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# A Detailed Review on Therapeutic Properties of Oil Seed Cakes

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**Abstract:** Oil seed cakes, the leftovers from oil extraction of different oilseeds, are gaining more attention for their possible therapeutic benefits. This review provides a thorough analysis of the therapeutic advantages of oil seed cakes made from various plant sources. It includes the biological components found in these cakes, such as proteins, fibers, polyphenols, and essential fatty acids, which support their therapeutic effects. It also looks at how oil seed cakes could benefit health, including their anti-carcinogenic, anti-diabetic, neuroprotective, promising benefits on the cardiovascular system, blood pressure-regulating effects, anti-oxidative and anti-inflammatory qualities, and anti-microbial capabilities. Several tables and pictures are also included for better understanding. The future of therapeutic properties of oilseed cakes lies in their potential as nutritional supplements, functional foods, and sources of phytochemicals. They may also play a role in sustainable agriculture, biodegradable plastics, and skincare products. Continued research and innovation will drive their applications in health and wellness, waste reduction, and biofuel production, shaping their role in various industries and consumer preferences.

Keywords: Oil seed cakes, Therapeutic benefits, Phytochemicals, Antioxidant.

## Introduction:

Oilseeds are valuable plant-based products known for their high concentration of essential oils and dietary lipids. They also contain proteins, fibers, vitamins, antioxidants, and bioactive compounds, along with various carbohydrates. Oilseeds find applications in both industrial and human contexts due to their exceptional therapeutic potential. Their byproducts like oil seed cakes are gaining attention for their use in creating value-added functional foods and other products through advanced technologies. Protein isolates, hydrolysates, and bioactive peptides can be derived from oilseed cakes (Usman et al., 2023).Oilseeds, in their natural state, are considered basic yet potent functional food ingredients due to their rich content of oleochemicals and phytochemicals. These phytochemicals encompass phenolic compounds, flavonoids, lignans, tocopherols, and tocotrienols, knownfor their antioxidant characteristics. They have an essential function in fighting against oxidative damage in the body and lowering the likelihood of developing some forms of cancer. Thus the oil seed cakes derived from these oil seeds will also possess few of these properties (Sarwar et al., 2013).

The residual cakes left over after extracting oil from oil-seeds serve three main purposes: they can be used as feed for cattle, as additives to enrich compost, or as conditioning agents for plants. The leftover cakes are abundant in minerals, nitrogencontaining compounds and proteins. Studies have explored the potential for these protein-rich resources to be used for human consumption, offering novel food items and addressing the challenges posed by a growing human population and rising food costs. The quality and utility of proteins from oilseed cakes not only surpass currently available protein sources but also provide growers and processors of oilseed crops with an additional source of income. This approach has the potential to lower the carbon emissions and water consumption linked to the production of animal-based proteins (Singh et al., 2022).

Byproduct of oil seed like oilseed cakes (OCs) are currently utilized for various purposes in the food industry. They are sought after for their economic significance, affordability, and nutrient content, including protein, fiber, carbohydrates, and antioxidants. Moreover, their application in the food industry extends beyond nutrition, impacting factors like flavor, texture, color, and antioxidant characteristics (Abedini et al., 2022).Oilseed cakes also offer various therapeutic effects, such as anti-carcinogenic, anti-diabetic, neuroprotective, cardiovascular benefits, and blood pressure regulation. These underutilized resources are abundant in valuable proteins, dietary fibers, and bioactive compounds, making them appropriate sources for bioactive substances to develop innovative functional or nutraceutical products. (Usman et al., 2023).

For example, Jatropha curcas L., a member of the Euphorbiaceae family, is globally used for biodiesel production, and its oilseed cakes possess numerous properties. In addition, it has traditional medicinal uses in Latin America, Asia, and Africa for various ailments(Boudjeko et al., 2013).Scientists particularly in the food industry are becoming increasingly interested in extracting natural bioactive compounds from agricultural by-products, especially oilseedcakes for the purpose of developing therapeutic, nutraceutical, or functional products (Usman et al., 2023).

