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Comparative Study Ofsynthesis and Nutritional Aspects of Lecithin Fromsoya and Sunflower Oil

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ABSTRACT
Lecithin is a fatty molecule that ranges in color from yellow to brown and is found naturally in plant and animal tissues. Lecithin has a number of health advantages as a result of its primary component, phosphatidylcholines. It has been shown to help decrease harmful cholesterol levels in the body. Additionally, it has been shown to boost immunological function, alleviate stomach discomfort, enhance memory, aid in brain development, and promote breastfeeding. Lecithin is used as a supplement due to these advantages. Thus, lecithin may be extracted commercially from soybeans and sunflowers. As a result, this essay will concentrate on the distinction between soy lecithin and sunflower lecithin. The article compares the synthesis and nutritional characteristics of lecithins produced from soybean and sunflower oil. The findings indicate that sunflower lecithin is a more secure and healthy alternative to soy lecithin.

I. INTRODUCTION

A. Overview

Gobley was the first to extract lecithin from egg yolk in 1846. In 1850, he coined the term "lecithin," which comes from the Greek word "lekithos," which meaning "egg yolk [1] [2] [3]." Lecithin is primarily phosphatidylcholine, but it is also a mixture of other phosphatides with a range of colors (from light to dark reddish brown) and a fluid to semi-solid consistency [4] [5] [6]. Lecithin is defined as "a mixture of distinct phospholipids (PLs) extracted from meals of various origins (animal or vegetable) containing at least 60% of acetone-insoluble components [7] [8]." Phospholipids are metabolic intermediates that have a role in the functioning and proliferation of plant cells [9]. Phospholipids are found in practically all of the body's cells [10].

Phospholipids, commonly known as lecithins, are a component of plant and animal cells [11] [12] [13]. In reality, phospholipids make up the outer cell membrane of all living things.

These are natural compounds made from triglycerides in which one of the fatty acids is replaced by a phosphoric group or a nitrogenated base: the fat-related part is the remaining lipid group, while the hydrophilic part is the phosphoric group [14] [15].

Because of this property, lecithin may bind water and oil, which are generally incompatible, making it an emulsifying agent [16].

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Lecithin is widely employed in a variety of applications and functions:

- Emulsifiers, particularly in water-in-oil systems like margarine and chocolate;
- Powder form is easily soluble in oil and dispersible in water;
- Suspensive agent: inhibits aggregation of dust by keeping it disaggregated.
- Wetting agent: aids in the faster dissolution of dusty particles in water.
- Anti-crystallizing agent: prevents the crystallization of sugars in the presence of fat, such as in chocolate;
- Anti-retrogradation effect: it interacts with starch molecules to form complexes that are slower to retrograde, extending the shelf life of baked goods;
- Anti-thickening agent.

B. Sunflower Lecithin

The fatty compounds derived from sunflowers are referred to as sunflower lecithin. It's a group of phospholipids that's vital to human wellness [17] [18] [19].

Natural antioxidants and volatile chemicals are found in sunflower lecithin. These substances aid in the improvement of health and the reduction of disease risk [20] [21].

Phosphatidylcholine, choline, phosphatidylethanolamine, and phosphatidylinositol are only a few of the phospholipids found in sunflower lecithin [22] [23].

Sunflower lecithin contains a high amount of phosphatidylcholine and important fatty acids, according to a study published in the Journal of the American Oil Chemists Society [24] [25]. These chemicals' main job is to keep cell membranes intact [26].

To discover more about the advantages of sunflower lecithin and how to incorporate it into your diet, go to "12 Benefits of Sunflower Lecithin."

