %
Gadoleic	C20:1	0.2 %
Tetracosanoic	C24:0	0.5 %
Behenic	C22:0	0.7 %

#### Oil composition of sunflower oil

Sunflower oil is liquid at room temperature and has excellent nutritional properties (Table-2). The refined oil is clear and slightly amber-colored

**Table 2. Sunflower seed kernels, dried in nutritional value per 100 g (3.5 oz) in percentages are relative to US recommendations for adults**

Sunflower seed kernels, dried in nutritional value per 100 g (3.5 oz)	
Energy	2,385 kJ (570 kcal)
Carbohydrates	18.76 g
- Sugars	2.62 g
- Dietary fiber	10.5 g
Fat	49.57 g
- saturated	5.20 g
- monounsaturated	9.46 g
- polyunsaturated	32.74 g
Protein	22.78 g
Thiamine (vitamin B <sub>1</sub> )	2.29 mg (199%)
Riboflavin (vit. B <sub>2</sub> )	0.25 mg (21%)
Niacin (vit. B <sub>3</sub> )	4.5 mg (30%)
Pantothenic acid (B <sub>5</sub> )	6.75 mg (135%)
Vitamin B <sub>6</sub>	0.77 mg (59%)
Folate (vit. B <sub>9</sub> )	227 µg (57%)
Vitamin C	1.4 mg (2%)
Vitamin E	34.50 mg (230%)
Calcium	116 mg (12%)
Iron	6.77 mg (52%)
Magnesium	354 mg (100%)
Manganese	2.02 mg (96%)
Phosphorus	705 mg (101%)
Potassium	689 mg (15%)
Sodium	3 mg (0%)
Zinc	5.06 mg (53%)

Source: USDA Nutrient Database.

with a slightly fatty odor. It is practically free of significant toxic compounds and has a high concentration of linoleic acid. This polyunsaturated fatty acid is an essential fatty acid not synthesised by humans and is a precursor of gamma linoleic and arachidonic acids. The relationship between cholesterol concentration in blood plasma and the risk of coronary heart disease has been debated extensively (Hegsted et al., 1965). Generally, it is accepted that increasing the proportion of unsaturated to saturated fatty acids in the diet will lower the level of serum cholesterol (Booyens et al., 1988). There is an established relationship between cholesterol and arterial sclerosis. There is no agreement, however, that the composition of a high proportion of polyunsaturated fatty acid will reduce the incidence of arterial sclerosis or prevent coronary heart disease (West and Redgrave, 1974). At this stage, the consumption of sunflower oil can be considered only as an aid in controlling cholesterol levels. The daily requirement for linoleic acid has been considered to be about 100/kg/day of body weight (Mullor, 1968). In addition to linoleic acid (an essential fatty acid), sunflower seeds are also an excellent source of dietary fiber, some amino acids (especially tryptophan), Vitamin E, B Vitamins (especially vitamin B1 or thiamine, vitamin B5 or pantothenic acid and folate) and minerals such as copper, manganese, potassium, magnesium, iron, phosphorus, selenium, calcium and zinc. Additionally, they are rich in cholesterol-lowering phytosterols. The iron-rich sunflower seeds are, by weight, 47% fat and 24% protein (Doty, 1978).

**Comparative properties of common cooking fats**

Several varieties of sunflower oilseeds have been developed by standard genetic methods. The original oilseed was high in glyceryl linoleate. It is also rich in fibers and polyunsaturated fatty acids (about 66% linoleic acid) and low in saturated acids, such as palmitic acid and stearic acid. These are processed into polyunsaturated margarines. A premium high oleic strain was developed in the late twentieth century. Early in the 21<sup>st</sup> century, a mid oleic strain marketed as Nu-Sun was introduced as an improved frying oil that would have a low level of saturated fat but would not require hydrogenation (Table 3). These three major strains differ greatly in their levels of monounsaturated and polyunsaturated fats. There are also minor differences in their saturated fat content (Thomas, 2000). Comparative fatty acids contents and major fatty acids composition of some selected oil crops revealed that sunflower fat per 100g has low saturated and monounsaturated fats and high poly unsaturated fats with smoke point of 232°C (Table 4).