## **Therapeutic Properties of Oil Seed Cakes:**

## I. Anti-carcinogenic effects:

Oil seed cakes are rich in polyphenols (Teh et al., 2014). Polyphenols found in dietary sources exhibit a dual role in the management of cancer, as they possess the

capacity to both prevent and treat the disease (Augustine & Bisht, 2016). Extensive epidemiological studies have indicated that consuming foods and supplements rich in polyphenols may reduce the risk of developing different cancer such as colorectal, breast, prostate and lung cancer (Rana et al., 2022). This chemopreventive effect is attributed to the anti-inflammatory and antioxidant properties of polyphenols, which are particularly relevant in the context of the oxidative stress and inflammation associated with the tumoral environment (Maruca et al., 2019).

Pre-clinical research has consistently shown the beneficial effects of a diet enriched with polyphenols on cancer development and progression. This positive impact is attributed to the ability of polyphenols to modulate various enzymes and signaling pathways associated with oxidative stress, cell growth and inflammation by regulating gene expression. Consequently, high-polyphenol supplements have been identified as having anti-carcinogenic mechanisms with in vivo intracellular targets (Ricketts & Ferguson, 2018).

A study by Alfuraydi, Devanesan, Al-Ansari, et al. (2019) successfully utilized sesame oil cake to facilitate the biosynthesis of silver nanoparticles (SCAgNPs). Various characterization analyses confirmed the nature of the synthesized nanoparticles. These nanoparticles underwent cytotoxicity testing on MCF-7 human breast cancer cell lines, revealing significant levels of cell death through apoptosis and necrosis. The synthesized SCAgNPs demonstrated promising efficacy against pathogenic microbes and cancer cell lines, indicating their potential for further research exploration.





The oil-seed cakes derived from neem, madhuca, and simarouba contained diverse plant-based compounds with biological importance and potential applications. These phytochemicals showed an effect in preventing various types of cancers (VasudhaUdupa et al., 2021).

A study investigated the effects of total saponins extracted from the leftover seed cake of Camellia oleifera Abel (TSSC) on mice with hepatoma-22 tumors. The results showed TSSC's ability to induce apoptosis (cell death) in cancer cells within solid tumors. Daily intratumoral injections of TSSC over 10 days, at doses of 20  $\mu$ g kg-1, 100  $\mu$ g kg-1, or 2000  $\mu$ g kg-1, were well-tolerated and significantly inhibited tumor growth. TSSC facilitated apoptosis in solid tumor cells by increasing the expression of the Bax protein while decreasing the expression of the Bcl-2 protein, thereby regulating cancer cell apoptosis in mice with hepatoma 22 solid tumors. Molecular docking studies indicated that compounds like camelliasaponins B1, Bcl-2, and MDM2 in TSSC contribute to its anticancer activity, with the glycosidic ligand on C3 being a primary source of this activity. These findings suggest that TSSC possesses anticancer properties, can promote cancer cell apoptosis in hepatoma-22 tumorbearing mice, and may serve as a promising adjunctive therapy, pending further investigation (D. Wang et al., 2019).

Therapeutic potential of Ocimum sanctum seed cake extracts against oral cancer cells by activating the p53 apoptotic pathway was studied. The GC-MS analysis confirmed the presence of alkaloids, phenols, and other compounds in the extracts obtained from the seed cake of Ocimum sanctum (holy basil). The cytotoxicity tests revealed that the aqueous extract exhibited the highest antiproliferative activity against oral cancer cells, while showing no cytotoxic effects on normal L929 cells. Both the ethanolic and aqueous extracts displayed a high selectivity index (SI), indicating their ability to selectively target cancer cells over normal cells. Further studies on DNA fragmentation and gene expression confirmed that the aqueous extract of the seed cake induced maximum activation of the p53-dependent apoptotic pathway in KB oral cancer cells. These findings highlight the therapeutic potential of seed cake extracts from Ocimum sanctum as herbal remedies for the prevention and treatment of oral cancer (Y. Sharma et al., 2023).