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 16356 - 16376
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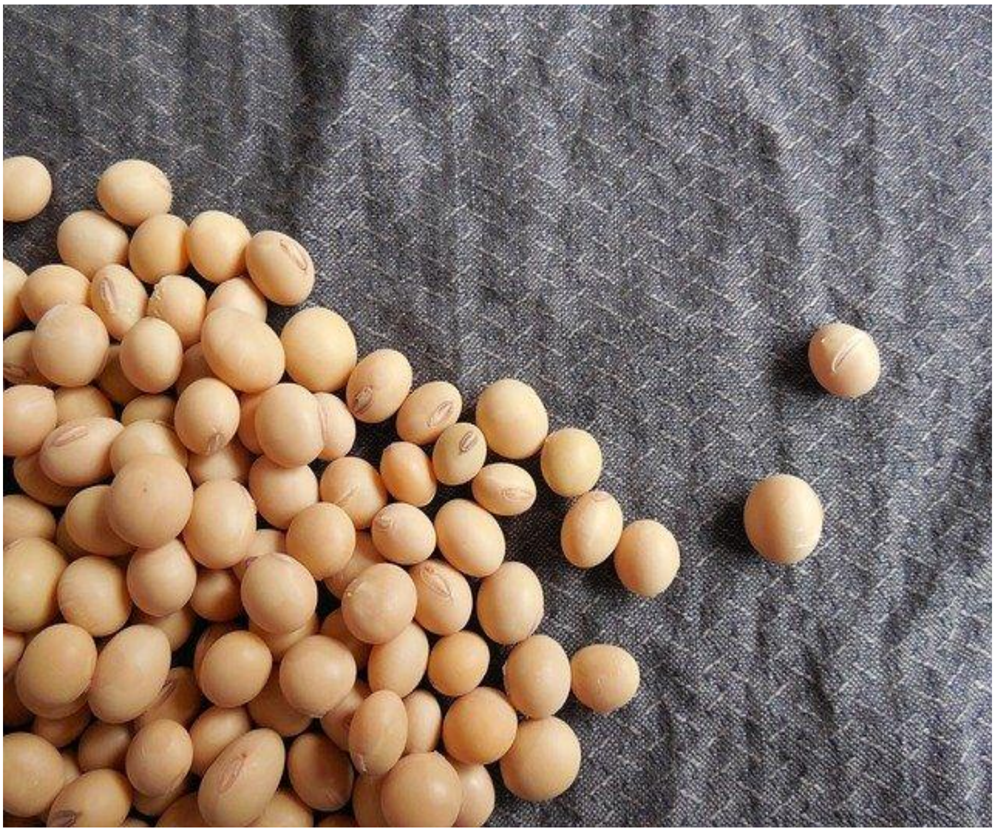
C. Soy Lecithin



The extract derived from raw soybeans is known as soy lecithin. A chemical solvent, such as hexane, is used in the extraction procedure [27] [28] [29].

Following that, the crude soy extract is degummed till the lecithin is hydrated. It is separated from the oil later [30] [31].

After drying, the lecithin is bleached using hydrogen peroxide [32] [33].

Soy lecithin's composition varies based on the producer and intended purpose. Soybean oil accounts for around 35% of the total. It also contains 16 percent phosphatidylcholine, as well as lower levels of phospholipids and glycolipids [34] [35].

D. Fractionation of Lecithin

In most cases, lecithin fractionation entails one or more of the following processes [36].

1. Fractionation of neutral oil including lecithin by solvent treatment 1. Separation of neutral polar lipids (deoiling)
2. Solvent treatment fractionation of deoiled lecithin [37] [38]
3. After chemical modification, solvent treatment
4. Methods of precipitation
5. Methods of ultrafiltration and
6. Chromatographic techniques (mainly for polar lipid separation) [40] [41]

E. Objectives of the Study

- To study the concept of lecithin
- To study the concept of Phospholipids
- To study various sources of Phospholipids
- To study synthesis and nutritional status of Soy and Sunflower lecithin
- To study comparison of synthesis and nutritional status of Soy and Sunflower oil lecithin

II. REVIEW OF LITERATURE

Wealleans *et.al.* (2020) three experiments have explored lecithin's and lysolecithin's capacity to promote the digestion and development of lipids: 1. a model in vitro, which simulates the chick's intestinals, 2. a 5–7-day (chick) digestibility study and 3. a 21-day performance study. In experiment 1, in vitro hydrolysis was used in palm oil (PO+L), lecithin palm oil (PO+LY), and lipolecithin palm oil (PO+LY) to analyse the lipid absorption of caco-2 monolayers. Crude fat ATTD was higher with lysolecithin-supplemented frying, but lower with lecithin-supplemented frying. DM and AMEn were dramatically increased (3.03 and 0.47 MJ/kg respective) in birds treated with lysolecithin. Day 10 and 21 lecithin diets decreased considerably by weight compared to soya oil. However, lysolecithin was greatly improved in avian performance by addition to lecithin-containing meals. In contrast to lecithin, the results of these experiments suggest that lysolecithin has been greatly enhanced for young broiler feed's digestibility and energy levels [42].