**Sunflower oil has more vitamin E than any other vegetable oil**

Sunflower oil contains high levels of vitamin E and tastes much lighter than vegetable oil. According to the National Sunflower Association (2011), sunflower oil contains both mono-unsaturated and polyunsaturated fats and is lower in saturated fat, making it a healthy cooking choice. Sunflower oil has been used topically on the skin to promote wound healing and heal certain skin conditions. Researchers states that there is evidence suggesting that the use of sunflower oil in the diet instead of olive oil may lower LDL cholesterol (<http://www.webmd.com>).

**Table 3. Sunflower oil, high oleic (70% and over), standard and (NuSun), mid oleic at nutritional value per 100g (3.5 oz)**

Nutrition	Sunflower oil, high oleic (70% and over)	Sunflower oil, standard	Sunflower oil (NuSun), mid oleic
Energy	3,699 kJ (884 kcal)	3,699 kJ (884 kcal)	3,699 kJ (884 kcal)
Carbohydrates	0 g	0 g	0 g
Fat	100 g	100 g	100 g
- Saturated	9.748 g	10.3 g	9.009 g
- Monounsaturated	83.594 g	19.5 g	57.344 g
- polyunsaturated	3.798 g	65.7 g	28.962 g
Protein	0 g	0 g	0 g
Vitamin E	41.08 mg (274%)	41.08 mg (274%)	41.08 mg (274%)
Vitamin K	5.4 µg (5%)	5.4 µg (5%)	5.4 µg (5%)

*Percentages are relative to US recommendations for adults*

**Table 4. Fat content and major fatty acid composition of selected fats and oils of linoleic acid content and smoke point (per 100g)**

Oil type	Total Fat	Saturated Fat	Mono unsaturated Fat	Poly unsaturated Fat	Smoke Point
Sunflower oil	100g	11g	20g	69g	232°C (450°F)
Soybean oil	100g	16g	23g	58g	232°C (450°F)
Olive oil	100g	14g	73g	11g	216°C (420°F)
Corn oil	100g	15g	30g	55g	232°C (450°F)
Peanut oil	100g	17g	46g	32g	232°C (450°F)
Vegetable Shortening (hydrogenated)	71g	23g (34%)	8g (11%)	37g (52%)	182°C (360°F)
Lard	100g	39g	45g	11g	188°C (370°F)
Suet	94g	52g (55%)	32g (34%)	3g (3%)	200°C (400°F)
Butter	81g	51g (63%)	21g (26%)	3g (4%)	177°C (350°F)

Viscosity, 25°C, unrefined: 0.04914 kg/(M\*S)

### Cooking Quality

Sunflower oil is light in color, mild in taste, and low in saturated fats. It contains more of the antioxidant vitamin E than any other vegetable oil and is also high in vitamins A and D. Sunflower oil is able to withstand high temperatures and is thus a good choice when frying foods. Sunflower oil can be used in place of olive oil in salads and dressings.

### Skin Safety and Beauty Products

Sunflower oil is easily absorbed by the skin and provides deep nourishment and moisturizing. For these reasons, it is a popular ingredient in over-the-counter and homemade beauty products including lotions, creams and massage oils. Used in aromatherapy, sunflower oil incites feelings of harmony and peace of mind.

Like other oils, it can retain moisture in the skin. It may also provide a protective barrier that resists infection in premature infants. Studies using sunflower oil have been conducted involving low birth weight infants who are often susceptible to infection due to their underdeveloped skin. The study determined infants receiving a daily skin treatment of sunflower oil were 41% less likely to develop infections in the hospital (Moran et al., 2009).

### Diet and cardiovascular benefits

Cardiovascular disease (heart disease or a stroke) can result from the polyunsaturated fatty acids found in sunflower oil. These fats can react with the body, damaging arteries and oxidising blood (Iszatt, 1999-2012).