Oil seed cakes	Phytochemical content	Reference		
	present			
Flax seed cake	Lignans (e.g.,	Gutiérrez et al. (2010)		
	secoisolariciresinol			
	diglucoside), phenolic			
	acids, flavonoids			
Sunflower seed cake	Phenolic acids (e.g.,	Weisz et al. (2009)		
	chlorogenic acid, ferulic			
	acid), flavonoids,			
	tocopherols			
Soybean seed cake	Isoflavones (e.g., genistein,	Kudou et al. (1991)		
-	daidzein), saponins,			
	phytosterols			
Sesame seed cake	Sesamol, Sesamin,	Sarkis, Michel, et al.		
	Sesamolin, Sesaminol	(2014)		
	diglucoside, Sesaminol			
	triglucosidel			
Rapeseed press cake	Sinapic acid, Sinapine,	Asl and Niazmand (2023)		
	Gallic acid, p-Coumaric			
	acid, Catechin,			
	Caffeic acid, Epicatechin,			
	Ferulic acid, Quercetin,			
	Luteolin			

Table 1: Oil seed cakes and the phytochemical content present in them

# **II.** Anti-diabetic properties

The polyphenol fraction found in flaxseeds has demonstrated remarkable potential in addressing diabetes and its related consequences. This study indicates that the residual cakes obtained after cold-pressing flaxseeds for oil extraction also contain valuable chemicals with potential applications. These cakes are a byproduct that could be further optimized to develop new formulations and phytomedicines for managing diabetes. The polyphenolic compounds present in these flaxseed cakes possess anti-inflammatory properties, which may play a role in addressing the inflammatory complications associated with diabetes. The study suggests that these byproducts from flaxseed oil production could be a valuable source for creating natural therapeutic options to help manage and alleviate the symptoms and complications related to diabetes (Mechchate et al., 2021).

Oilseed cakes contain valuable bioactive compounds, including polyphenols, which exhibit antioxidant properties. These compounds may help regulate blood sugar levels and reduce oxidative stress associated with diabetes. The oilseed cakes, which are byproducts from oil extraction, were subjected to subcritical water treatment, resulting in extracts that contained significant amounts of total phenols and flavonoids. These phenolic compounds present in the extracts contribute to their potential antidiabetic effects. Additionally, the extracts exhibited antioxidant activity, which is advantageous for managing diabetes. Antioxidants play a crucial role in protecting cells from damage caused by free radicals, which can exacerbate the complications associated with diabetes. The presence of these phenolic compounds and their antioxidant properties in the oilseed cake extracts suggest their potential therapeutic value in the prevention and management of diabetes (Švarc-Gajić et al., 2022).

The study by Bigoniya et al. (2012) aimed to investigate the potential hypoglycemic (blood sugar-lowering) effects of sesame seed cake (SSC) on rats fed a high fructose diet (HFD). The sesame seed cake was found to contain dietary fiber, lignans, and phenolic compounds. After one month of being fed the HFD, the rats exhibited significant increases in obesity, hyperglycemia (high blood sugar), hyperlipidemia (high blood lipids), insulin insensitivity, and an elevated atherogenic index (AI), which is a risk factor for cardiovascular disease. However, when the rats' diets were supplemented with sesame seed cake, it mitigated (reduced) weight gain, normalized blood glucose levels, reduced serum cholesterol, and improved glucose tolerance. In the oral glucose tolerance test (OGTT), rats fed the HFD supplemented with 2% and 4% sesame seed cake showed significant reductions in plasma glucose levels after 120 minutes, indicating an improvement in their ability to regulate blood sugar levels after a glucose load.Overall, supplementation with SSC could serve as a therapeutic approach for preventing Type 2 hyperglycemia.

The diet and dietary modifications are critical components in the management of type 2 diabetes mellitus (T2D), playing an important role in both preventing the onset of the disease as well as treating it effectively. Clinical studies involving prediabetes and healthy individuals have shown that foods and beverages rich in polyphenols significantly reduce post-meal blood sugar levels (Özbek & Ergönül, 2022). Additionally, polyphenol supplementation serves as an adjunct in diabetes

treatment. Furthermore, it was found that supplementing with foods containing oat beta-glucan, agave inulin, and polyphenols enhanced the tolerance of male T2D patients to metformin (Usman et al., 2023).

A study investigated the potential utilization of defatted black sesame cake (DBSC), a low-value byproduct from cold-pressed sesame oil production, as a renewable source for producing bioactive products. The focus was on examining the bioactivities of protein hydrolysates derived from DBSC and their peptide fractions, particularly their antioxidant activity and inhibitory effects on enzymes like DPP-IV, ACE,  $\alpha$ -amylase,  $\alpha$ -glucosidase, and pancreatic lipase. The DBSC was hydrolyzed using Flavourzyme, followed by ultrafiltration to obtain peptide fractions of different molecular weights. The results revealed that the products derived from DBSC exhibited antioxidant properties and the ability to neutralize free radicals. Notably, the peptides with low molecular weights (less than 3 kDa) demonstrated the highest inhibitory effects against ACE, DPP-IV,  $\alpha$ -amylase, and  $\alpha$ -glucosidase, suggesting that DBSC could serve as a promising nutraceutical or functional ingredient for managing and preventing disorders associated with free radicals, such as diabetes, hypertension, and hyperglycemia(Chaipoot et al., 2022).

