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CLINICAL ADVANTAGES AND VERSATILITY OF SOYBEAN OIL AND PRODUCTS

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ABSTRACT

An important foodstuff and staple food for human being around the world, soybeans and soybean oil have many applications in daily diet. Soybean and crush is a rich source of protein and energy. Soybean is crushed to extract edible oil which has excellent essential fatty acid composition. The health friendly fatty acids has best ratio as recommended by the WHO. Soybean oil is used in preparing many food products with enhances quality and shelf life of food products. Many innovative recipes can be formulated with add on taste and vegetarian products. A new concept of vegan diet recommends maximum use of soy products. Soybean versatility is extended in the health care products particularly in cosmetic industries which include skin lotions and skin creams. A clinical survey on uses of soy based cosmetic products suggests that it is the good challenging material in competition with other animal based cosmetic products. Fatty acid composition of soybean oil was analyzed and its clinical advantages were discussed.

KEYWORDS : Soybean oil, Fatty acid composition, Health benefits

INTRODUCTION

In the 21st century variety of edible vegetable oils are consumed[1]. Amongst this, Olive oil, Rice Bran oil, Soybean oil, Groundnut oil, Canola oil, Ginglyseed oil, Sunflower oil, Safflower oil, Cottonseed oil, Palm oil are major plant based oil consumed in India, Each vegetable oil has their own nutritional merits. Based on their fatty acid composition health benefits and consumption pattern varies. All of these oils cannot be used for cooking purpose since many of them are heat sensitive and decompose at high temperature. As an example olive oil can be used exclusively for salad dressing. Any two of these vegetable oils are blended in different proportion to meet the fatty acid composition recommended by the WHO.

Soybean is the most economically important bean in the world. Soybean oil accounts for about 58% of vegetable oil used in commercial and consumer cooking. A new generation of commercially available edible oil is soybean oil to the food industry Soybean oil's light, golden appearance and neutral flavor make it an ideal ingredient for many types of cooking. Amongst the commercially available soya products soy milk, soy flour fortified with wheat flour, soy sauces and Textured Soy Protein are popular. Soybean oil is useful in cosmetic products also.

Generally soybean is processed for its protein, edible oil and lecithin content. Nutritionally soybean oil is excellent for health due to its good quality protein, carbohydrates, cholesterol free oil and reasonable amount of vitamins and minerals. Soybean oil is rich in protein and has a great potential to meet the challenges of protein energy malnutrition PEM. The study was planned with following three aims and objectives.

1. To analyses the soybean oil for its nutrient composition,
2. To correlate Soybean oil nutrient with health benefits.
3. To understand soybean oil as a cooking medium.

METHODOLOGY

A brief survey on soybean oil consumption and soy based cosmetic products were conducted. Soybean oil samples were collected from local market and investigated for its nutrient content and fatty acid composition. Physical characteristics like color, flavor, density, refractive index, Iodine value, saponification value were determined by recommended methods[2]. The fatty acid composition was determined by HPLC technique. Each analysis was performed three times to verify the reproducibility of result. The observations and results are summarized and reported in tabular form. The data is used to comment on clinical advantages and related with certain specific health parameters.

RESULTS AND DISCUSSION

For decades, food manufacturers have selected soybean oil for its versatility and competitive pricing. Soybean oil is a good source of healthy fats, including omega-3 fatty acids and polyunsaturated fats. It is reported that these types of fats may have several health benefits. Soybean oil is still pure fat, which means that eating too much of it can be detrimental for overall health. When eaten in moderation and in place of unhealthy fats, such as lard, soybean oil can be a healthy addition to diet.

The neutral flavor and well-balanced fatty acid profile of soybean oil makes it a desirable ingredient for a variety of applications from baked goods to salad dressings. The samples were analyzed for physical characteristics and reported in table 1.

Physical characteristics of Soybean Oil

Nutrient	Value
Color	Golden
Flavor	Neutral
Density	0.910g/cm^3
Refractive index	1.465
Iodine value	121
Saponification value	137
Flash point	2850C
Smoke point	2200C
Oxidative stability index	20 hours

Soybean oil is light, golden appearance and have neutral flavor. Any deviation from color index indicates adulteration in it. Poor oil extraction can impart darkness in the color. It has virtually no flavor or aroma, allowing the clean, full flavors of other foods to stand out. Because it has a neutral flavor, Soybean oil may not be ideal for salad dressings. Soybean oil can be used in foods that are already highly seasoned Soybean oil can turn two ounces of olive oil into a whole pint of flavored oil for dressings. The distinctive olive oil aroma will be evident, even though the bulk of the dressing's oil component comes from inexpensive soybean oil.

Soybean oil has density 0.910g/cm^3 and refractive index 1.465nD at room temperature. The smoke point and flash point are 220^{0}C and 285^{0}C respectively which are very close to reported values. The Iodine value and saponification value is a measure of its unsaturation and the values are 121 and 137

respectively. Such value indicates the unsaturation of fatty acid content of soybean oil.