Günal-Köroğlu *et. al.* (2019)SFO changes were assessed on the basis of certain physical/chemical characteristics during deep-frying settings. Results show that the inclusion, along with lecithin, of OMWW and OP extracts prevented lipid degradation and postponed lipid oxidation [43]. In comparison with the inspection, oil containing extracts or lecithin showed a light darkening. During deep-frying, fatty acid profiles were similar. OMWW and OP extract enriched SFO is beneficial for usage in deep-freezing oils, and lecithin can be utilized to delay lipid oxidation in deeper frying.

Li*et. al.* (2019) Natural phospholipids have gained much attention during the last few decades for nanostructured drug delivery systems. Although a drug carrier has almost flawless qualities, liposome is known to be removed from the body's systems very quickly. In many investigations this limitation was solved by a surface modification of liposomes. In this review, we explored intensely the surface liposomes that improve focusing, cell physical absorption and therapeutic reaction. Re focused on the treatment of cancer, brain targeting and vaccine use of the soy lecithin-derived liposomes are also detailed in recent applications [44].

Mu, Kaiwen & Kitts, David. (2018)Increasing polyunsaturated poultry meat fatty acid concentration can be linked with chemical oxidation and sensory loss. In this study, the breast of birds and leg muscle meats were tested as substitutes for the tallow in a conventional poultry diet from birds which had graded lecithin levels. The presence of omega-3 was highly unsaturated and there were no changes in feeding diets. The overall increase in PUFA was the reduction in MUFA, whereas SFAs in lecithin birds fed did not alter. There was no significant change in the P/S ratios from un stored samples in refrigerated 5-day storage, cooked breast, and leg products obtained from birds fed lecithin [45]. TBARs, corrected in MDA, increased after a 3- to 5-day period of storage, in both cooked breast and leg meat from tallow-fed birds ($P<0.05$), as compared to lecithin-fed counterparts. This finding showed an antioxidant impact of PUFA retention and lowered MDA for lecithin feeding. Descriptive sensory analyses using lipid oxidation-trained panellists have shown significant

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alterations in flavor, compared to lecithin fed comparable meats, of 5 day coldened meats (e.g., carboard flavor, oxidized aftertaste, sour taste).

Adeyanju *et. al.* (2018) Due to its distinctive phospholipid composition which had a large cryoprotective effect, soy lecithin was employed as a replacement for egg yolk in the domestic animal semen expander during cryopreservation. Effect of the KR buck semen quality with slow freezing method was assessed by different amounts of SL during cryopreservation. Samen samples were taken using artificial vagina from four bucks with KR between two and two and half years. The results revealed that 0% motility (22%) and acrosome integrity (AI) were similar; 85% (22%); 2% (2% ± 4.0%); 3% (13.0% + ± 2.0%), 82% (+ ± 2.5%); 1,5% (+ 2%) and + 4% (+ 2%); 3% (+ +/- 13%, 8% + + 0,41 and 76.9%) and 4.5% (+/- 12% + ± 3.79 and 89.00 ± 2.08) [46].

Elena *et. al.* (2017)The article presents comparative data regarding the chemical composition of lecithins from plant and animal raw material and the physiological functional aspects of the lecithin. The clinical trials reveal the hepatitis lipid-lowering and antioxidant capabilities of sunflower lecithin. The results are reported. The rapid and advantageous impact of sun flora lecithin onto lipid peroxidation processes makes it possible to view this type of lecithin as a viable strategy for preventing and treating a variety of disorders in which pathogens are breached [47].

Viñado *et. al.* (2017) Crude soy lecithin is a by-product of the process of refining soy oil, an important and inexpensive power source for feeding the broiler. Lecithin has a large number of phospholipids which can act as an emulsifier in the fowl gut and enhance the use of dietary fat. It was aimed at studying the use of raw soy lecithin as a source of energy for feeding broiler hens as a replacement for soy oil. In total, 120 one-day Ross-308 women broilers were randomly dispersed throughout 30 cages and assigned to four isonutrient experimental treatments. A 3% (C: 12 repetitions) basal soy diet has been supplemented by soybean oil and increased quantities of soybean lecithin (L) have been added to the substitution of: 1% (L1), 2% (L2) and 3% (L3), respectively, with 6 replicates per treatment. 38 days of growth and two balances between 9-10 d (starting period) and 36-37 d age were done (growing-finishing period). As indigestible marker titanium dioxide (TiO2), 0.5% of the diet is employed. Three degrees of raw soy lecithin were added to substitute soybean oil, which did not alter the performance. In the beginning, the broiler-fed C diet showed considerably higher feed AMEs than L diets and higher TFAs than L2 and L3 ($P<0.01$). The AME of the C diet, however, was no different from that of the L diet during the growing-finishing stage (C: 3310 a; L1: 3466 ab; L2: 3249 b and L3: 3254 b kcal/kg; $P<0.02$). Broilers fed enriched lecithin diets (levels 1, 2 and 3%) showed a similar digestibility percentage of TFA, saturated FA and FA monounsaturated than that of the C diets supplied. The conclusion is that crude soy lecithin can be employed as an alternate energy source in crop-finishing griller diets to replace soybean oil [48].