The study by Kamal et al. (2021) investigated the potential anti-hyperglycemic effects of Argan fruit products, including cake byproducts (saponins extract) and hand-pressed Argan oil, through both in vitro and in vivo experiments. In vitro assays were conducted to evaluate the inhibitory effects on  $\alpha$ -glucosidase and  $\alpha$ amylase enzymes, which are involved in carbohydrate digestion and glucose absorption. For the in vivo evaluation, alloxan-induced diabetic mice were orally administered an aqueous saponins cake extract (100 mg/kg body weight) and Argan oil (3 mL/kg body weight), and their blood glucose levels and body weight were monitored for 30 days. The chemical properties and composition of Argan oil, including acidity, peroxides, fatty acids, sterols, tocopherols, total polyphenols, and phenolic compounds, were also analyzed. The results showed that the saponins cake extract significantly reduced blood glucose levels in diabetic mice, outperforming the effect of Argan oil. This reduction was comparable to that observed in mice treated with the anti-diabetic drug metformin over 2-4 weeks. Furthermore, the saponins cake extract exhibited potent inhibitory effects on  $\alpha$ -amylase and  $\alpha$ glucosidase enzymes, surpassing the activity of Argan oil in these assays.

**Table 2:** Different oilseed cakes and their protein contents and nutrition characteristics which helps in lowering blood glucose in patients with type 2 diabetes and improves overall glucose control.

Oilseed cake	Protein content	Others	References		
Sunflower seed cake	37%	Ca, P and Fe	Vasudha and Sarla, 2021		
Cotton seed cake and	21–57%	Amylase	Ancut and Sonia, 2020		
Soya bean cake	40–50%	Ca, P, Na	Chen et al., 2010		
Sesame oil cake	32%	Ca and P, Vitamin B, Lignan (neutraceutical)	Yasothai, 2014; Sunil et al., 2015		
Copra cake	18%	Ca, P, Na, Fe and Zn	Sunil et al., 2015		
Linseed meal	32–35%	Vit. A, and Niacin	Hicks and Verbeek, 2016		
Corn gluten meal	53–65%	Carotene and Xanthophyll	Hicks and Verbeek, 2016		



Figure 2: Therapeutic properties of oil seed cake

# III. Cardiovascular promising effects:

Cardiovascular diseases refer to a group of conditions that affect the heart and blood vessels in a harmful way. This category includes conditions like coronary heart disease and congestive heart failure. Dietary changes can be an effective means to regulate or reduce risk factors associated with chronic diseases, such as atherosclerosis and high blood pressure (Willett et al., 2006). The use of bioactive compounds found in oilseeds and their derivatives, as highlighted byShahidi et al. (2019), is instrumental in the treatment and prevention of cardiovascular disorders. These bioactive substances show promise for human health based on factors like the quantity consumed and their bioavailability. Numerous studies have demonstrated the positive impact of oilseed cakes on the vascular system, including blood pressure reduction, reinforcement of antioxidant defenses, improvement of endothelial functions, inhibition of platelet aggregation and low-density lipoprotein oxidation, and mitigation of inflammatory responses.

Oilseed cakes contain protein, which plays a crucial role in human health. Reports suggest that diets rich in protein (especially plant-based protein) can lead to lower

blood pressure, reduced cholesterol levels, and a decreased risk of heart-related issues (Singh et al., 2022). Oilseed cakes are a good source of dietary fiber. An intake of sufficient dietary fiber has been linked to reduced cholesterol levels and better cardiovascular health outcomes. Soluble fiber, in particular, helps reduce LDL (bad) cholesterol by binding to it and promoting its excretion from the body (Sunil et al., 2014).

