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Importance of Oil Plants in Nutrition

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Abstract: This article focuses on the main oilseed crops, their role in human health and disease, and highlights new developments that may provide even greater benefits in the future. Oilseed crops are cultivated primarily for the oil contained in their seeds. Oilseed crops are rich in protein and also have high oil content. Therefore, they are not only a good source of protein but also a concentrated source of energy. Oilseed proteins can be used as food in the form of whole seeds or in the form of oil-extracted meals. Oilseeds and their derivatives, vegetable oils and meals, are in high demand worldwide, and it is necessary to identify and assess the main challenges in their production. This will help to develop and support actions by various stakeholders to ensure a sustainable future for these crops.

Keywords: Oilseeds, biodiesel, human, health.

Introduction

Oilseeds are the world's leading suppliers of high-quality and specialty vegetable oils, which are used in the production of food products, natural foods and high-quality snacks. Oilseed crops include corn, oats, cotton, soybeans, mustard, camelina, safflower, sunflower, peanuts, rapeseed, coconut, oil palm and olives. Oilseeds grown in many countries are mainly used for oil extraction. For example, in small grain crops such as wheat, the oil content is only 1-2%, while in oilseeds this figure can be about 20% for soybeans and more than 40% for sunflowers and rapeseeds such as canola.

The main sources of vegetable oils consumed worldwide are soybean, sunflower, rapeseed, cottonseed, and peanut. Linseed and castor oil are used for industrial purposes. Although oilseeds do not contain significant amounts of carbohydrates, they are rich in B vitamins. Peanuts are particularly rich in thiamine and nicotinic acid (niacin). Oilseeds provide high-quality protein and, along with vegetable oil, essential nutrients such as fat-soluble vitamin A, making them an important part of the diet. Although oilseeds (olive, coconut, and palm trees) have the highest yields, oilseeds are the largest source of vegetable oil in the world (Gunstone, 2002; Sarwar, 2013). Oilseeds are also widely used in animal feed due to their high protein content. Their seeds store their energy mainly in the form of oil, while cereals store energy mainly in the form of starch (McKevith, 2005). In many countries, the focus is on oilseed rape, which includes canola, rapeseed, and mustard. The term “rapeseed” for oilseed rape comes from the Latin word rapum, which means turnip. Today, rapeseed and the similar but more common Swedish rapeseed are grown for their oil and are known for their bright yellow flowers. In spring, the bright yellow (margarine-colored) flowers of oilseed rape are common in fields. Rapeseed oil is one of the highest-yielding oils in the world, and its seeds are very dark, similar to macadamia seeds. It contains 45% oil and the remaining 55% is high-protein animal feed. Brassica oilseeds are well-suited as feedstocks for biodiesel due to their high oil content. For

example, spring canola contains more than 42% oil, which is much higher than the oil content of soybeans (20%) (Sarwar et al., 2003, 2004a).

Methodology

Edible oils and their importance. Edible oils and fats are similar in molecular structure, but fats are solid at room temperature, while oils are liquid. Fats and oils are essential nutrients for a balanced diet, accounting for about 40% of the average person's daily calories. Vegetable oils are used as salad or cooking oils or can be converted into margarine and shortening through a hydrogenation process. These products are replacing animal fats (such as butter and lard) as the rapid growth of the world's population increases the demand for these products. Although vegetable oils are also used in industry, the total world production of industrial oils is only 3% of that of edible oils. Industrial oils are used mainly for their fatty acid composition. For example, flaxseed oil contains high levels of linolenic acid, which makes it a fast-drying oil. It is therefore used in protective coatings such as paints and varnishes. Vegetable oils are also used in putty, printing inks, erasers, coating and nuclear oils, lubricants, plastics, and other industrial products.

The residue left after oil extraction—oilseed meal—is an important source of feed for farm animals. Soybean, peanut, rapeseed, and flaxseed meal are very rich in protein and, when mixed with cereals, form a nutritionally balanced feed (Sarwar et al., 2004b, 2011a).

Oilseeds have excellent protein content, quality, caloric value, and overall nutritional value. Phenolic compounds in protein sources of fresh oilseeds are also important components that cause taste and color deterioration, along with factors such as unsaturated lipids, carbonyl compounds and non-enzymatic browning. Phenolic acids are important in food products because they are converted to quinones by enzymatic oxidation and, as a result, bind to lysine and methionine in proteins. Free phenolic acids have been identified in all oilseed flours, of which syringic, ferulic and vanillic acids are the main components in cottonseed, peanut and soybean flours. There are also specific phenolic microcomponents that pose problems when using unrefined flours and protein isolates of some oilseeds in food products:

- In cottonseed – gossypol
- In sunflower – chlorogenic acid
- In rapeseed – sinapine

Conjugated phenols and tannins require further investigation by binding to certain essential nutrients or changing chemical and functional properties (Sosulski, 1979).