Zhoua *et. al.* (2017)The dietary quantities of soy lecithin and cholesterol did not significantly affect highly insaturated fatty acids in muscles. The amounts of total soybean lecithin and cholesterol in hepatopancreas are altered considerably. In conclusion, interaction between dietary soya lecithin and cholesterol has an impact on growth, feed use and fatty acids, and on the dietary addition of soya lecithin and cholesterol [49].

Siyal *et. al.* (2017) In the current study, soy lecithin (SL) was examined by measurement of its efficiency, nutetious consumption, serum parameters and hepatic antioxidants in broiler chickens as

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a dietary fat substituent (emulsifier). The average daily increase (ADG) and the average daily feed consumption (ADFI) were better than the control in initially the cultivators and in general the experimental chicken fed with SL, while the SL2 enhanced the FCR compared to SL1 and control. SL0.10 had higher relative liver weight than SL0.05 and control ($P<0.05$) with 21 and 42 days of age. D 21 considerably improves digestibleness in SL0.10-fed chicken diets in comparison to those filled with SL0.05 and control for dry matter and gross energy, ether mineral extract and crude protein. Concentrations in SL0.10 in contrast with the control were lowered in cholesterol, triglyceride, and low-density lipoprotein (LDL). Based on the results of soy lecithin filling, LDL concentrations in serum grills were 0.10% higher growing performance, lowered cholesterol and triglyceride. Furthermore, soy lecithin helps to improve the status of antioxidants and protects from oxidative stress [50].

Rini*et. al.* (2016) Liposomes are formulations which are highly soluble as well as stable. The impact of hypopigmentation is 4-n-butylresorcinol and, like resorcinol, it is unstable. Consequently, 4-n-butylresorcinol could be assisted in the development in a better dosage form by lipsomes. The purpose of this paper was to determine how soy lecithin phospholipide phospholipids affect the size of the liposoma particle. The research reported was Thereafter the influence on the particle size and shape of the liposomes is also provided as the active compound of adding 4-n-butylresorcinol. There was no indication in this investigation that the concentration of phospholipids significantly impacted liposomes. Notably, the particulate size and morphology of 4-n-butylresorcinol liposomes as an active ingredient were considerably different than the 4-n-butylresorcinol free liposomes [51].

Lončarević*et. al.* (2016)The commercial production of vegetable lecithin consists of seeds that carry oil such soya, sunflower and rapeseed. In Serbia and elsewhere, soya seeds are the primary source of lecithin in the clothing business. On the other hand, sunflower and rape oil produce and emulate sunflower and rape lecithin from different candy items on an economically sustainable basis [52]. The physical features of fat filling produced in the oil business are compared with the frequently employed emulsifier-soy lecithin by-products sunflowers and pregnant lecithin. The rotational viscometry, texture analyzer and differential calorimetry scan have been used to establish rheological, textural and thermal properties during the analysis of particle size distribution utilizing the particle size analyzer. The findings achieved suggest that fat-filling generated with soya, sunflower and rapeseed lecithin has similar particle size distributions throughout each application of the fraying time and indicate a suitable manufacture. As far as rheological properties were concerned, fat-filled samples of sunflower lecithin had lower viscosity and textural time than soy and rapeseed lecithin samples at all applied friction times. The higher values of the metrics referred to were altered by soy lecithin.

Merino *et. al.* (2016) In this study, a study was carried out with order to synthesis bio organoclays on the exchange of soy lecithin, a natural product, in bentonite. The organoclays were also described by an examination of the radiation. Effective soy lecithin interspersion was achieved between the clay layers. A small increase in the basal spacing for organoclays was found at low ratios of soy lecithin to bentonite due to intercalation between the clay layers of the organic modification and a significant decrease in water absorption were achieved. When organic contents were raised, the space between the layers rose, but organoclay thermal stability was lowered in relation to samples with a low organic content [53].