The study by Bhardwaj et al. (2020) found that certain oilseed cakes, such as those derived from flaxseeds and chia seeds, are good sources of omega-3 fatty acids. These healthy fats have anti-inflammatory properties and may help prevent heart disease by reducing inflammation and improving blood vessel. Protein hydrolysates derived from oilseed cakes have shown potential as ACE inhibitors. ACE inhibitors help regulate blood pressure by blocking the production of angiotensin II, a hormone that constricts blood vessels. Lower blood pressure is beneficial for heart health function (Ciurko et al., 2022).

## **IV.** Neuroprotective Effect:

Researchers from multiple studies have proposed that the consumption of polyphenols, which are present in various foods and food preparations, may confer beneficial effects on the central nervous system (CNS). These potential benefits include increased cerebral blood flow, enhanced cognitive function in individuals with cognitive impairments, and a reduced risk of neurodegenerative diseases. The antioxidant properties of polyphenols have been explored as a potential avenue for treating mental disorders (Morya et al., 2022).

Oil seed cakes contain oleochemicals, phytochemicals with antioxidant activity, proteins, fiber, carbohydrates, vitamins, and mineral which play a role in neuroprotective health (Teh & Bekhit, 2015). Numerous studies demonstrated the modification of the intracellular signaling cascade and transcription factors that control neuroinflammation and oxidative stress as well as the neuroprotective benefits of dietary interventions with foods high in polyphenols. According to reports, giving patients with stress-mediated depression meal preparations rich in bioactive polyphenols improved their resiliency(Vauzour, 2012). Numerous investigations revealed that preparations rich in polyphenols had the ability to alter both the cerebral blood flow (CBF) and the cerebrovascular network's geographical position. Failure of the cerebrovascular system causes neuronal integrity disruption, a lack of energy substrate, and cognitive dysfunction (Zhou et al., 2019). A diet rich in polyphenols was found to increase the production of nitric oxide (NO) and vascular endothelial growth factor (VEGF) in rats with post-ischemic neovascularization. This led to improved angiogenesis and blood flow. The study

demonstrated the potential beneficial effects of polyphenols on neuronal disorders by enhancing vascularization and blood supply to the affected areas (Usman et al., 2023).



Figure 3: Biological activity of oilseed proteins and peptides

## V. Anti-oxidative properties

Seed cakes from various sources, including sunflower, pumpkin, flaxseed, defatted sesame, as well as nut cakes like almond, pecan, macadamia, and hazelnut, possess antioxidant properties. These antioxidant properties were evaluated using methods such as DPPH and ABTS radical scavenging assays, along with assessments of reducing power and chelating activity. Among the tested extracts, the pecan nut cake extract exhibited the highest levels of the analyzed compounds, followed by sunflower seed and hazelnut cake extracts. Furthermore, these samples demonstrated the most significant effects in scavenging ABTS and DPPH radicals and exhibited the highest reducing power capabilities when compared to the other extracts analyzed in the study (Sarkis, Côrrea, et al., 2014).

Camelina meal is an underutilized source of polyphenols that exhibit exceptional antioxidant properties (Mieriņa et al., 2017).Most recently, researchers looked into the antioxidant capabilities of black cumin seed cake's crude methanolic extract, and they discovered various phenolic compounds with strong antioxidant properties in vitro systems, including hydroxybenzoic, syringic, and p coumaric acids

(Shrivastava et al., 2011). Black cumin cake offers promising potential as a nutritional and natural antioxidant source, making it valuable for inclusion in balanced nutrition and food supplements (Ramazan et al., 2016). Sesame cake was extracted with methanol to obtain a crude antioxidant extract. It showed high level of antioxidant activities (Suja et al., 2005).

A study by D. Xu et al. (2020) optimized the extraction and purification conditions to obtain a crude polysaccharide (CPCP) from the cold-pressed oil cake of Tengjiao (Zanthoxylum armatum DC.) seeds. By using an optimized liquid-to-solid ratio of 44 mL/g, extraction time of 16 minutes, microwave power of 500 W, and temperature of 80°C, the extraction rate of CPCP reached  $4.76 \pm 0.07\%$ . The purification process increased the purity from  $48.52 \pm 2.76\%$  to  $93.76 \pm 2.06\%$ . CPCP was primarily composed of water-soluble pyranose with an  $\alpha$ -configuration and consisted of five monosaccharides: L-Rhamnose, D-Glucuronic acid, D-Glucose, D-Galactose, and D-(-)-Arabinose. Importantly, CPCP exhibited antioxidant activity, indicating its potential as a valuable resource for the development and utilization of antioxidants from this seed cake byproduct.