Mid- and high oleic soybean oils show favorable oxidative stability index (OSI), which is defined by the number of hours needed to reach an end point at a given temperature (110°C). A measurement of oxidative stability in the 20-25 hours range is most advantageous[3]. Most of the other vegetable oil has like corn, cottonseed, canola and sunflower show has values of 3-14 hours. Soybean oil does not withstand high cooking temperatures, so it is not a good choice for grilling, roasting or frying foods. However, it works well for gentle heating of either meat or vegetables or even as a marinade for these foods prior to high-heat cooking. Soybean oil is used in formulations for cooking oil and to create mayonnaise, salad dressings and sauces. Compared to other vegetable oils, soybean oil has good emulsifying ability, making it the first choice of the general food industry.

Soybean oil Nutritional Value per 100g

Nutrient	Amount
Water	89.0g
Energy	884Kcal
Protein	0.0g
Fat(total lipid)	100g
Saturated fatty acid	14.4g
Mono-saturated fatty acids	23.3g
Poly-unsaturated fatty acids	57.9g

A 1-tablespoon serving of soybean oil has 120 calories per serving and 13.6 grams of total fat. Compared with a 1-tablespoon serving of lard, it has more calories and fat lard has 115 calories per serving and 12.8 grams of fat. However, soybean oil is richer in unsaturated fats, containing only 2.1 grams of saturated fat while lard has over 5 grams of saturated fat, almost 40% of the total fat content. The quality of protein in soya is at par with that of egg and meat

Fatty acid composition of Soybean oil/100g

Nutrient	Amount
Saturated fat-	**16g**
Stearic acid	4%
Palmitic acid	10%
Mono unsaturated fat	**23g**
Oleic acid(C-18:1)	23%
Poly unsaturated fat	**58g**
-Linolenic acid(C-18:3)	7-10%
Linoleic acid(C-18:2)	51%

Soybean oil is low in saturated fat but high in poly and monounsaturated fats[4-6]. It does not contain trans-fat. It is the principal source of omega-3 fatty acids and the primary commercial source of vitamin E in the diet. Soybean oil contains saturated fatty acids along with crucial ingredients which are beneficial for human health.. Soybean oil contains 10% palmitic acid and stearic acid (4%) which is relatively low as compared to other vegetable oil. Saturated fats tend to raise LDL cholesterol, and therefore increase the risk of heart diseases and strokes.

Soya oil comprises of 23% of mono unsaturated fat typically oleic acid. Unsaturated fats are found in soybean oil, and when they replace saturated fats, it lowers both total and bad LDL cholesterol levels

Soybean oil has 58% of the total fat content. Polyunsaturated fats are considered healthy, when they are eaten in place of saturated and trans-fats, as they help lowering bad cholesterol levels. Polyunsaturated fats contain omega-3 fatty acids, which is an essential acid that body is not able to produce. Omega-3 fatty acids lower inflammation and reduce the risk of arthritis and heart disease. It also promotes brain health and general cognitive function. Soybean oil is one of the few non-fish sources of omega-3s, and is the principal source in the diet. These polyunsaturated fatty acids positively affect overall cardiovascular health[7-9], including reducing blood pressure and preventing heart disease. For baking and frying applications that traditionally used

Vitamin E is a fat-soluble antioxidant vitamin prevents cell damage that may lead to diseases such as cancer and heart disease. Soybean oil is the principal source of vitamin E in the diet. Vitamin E is an effective antioxidant. Its effectiveness is lost, in case of very high temperatures, such as processed foods. Cooking at high temperature results in to vitamin E loss[10].

Soybean oil contains zero trans fats. Trans Fats are produced during the hydrogenation process to make a more stable, solid fat for food products, trans fats elevate bad LDL cholesterol and lead to increased risk of heart disease. Instead, make soybean oil an essential part of everyday cooking. It's one of the most versatile ingredients in the kitchen. Flawlessly replaces oils higher in saturated fat in sautés and stir-fries, maintaining the flavor and integrity of other ingredients. Has a high smoke point (220°C), making it an excellent option for frying foods quickly and easily

1. **Low Fat**: Soya is low in fat with zero cholesterol and is an excellent source of fibre which makes it easy to digest.
2. **Omega-3 Fatty Acids**: It contains essential omega-3 fats which assist in maintaining a healthy heart. Omega-3 fatty acids are also vital in slowing down ageing, combating risks of cancer, dementia, Alzheimer's and diabetes.
3. **Minerals**: It provides bodies with all the essential minerals including Ca, Fe Mg and Se.
4. **Ailments:** Soya is rich in isoflavones which aid in reducing risk of various cancers, heart disease and osteoporosis.
5. **Protein:** Soybean is the only vegetarian food that is a complete protein which means that it contains all eight essential amino acids.