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Hosseini, Farzaneh&Sadjadi, Mirabdullah. (2016) In the following papers, we report a one-stop co-precipitation approach of synthesis and characterization of soy lecithin (SL) coated nanoparticles with ferrous and ferric Salts (1:2), varied SLP values (0.0, 1.5 and 6 grammes) and pH <10 ammonia in aqueous solution. Characterization of the sample of magnetite nanoparticles with the average predicted size of 25 nm for naked Fe_3O4, 13 nm for "SPION1.5" and 9 nm for "SPION6" nanoparticles by the equation Sherrer ("Spione 1,5 and SPION6") with X-ray powder (XRD) patterns. Scanning electron microscopy pictures and morphology of the samples (SEM). Detailed chemical nanoparticles analysis was accomplished using X-ray (EDX) energy-distribution data. A vibration sample magnetometer (VSM), a dynamic light scattering instrument (DLS) for measuring the nanoparticle hydrodynamic diameter, has been utilised to test the magnetic property of the produced samples. The results showed that Fe3O4 nanoparticles had coated the lecithin soybean, and that smaller particle had boosted soy lecithin concentrations [54].

Krüger *et. al.* (2015) There is growing concern for food producers because of the problematic supply of non-genetically modified soybeans on the world market. Therefore, the impacts on the chocolate manufacturing of soya replacing with sunflower lecithin were examined in this study. Particularly because of the influence of the two glycerophospholipid on the rheological parameters of chocolate manufacture the phosphatidylcholin content (PC) and Phosphatidylethanolamine (PE) were of particular interest. The substitution of lecithin resulted in relatively modest changes of milk and dark chocolate rheological properties. Detection limits (LODs) and quantification limits (LOQs) have been explored for three detection techniques with seven glycerophospholipids. For HPTLC- FLD, the LODs varied from 8-40 mg/kg; and after derivation with the primuline reagent records were recorded using single quadrouple MS 10-280 mg/kg for HPTLC-ESI+-MS and 15-310 mg/kg for HPTLC-FLD-ESI+-MS [55].

List(2015)Lecithin is a significant part of a host of foodstuffs and non-foodstuffs and one of the most flexible and profitable oilseed industry by-products. Lecithin has over a dozen functions in food, such as a weathering agent, emulsifiers, reduction of viscosity, releasing agents, and control of crystallization. In several industrial applications, Lecithin also offers functionalities. By 1940, the lecithin industry of the United States had been substantially established. The lecithin industry is mature, although it has been affected by numerous issues. Although traditionally sodium has been the main source of lecithin over the world, additional lecithins, for example canola and sunflower, have been sought because of rising demand for non-GMO lecithin. While GMO lecithin was demonstrated to be similar to non-GMO lines, non-GMO lecithin is preferred by the European market [56].

Jangle*et. al.* (2013) The reverse phase high-performance fluid chromatography examined a new, efficient, and easy way to soy phosphatidylcholine analysis based on its content of fatty acid. The proposed high-performance method for liquid chromatography was effectively used in the extraction and purification of soy phosphatidylcholine from deoil lecithin with no contaminants or solvent maximums interfered with. In individual cases, mass spectroscopy was performed on the obtained peaks of phosphatidylcholine soy. The technique devised is economical and well suited for estimating the fatty acid composition of soy-phosphatidylcholine [57].

Cabezas *et. al.* (2011) The agro-ecological environment of sunflower (Helianthus annuus L.) is particularly favorable for production in Argentina. The entire oil producing harvest is deemed to be

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non-GMO in this country. In the degreasing process that is part of the refined process of raw vegetable oils, sunflower lecithins are derived from raw oil by means of gum purification. Due to its multifunctional components the food industry employs lecithins. Changes in the original phospholipid native lecithin composition, such as enzyme hydrolysis, for particular purposes are appropriate [58]. The enzyme activity for the main phospholipids (PC, PE, PI) of the sunflower lecithin in microbial PLA2 (phospholipase A 2) and its effect on processing conditions, (PLA2 0.4, 2.0 / 100 g lecithin without or with the addition of CaCl2 0.4 M, pH 7-9 40-300 min) have been investigated. Phospholipid composition and enzyme hydrolyse level of each phospholipid (percent HPL) were assessed by the sunflower lysolecithin utilizing the31P NMR. The results demonstrated a high concentration of LPL for native lecithins (LPL ~1,1%), which shows process effectiveness, among different hydrolyzed sunflower lecithins. The concentration of PLA2 had a considerable impact on hydrolysis, in particular. A wide range of LPL/PLT percentage values allowed the acquisition of customized lecithins under different operation settings (11.17- 57.48 percent). In addition, the employment of a microbial phospholipase allows a spectrometer of sunflower lecitins with a diverse composition of phospholipids to be developed in food products certified as kosher.