Oil seed cakes	Antioxidants present	Reference		
Cottonseed	Quercetin	Şahin	and	Elhussein
		(2018)		
Flaxseed	Ferulic acid	Şahin	and	Elhussein
		(2018)		
Sesame	Lignans	Senanayake et al. (2019)		
Hemp	Quercetin	Teh and Bekhit (2015)		
Linseed	p-coumaric	Şahin	and	Elhussein
		(2018)		
Canola	Luteolin	Şahin	and	Elhussein
		(2018)		
Rapeseed	Caffeic acid	Teh and Bekhit (2015)		

**Table 4:** Oilseed cakes and antioxidants present in them.



Figure 4: Percentage distribution of essential amino acids in selected oilseeds.

## VI. Anti-microbial and Anti-inflammatory properties:

A study by Tripathi and Sharma (2016) investigated the antimicrobial properties of Jatropha curcas seed cake against various microorganisms. The results indicated that methanolic extracts obtained from the Jatropha curcas seed cake exhibited antibacterial effects against both gram-positive and gram-negative bacterial strains. Furthermore, the study assessed the impact of Jatropha curcas seed cake extracts on the production of superoxide and nitric oxide in macrophage cells, which are important factors in the immune response against pathogens. The findings suggested that this seed cake byproduct from Jatropha curcas may possess significant antimicrobial and immunomodulatory properties that could be further explored for potential applications. These results indicate the herb's potential for anti-inflammatory and antibacterial activities, likely attributed to its bioactive components with inherent anti-inflammatory and antibacterial properties. The study investigated the anti-inflammatory, anti-ulcer, and hypoglycemic effects of an ethanolic extract (EE) and a crude alkaloid extract obtained from the seed cake of Madhuca indica in albino rats. The results showed that the EE exhibited significant anti-edematogenic (reducing edema/swelling), anti-ulcerogenic (preventing ulcers), and hypoglycemic (lowering blood sugar) activities in a dose-dependent manner. In contrast, the crude alkaloid extract demonstrated significant anti-inflammatory activity only. Both extracts displayed dosedependent inhibitory effects on carrageenan-induced edema, suggesting inhibition of prostaglandins or mediators involved in prostaglandin synthesis, particularly during the second phase of inflammation. Additionally, the EE was effective in protecting against gastric ulcers induced by pylorus ligation at higher doses. The findings indicate the potential therapeutic applications of these seed cake extracts, particularly the ethanolic extract, for managing inflammatory conditions, ulcers, and hyperglycemia. The active principle of EE appeared to selectively inhibit COX II (involved in prostaglandin synthesis) without significantly affecting COX I, as evidenced by its anti-edematogenic and antiulcerogenic effects (Seshagiri et al., 2007).

The study investigated the antifungal and antibacterial properties of ethanolic extracts from different oilseed cakes against soil-borne pathogenic fungi (Fusarium oxysporum and Rhizoctonia solani) and virulent bacterial strains (Bacillus cereus and Rhizobium sp.) using the disk diffusion method. At a concentration of 1000 ppm, the extracts from Prunus dulcis, Gossypium hirsutum, Jatropha curcas, Simmondsia chinensis, and Azadirachta indica seed cakes exhibited significant antifungal and antibacterial activity. Notably, the Gossypium hirsutum seed cake extract demonstrated the highest inhibition against Fusarium oxysporum, the Prunus dulcis extract showed maximum inhibition of Rhizoctonia solani and Bacillus cereus, and the Simmondsia chinensis extract was most effective against Rhizobium sp. These findings suggest the potential of oilseed cakes as natural sources for developing fungicides and antibacterial agents in sustainable agricultural practices. Implementing oilseed cakes as biocontrol agents could benefit horticultural crops, aid in managing industrial waste, and contribute to preserving soil fertility (Fatima & Mukhtar, 2023).

Flaxseed cake, a byproduct of cold-pressing oil, was processed to obtain polyphenol-rich extracts, particularly lignans. These extracts were assessed for potential use in food andcosmetics. HPLC analysis identified and quantified lignans such as SECO, MATA, and LARI. Extracts showed comparable polyphenol content to those from spices or medicinal plants and exhibited significant radical scavenging activity. They also contained notable levels of SECO, MATA, and LARI. Moreover, both crude and hydrolyzed extracts displayed antibacterial activityagainst various bacteria. This process offers a way to extract valuable chemicals from flaxseed cake, adding value to the flaxseed industry (Pag et al., 2014).