### Hypertension

Hypertension, or high blood pressure, occurs when the body exhibits overly high levels of the polyunsaturated fats found in sunflower oil. The fats build up in the blood and put the arteries into a chronic state of elevated pressure, leading to kidney failure and other serious diseases.

### Non Insulin Dependent Diabetes

Sunflower oil contains large amounts of Omega 6 linoleic acid; when not counteracted with Omega 3, it can aggravate hyperinsulinemia and possibly lead to non-insulin-dependent diabetes (Iszatt, 1999-2012).

### Obesity

Polyunsaturated fat is high in calories, and it should not exceed 10% of daily calorie intake. Research from the American Heart association recommends that individuals limit total fat intake to less than 25 to 35% of total calories each day.

### Inflammation and joint pain

Too much omega 6 can have an inflammatory effect which can suppress the body's immune system, causing joint pain.

### Other Beneficial Uses of Sunflower Oil

Studies were conducted by researchers from the Johns Hopkins University between 1998 and 2003 in Bangladesh which suggest that sunflower oil can protect premature babies from bacterial infections when rubbed onto their skin several times daily. Sunflower oil can also be applied to the face and neck to treat and prevent acne breakouts (<http://www.sunflowerusa.com>).

- Diuretic and expectorant properties have been employed with success in the treatment of bronchial, laryngeal and pulmonary affections, coughs, whooping coughs and colds.
- The following preparation is recommended: Boil 2 oz of the seeds in 1 quart of water, down to 12 oz and then strain. Add 6 oz of good Holland gin and 6 oz of sugar. Give in doses of 1 to 2 teaspoonsful, three or four times a day. The oil possesses similar properties and may be given in doses of 10 to 15 drops or more, two or three times a day.
- A tincture of the flowers and leaves has been recommended in combination with balsamics in the treatment of bronchiectasis.
- The seeds, if browned in the oven and then made into an infusion are admirable for the relief of whooping cough.
- Tincture of Helianthus has been used in Russia. Kazatchkoff says that in the Caucasus, the inhabitants employ the Sunflower in malarial fever. The leaves are spread upon a bed covered with a cloth, moistened with warm milk and then the patient is wrapped up in it. Perspiration is produced and this process is repeated every day until the fever has ceased.
- A tincture prepared from the seed with rectified spirit of wine is useful for intermittent fevers and ague instead of quinine. It has been employed thus in Turkey and Persia where quinine and arsenic have failed, being free from any of the inconveniences which often arise from giving large quantities of the such other drugs.
- The leaves are utilised in herb tobaccos.
- Sunflower oil is a sought-after cooking oil; many chefs choose it for its light taste and frying performance and many families choose it for its health benefits. The benefits of sunflower oil are wide ranging, thanks to its high Vitamin E content. Benefits include protecting cells from cancer-causing radicals as well as preventing infection and diseases.
- If you take sunflower oil as part of a well-balanced diet, you should see no side effects- as long as you take less than 2 tbsp. a day.
- 95% of the people who use conventional acne treatments get rid of their acne temporarily and sometimes their acne ends up worse than when they started whereas the remaining 5% keep acne off forever using sunflower oil(<http://www.acnenomore.com>).
- Curing acne can never be achieved by tackling only one of the many factors responsible for acne. For instance, opting for antibiotics or detox diets only might not work if applied in isolation.
- Drugs, creams and typical acne treatments sometimes work in a partial way but the results are temporary and the side effects are nasty. The tiny handful acne sufferers who have learned how to clear their acne from within and without ever using drugs or over the counters are the only people in the world who keep their skin clear permanently.
- You can make sprouts from wild sunflower seeds. Sprouts contain more health benefits than any other. Harvested sunflower seeds will germinate well if they're stored in a freezer. There are several ways to sprout seeds including using a sprouting bag, a wide mouth glass jar or potting soil on a plate.

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