Cabezas *et. al.* (2009) In the food sector, lecithins that are native or modified are frequently employed as a multifunctional component. In order to create enriched fractions under different experimental settings for certain phospholipids, a procedure of fractionation was used in sunflower Lecithin (a non-GMO-product with 100% ethanol, 30–90min fractionation time, ethanol/lecithin ratio 2:1, 3:1). 31P NMR findings have been collected and examined for enriched phospholipid in PC and PI fractions. The percentage extraction coefficients were computed in both fractions for distinct phospholipids (percent EPC, percent EPE and percent EPI). The percent EPC values in PC fractions grew considerably ($p<0.05$) at rising temperature and incubation time from 12. 8 (35°C, 30min, 2:1) to 57.7 (65°C, 90min, 3:1). The percent EPE in all situations tested ranged from 3.0 to 18.3, with a percent EPI showing lower values (<3%) [59].

Judde *et.al.* (2003)A number of fats and oils with a different FA and tocopherol composition have been investigated for their antioxidant impact. Standard lecithins displayed a good protective action against oxidation. Better outcomes have been achieved with greater levels of PC and PE in lecithin samples. No α-tocopherols synergy was found, particularly when the oil examined was rich in linoleic acid. The protection of lecithins against antioxidants in sunflower oil was therefore ineffective. Finally, it was not obviously advantageous to employ broken or enriched lecithins in comparison with normal oil lecithins [60].

Pan, L. &Tomás, Mabel &Añón, M. (2002). The major purpose of the present study was to explore the capacity of various lecithins to emulsify in sunflower to evaluate the usefulness and utilisation of these by-products. On the other hand, a concentration of 0.1% more rapid sedimenting kinetics than 1% were observed. The optimum emulsifying agent for W/O dispersion was determined to be lecithins with high content of phospholipids, particularly phosphatidylethanolamine and phosphatidylinositol. With oil-in-water emulsions, two processes may be observed: emulsion creaming by adding 1% of lecithins, immediate creaming and creaming followed by cremation in the 0,1% addition of lecithin in such circumstances [61].

Wendel, Armin. (2000). Initially a stically-colored, orange phosphorus and a nitrogen-containing substance, originally insulated from egg yolk was first utilised for the name lecithin. In living

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creatures, lecithin and other phospholipids are universal. Different sources use industrial lecithin. Vegetable oils and animal tissues are the main sources. However, the most significant are egg lecithin and especially soy lecithin. The degumming process of soy oil is used to obtain crude soy lecithin. Lecithin consists of six commercial levels: crude; fluidised; highly filtered; compound; chemically modified; and split. Soja is one of the most important food allergies recognised in the US FDA. Nevertheless, soy lecithin has not enough soy protein to cause allergic responses. In the food, drink, health and food items, in cosmetics, and in the industrial products, soy lecithin has numerous uses [62].

III. MATERIALS & METHODS

A. Sample of the Study

The main subject of this study is soy lecithin and sunflower oil lecithin and the samples of the subjects were collected in India only [63].

B. Composition of Samples

The fatty acyl composition of lecithins was analyzed by means of a gas chromatograph of CRISTAL5000, a column of SOLGEL-WAX 30m = 0,32 mm ID SOLGEL-WAX = 0,5μm, GOST R 51486 (GOST 31663, GOST 31665).In order to evaluate the group composition of phospholipids, the Agilent 1260 Infinity liquid chromatograph, LiChrospher 100 250x4 mm column and Diol (5 μm) were used according the protocols.In compliance with GOST EN 12822 the content and composition of the tocopherols have been determined [64] [65] [66].Lecithin has been examined using a Rancimat 743 device in line with GOST 31758 on the stability to oxidation of refined deodorised sun flour oil [67].