## **Conclusion:**

Due to its significant medicinal effects, oil seed cakes—the leftovers from the oil extraction process from various seeds have attracted growing attention. These natural resources provide a wide range of advantages, from advancing agricultural methods to fostering animal health and offering essential human nutrition. Oil seed cakes have been demonstrated to be adaptable and longlasting solutions in a variety of applications due to their strong nutritional profile and bioactive components. Agriculture is one of the main industries that employs oil seed cakes. These cakes are very important in improving soil fertility and sustainability as organic farming techniques gain popularity. Oil seed cakes are rich in critical elements including nitrogen, phosphate, and potassium when used as organic manure or compost. This boosts plant growth and raises production. Additionally, they support a healthy and resilient ecosystem by enhancing the soil's structure, ability to retain water, and microbial activity. Oil seed cakes are useful additives in animal husbandry and are fed to animals as a supplement. They are a healthy and affordable alternative to traditional feed sources due to their high protein content, which includes vital amino acids, vitamins, and minerals. Additionally, some oil seed cakes include phytochemicals that have anti-inflammatory and antibacterial effects, improving animal health and lowering the need for antibiotics.

This improves not only animal welfare but also addresses urgent global health issues including antibiotic resistance. The healing abilities of oil seed cakes also assist human nutrition. Oil seed cakes provide a workable answer to the growing need for sustainable protein sources and plant-based diets. These cakes can become protein-rich foods that can augment or replace traditional protein sources, helping to promote balanced diets and combat malnutrition in various parts of the world, when properly processed and manufactured. The bioactive substances found in some oil seed cakes also show promise as human health therapeutics. In scientific research, these substances such as polyphenols and phytosterols have proven to have antioxidant, anti-inflammatory, and hypocholesterolemic characteristics. Such cakes may help manage cholesterol levels, reduce oxidative stress, fight inflammation, and other conditions that are major risk factors for chronic illnesses like cardiovascular disease and some types of cancer. It is important to recognize that different oil seed cakes exist.

Depending on the seed type and method of oil extraction, differences in composition and characteristics can occur. Some oil seed cakes could have antinutritional components such as phytic acid or tannins that could prevent the body from absorbing nutrients and limit their function as food supplements. These effects can be lessened and the cakes' full medicinal potential can be realized with careful processing, such as heat treatment or enzymatic hydrolysis. Although oil seed cakes' medicinal abilities have tremendous potential, more study and improvement are required to fully comprehend and reap their rewards. Scientists and agricultural specialists must work together to investigate novel approaches to maximize the utilization of these by-products while minimizing any negative consequences on the environment and human health. Furthermore, regulatory frameworks should be put in place to provide quality assurance and security requirements for oil seed cake-based products used in both animal and human applications. Finally, oil seed cakes are recognized as precious resources with great medicinal qualities. Their impact is felt in a variety of industries, including promoting agricultural sustainability, enhancing animal health, and addressing human nutrition. A more sustainable, healthier, and ecologically sensitive future can be achieved by responsibly and scientifically utilizing the potential of oil seed cakes. We pave the path for a more promising and robust global food and agricultural landscape as we continue to investigate and embrace the advantages of these natural byproducts.

## Future Aspects and Trends:

Oilseed cakes' therapeutic benefits will likely continue to rise in line with the expanding demand for sustainable and all-natural healthcare. Oilseed cakes, a byproduct of the oil extraction process from seeds like soybean, sunflower, and flax, are gaining popularity due to their possible therapeutic uses. Their application in nutraceuticals and functional foods is one noticeable development. These cakes are full of bioactive substances, including polyphenols, antioxidants, and plant sterols, which have been linked to a number of health advantages, including the reduction of inflammation and cholesterol.

Oilseed cakes are also being investigated for their use in skincare and cosmetics due to their moisturizing and anti-aging qualities. In addition, efforts are being made to use their antibacterial and anti-cancer characteristics for pharmaceutical reasons. Oilseed cakes are anticipated to be essential in the creation of cuttingedge therapeutic goods, supporting a more holistic and environmentally friendly approach to wellness and healthcare as the demand for plant-based, sustainable healthcare choices rises.

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