Clinical advantages of soybean oil

Cholesterol Control:

The good balance of fatty acids contained in soybean oil means that the body can get the important and necessary fatty acids in their diet, including those which regulate cholesterol levels[11]. Omega-3 fatty acids can reduce dangerous cholesterol levels and counteract the negative types. The other fatty acids like stearic acid, palmitic acid, and oleic acid are also found in balanced quantities. The fatty acid composition of soybean oil, as well as the powerful plant sterols, such as β-sitosterol can actually cause a reduction in cholesterol storage in the gut by 10-15%. Thus soybean oil can seriously decrease chance of atherosclerosis and other heart conditions, such as heart attacks and strokes.

Cognitive Impact: '

Alzheimers disease is a terrible affliction that affects millions of people around the world. It results in the cognitive deterioration of a person's brain as neural connection fail and die, thereby making everything from remembering the past to performing simple tasks a challenge. However, soybean oil has an impressively high level of vitamin K, which has been consistently connected with improving the symptoms of Alzheimer's, and even reversing the effects in some cases. The vitamin K acts as an antioxidant against free radicals, keeping them from damaging the neural cells.

Bone Health:

Another important function of vitamin K is its osteotrophic

potential, which means that it can stimulate the regrowth or increased healing of bone. While this is often associated with calcium and vitamin K, of which soybeans has a good amount of these nutrients. It can stimulate bone development in a very positive way, and prevent conditions like osteoporosis, which is a natural result of the aging process.

Eye and Skin Health:

Omega-3 fatty acids, which make up 7% of the total fatty acid content in soybean oil, are integral to protecting the cardiovascular system in the role of scraping bad cholesterol, In addition it also protects cell membranes. This includes the very fragile and dangerous areas of the skin and eyes, both of which are common entrance points for bacteria and other foreign materials. These omega-3s also promote healthier vision by acting as antioxidants and neutralizing free radicals that can cause macular degeneration and cataracts.

Antioxidant Potential:

The high vitamin E content in soybean oil acts as a powerful antioxidant while similarly protecting the skin from the damage of free radicals. Vitamin E is directly associated with improving the appearance of blemishes, reducing acne scarring, protecting the skin against sunburn, and stimulating the re-growth of new skin cells to promote healing[12]. Vitamin E is associated with general antioxidant activity in the rest of the body, which boosts the immune system and helps to eliminate free radicals that cause conditions like cancer, premature aging, cognitive disorders, and heart diseases.

Soybean oil as cooking Medium

For food service oils are used in deep fat frying, pan frying and griddle frying with sensory attributes, like fry life, cost, availability and nutritional considerations[13-14]. Low-linolenic and mid-oleic soybean oils, promises a trans-fat solution without raising harmful saturated fats. Soybean oil has superior functionality in high-heat applications such as frying in foodservice operations and the manufacturing of baked goods. Unique fatty acid compositions, foods prepared in mid- and high oleic oils enjoy improved shelf lives compared to commodity oils containing higher levels of polyunsaturated acids. Low linolenic and high oleic soybean oils have proven to meet these criteria. Independent studies have shown that trait modified oils perform superior to, partially hydrogenated oils in deep fat frying applications[15-17].

Aside from frying applications, foodservice operators will want to be aware that edible oil consumption patterns over the past decade have shown a marked trend in the increased use of liquid oils for sautéing or stir-frying. New oils such as increased-oleic and other trait-modified oils offer a functional choice for these applications. Importantly for foodservice, the oils remain in liquid form below ambient temperatures, and are therefore easily pumped and handled. Although the costs of trait-modified oils will be initially higher than commodity oils, increased supplies and demand will lower costs. Consumer demand for trans foods with great flavor but little trans or saturated fat, increased emphasis on cardiovascular health and fortification with omega-3 fatty acids will provide stimulus to the foodservice industry to consider commodity and enhanced-trait soybean oils for their needs.

Soybean oil's clean, natural taste and nearly imperceptible odor support and enhance the natural flavors of prepared foods. Whether used as a shortening for old-fashioned pie crust or blended with flavored vinegar for a new dressing, soybean oil's neutral flavor lets the real taste of the food product come through. Adaptable to nearly every fat or oil application in the food industry, soybean oil works well with other ingredients including other fats and oils, making it very suitable for use in salad dressings, sauces and baked goods. Soybean oil is available with AOM (active oxygen method) stability levels ranging from 15 to over 300 hours, and it is a proven performer in the wide range of applications required by snack food manufacturers, bakeries, foodservice providers and more.

Summary &Conclusion

The above discussion on soybean oil can be summarized as:

1. Good Cooking Medium:
2. Inhibits Cholesterol Absorption:
3. Delays Aging & Prevents Skin Problems:
4. Makes Bone Healthy:
5. Treats Alzheimer's Disease:.
6. Prevents Cancer:
7. Treats Heart Related Conditions:
8. Reduces Triglyceride Levels:

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