The metal content is determined on a GTA chamber and VGA-77 hydride production agilent 240FS atomic adsorption spectrometer [68].

C. Experimental Evaluation

After collecting data, it is evaluated using static reliability calculation which is one of the modern methods with the help of Statistical 13.0, Microsoft Office Excel 2016 and Mathcad. 0.95 was the level of confidence [69].

IV. RESULTS & DISCUSSION

A. Nutritional Status

In oil plant seeds, the lipid complex is composed of phospholipids and is produced with neutral lipids (oil). Table 4.1 presents average statistics on the composition of lecithin phospholipids produced from several kinds of raw materials [70].

The ratio between phosphatidylcholines and phosphatidylethanolamines is a significant indicator of the biological activity of phospholipids alongside the phosphatidylcholines, the content of which is somewhat larger in sunflower lectithin than in soybean lecithin [71] [72]. In comparison with soybean, higher results reflect the increased biological activity of this ratio of sunflower lecithin.

This study has shown that the sunflower seed phospholipids have a substantially higher degree of hepatoprotective impact than the phospholipids on soybean seeds, which comprises of a more

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active regenerative activity on biological membranes, especially on hepatocyte membranes [73].

It should be noted that the sunflower lecithin contains a significant number of phospholipids which have essential physiologically-functional characteristics and whose specificity is studied in modern medicine [74].

Table 4.2 presents the composition of fatty acid acyls in lecithins derived from several types of source materials

Table 4.1: Group composition of lecithins

Name of phospholipid groups	**The content of phospholipid groups, % to the amount**	
	Soybean lecithin	**Sunflower lecithin**
Phosphatidylcholines (PC)	34	36
Phosphatidylethanolamines (PE)	26	17
Phosphatidylinositols (PI)	19	24
Phosphatidylserines (PS) and Lysophosphatidylethanolamines(LPE)	traces	traces
Phosphatidic acids (PA)	4	4
Phosphatidylglycerols (PG) and Diphosphatidylglycerols (DPG)	9	14
Polyphosphatidic acids (PPA)	8	5
Sphingomyelins (SM)	absent	absent
Ratio of PC/ PE	1.4:1.0	2.1:1.0

Table 4.2: Fatty acid composition of lecithins

Name of fattyacids	**Fatty acids content, % of the amount**	
	Soybean lecithin	**Sunflower lecithin**
Myristic $C_{14:0}$	0.1	0.1
Palmitine $C_{16:0}$	22.0	19.0

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 16356 - 16376
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Stearic $C_{18:0}$	4.6	3.6
Arachidonic $C_{20:0}$	0.2	0.3
Behenic $C_{22:0}$	0.4	1.1
Lignoceric $C_{24:0}$	0.4	0.4
	27.7	**24.5**
Palmitoleic $C_{16:1}$	0.1	0.1
Oleic $C_{18:1}$ (ω_9)	10.7	14.6
Linoleic $C_{18:2}$ (ω_6)	55.4	60.4
Linoleic $C_{18:3}$ (ω_3)	6.0	0.2
Eicosenoic $C_{20:1}$	0.1	0.2
Arachidonic acid $C_{20:4}$ (ω_6)	Abs.	Abs.
Docosahexaenoic acid $C_{22:6}$ (ω_3)	Abs.	Abs.
Others	-	-
	72.3	**75.5**

Table 4.3: Composition of concurrent and minor lecithin components

Indicator Name	**Indicator Value**	
	Soybean lecithin	**Sunflower lecithin**
Content of unsaponifiable lipids, %, including:	1. 7	2. 0
cholesterol	absent	absent
phytosterols	0.2	0.6
carotenoids	$5.0x10^{-2}$	$1.0x10^{-3}$
chlorophylls	$0.12x10^{-3}$	absent

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Content of tocopherols, m g%: including:	95	50
α-tocopherol	14	43
β-tocopherol	absent	7
γ-tocopherol	67	absent
δ-tocopherol	14	absent
Content of metals, mg / kg, including:		
Fe	0.4	0.6
Cu	0.3	0.4
Mg	170	380
Ca	900	940
K	560	2040
Na	940	910

Soybean lecithin is characterized by a substantial quantity of linolenic acid associated with antiatherogenic fatty acids of the ~3 class. This physiological benign feature simultaneously determines soy lecithin to be less stable for oxidation and sets particular criteria for production and storage technology [75].