Advances in biotechnology and molecular biology. The development of oilseeds and their components as functional food products or sources of nutraceuticals (food with biological activity) is beneficial for consumers and food producers, and creates great opportunities for biotechnology and breeding companies. Scientists are conducting research on the production of soybean and canola oils rich in sitostanol, using molecular biology and biotechnology approaches (Kishore & Shewmaker, 1999).

In addition, vegetable oils with 2-5% phytosterol/stanol content have been developed by expressing the hydroxymethylglutaryl-CoA reductase gene, an enzyme responsible for the rate-limiting step of sterol synthesis in plant seeds (Venkatramesh et al., 2000).

Results and Discussion

The findings from the analysis of oil plants' nutritional significance reveal their crucial role in human health, dietary composition, and economic value. This section discusses the results in the context of macronutrient composition, health benefits, economic impact, and challenges in production and consumption. Oil plants such as soybeans, sunflower seeds, rapeseed, and olives provide essential macronutrients, particularly fats, proteins, and essential fatty acids. The results indicate that vegetable oils derived from these plants are rich in unsaturated fats, notably monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA), which are vital

for cardiovascular health. For instance, olive oil contains approximately 73% MUFAs, primarily oleic acid, which has been linked to reduced inflammation and improved heart health. Similarly, flaxseed oil is a prominent source of omega-3 fatty acids, particularly alpha-linolenic acid (ALA), known for its anti-inflammatory properties and cognitive benefits. Protein-rich oil plants, such as soybeans and peanuts, contribute significantly to global protein intake, especially in vegetarian and vegan diets. Soybean oil, for example, provides high levels of tocopherols (vitamin E), which act as natural antioxidants, protecting cells from oxidative damage. The consumption of oil plant products has been correlated with numerous health benefits. Scientific evidence suggests that replacing saturated fats with unsaturated fats from plant oils can lower LDL cholesterol levels, thereby reducing the risk of cardiovascular diseases. A meta-analysis of dietary interventions demonstrates that Mediterranean diets, which incorporate olive and sunflower oils, are associated with a 30% reduction in the incidence of heart diseases. Additionally, oil plants serve as functional foods with therapeutic properties. For example, coconut oil, despite its high saturated fat content, contains medium-chain triglycerides (MCTs), which have been found to enhance energy metabolism and weight management. Furthermore, certain plant oils exhibit anti-inflammatory and antimicrobial effects. The presence of bioactive compounds such as phytosterols, flavonoids, and polyphenols in oils like sesame and canola contributes to immune system modulation and improved metabolic function.

Economic Importance and Agricultural Sustainability

Oilseed crops are a significant component of global agriculture, with the industry supporting millions of farmers worldwide. The economic impact of these crops is substantial, with soybean and palm oil being the two most extensively traded vegetable oils. The global vegetable oil market is expected to reach approximately **$300 billion by 2030**, driven by increasing demand for plant-based diets and biofuel production.

However, the expansion of oilseed cultivation, particularly palm oil, has raised sustainability concerns. Large-scale palm oil plantations in Southeast Asia contribute to deforestation and biodiversity loss, prompting efforts toward sustainable certification and eco-friendly production. The adoption of regenerative agricultural practices, such as intercropping and reduced pesticide usage, is increasingly promoted to mitigate the environmental footprint of oilseed crops.

Challenges and Future Prospects

Despite their numerous benefits, the overconsumption of refined oils and trans fats remains a public health concern. Industrially processed oils, often used in fast foods and packaged products, undergo hydrogenation, resulting in harmful trans fatty acids that increase the risk of cardiovascular diseases. Public health policies now advocate for the promotion of cold-pressed and minimally processed oils, which retain their natural nutritional properties. Furthermore, ongoing research aims to enhance oilseed crops through genetic modifications and biofortification. For example, genetically modified soybeans with higher omega-3 content are being developed to address global deficiencies in essential fatty acids. Additionally, plant-based alternatives to fish oil are gaining popularity due to concerns over marine resource depletion.

Conclusion

This article reviews the main types of oilseed crops, their cultivation, and processing into oil. It also provides information on the impact of oilseed crops and their derivatives on human health and disease-related aspects, as well as new developments that may provide additional health benefits in the future. Research aimed at improving the properties of oilseed meal will remain relevant in the future. There are two main approaches to this:

1. Improving technological processing processes

2. Changing the composition of oilseeds through plant breeding

As a result of these approaches, it is expected that oilseed meal products with improved nutritional content will be introduced to the market. This increases competition among industry players and further enhances efficiency. Historically, food professionals have had to quickly master the most effective ways to use new co-products and other ingredients as they come to market. A healthy diet depends on a balanced supply of the three main macronutrients: proteins, carbohydrates and fats, as well as vitamins, minerals, antioxidants and other micronutrients. From this perspective, oilseeds play an important role and can contribute even more to health in the future.

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