Lecithin from sunflower differs from a big number of oleic and linoleic acids from one soybean. The physiological importance of this type of lecithin is quite significant since monogenic acids are needed to reduce the risk of cardiovascular disease, and linoleic acid.

The positional distribution of acyl of fatty acids in the phospholipid's molecule is an important feature of lecithin's physiological values [76].

In the molecule Phosphatidylcholine two linoleic acid acyls are thus a crucial determining factor in normalizing membrane problems in defining the activity of those phosphatidylcholines and levelling associated ailments in the body. In the scientific literature, there is also evidence of substantial antioxidant, anti-inflammatory, antifibrogenic and other physiologically useful qualities of phosphatidylcholines with two linoleic acid acyls. The research shows that the content of phosphatidylcholines containing two linoleic acid acyls is 40.6 percent on soybean lecithin and 64.2% on sunflower, which shows the latter being more physiological.

Table 4.3 presents the results of the composition of concurrent chemicals and small components of

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Received 25 April 2021; Accepted 08 May 2021.

lecithins.

The data in table 4.3 demonstrate cholesterol, phytosterols are anti-therogenic and their significant presence in sunflower lecithin (relative to soybean lecithins) explains the inherent hypo cholesterol and antiathrogenic capabilities.

In the composition of non-saponifiable lipids, the presence of soybean lecithin and an elevated pigment content (carotenoids and chlorophylls), typically require the procedure of bleaching using hydrogen peroxide to produce marketable products, which severely impacts its physiological value [77].

The data on composition of mineral components of plant-based lecithins in Table 3 reveal that the composition of sunflower lecithin that is conducive for people living with a cardiovascular disease is dominated significantly by bioavailable potassium and magnesium.

If a physiological analysis is made of plant lecithin, the risk of using raw materials undergoing genetic modification cannot fail to be evaluated.

Soya is the world's historic commodity for plant lecithin manufacture, which is why soya is derived from soybean seeds.

The hypolipemic mechanism for the action of sunflower lecithin is primarily associated in processes that increase its 'saturation' degree and thereby alter its physical chemical features and biological properties by involving its constituting phospholipid molecules in the modifying of cellular membrane.

This means that sunflower lecithin can operate as another potential method through the effect of prostaglandins, prostacyclines, leucotrienes and the preceding PUFAs omega-6 production is one of the structural components of phospholipid molecules.

In the liver's pathology, their molecules prevent dystrophic alterations to the hepatocytes and the development of necrosis, as well as improve repair procedures even more soybean. This is because of the hepatoprotective qualities of the sunflower lecithin [78].

The fast and positive influence of sunflower lecithin on lipid peroxidation processes enables this type of lecithin to be regarded as a promising strategy to prevent and treat a range of disorders in pathophysiology that violate the above-mentioned processes.

It should be highlighted that natural exogenous phospholipid have a substantial advantage in their affinity to endogenous. The results of scientific toxicological investigations of natural phospholipids show a total lack of toxicity, both at single high dose levels and for longer consumption periods of up to one year. Embryotoxicity, perinatal and postnatal toxicity are not adequate, and there are no mutagenic and carcinogenic concerns.

Thus, domestically-produced sunflower lecithin can be seen as a promising, independent food ingredient and as raw material to produce comprehensive physiological, pharmacological and culinary constituents.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 16356 - 16376
Received 25 April 2021; Accepted 08 May 2021.

B. Synthetic Phospholipids in Pharmaceutical Formulations

Phospholipids as weighers, emulsifiers and builders or ingredients of mesophase such as liposomes, micelles, mixed micelles, cubosomes are utilized in pharmaceutical technology. These functional characteristics are used in many different formulations such as suspensions, different emulsion types, micelles, solid dispersions, pharmaceutical phospholipid complexes, etc. Phospholipids have a relatively low toxicity profile due to their physiological purpose and can be employed on any pathway.

The scientific academic literature demonstrates that both phospholipids are investigated for every route of administration, both natural and synthetic. However, these characteristics play an important role and should play a considerable part at the industrial level in selecting excipients at the start of the pharmaceutical development process.

It is obvious that synthetic phospholipids are only used in the parenteral/injectable administration when the occurrence of natural and synthetic phospholipids is settled (Table 4.4). In contrast, for any mode of delivery, including parenteral administration, natural phospholipids are employed.

Table 4.4: Frequency (percent) in the inactive list of approval drug products of natural and synthetic phospholipids based upon the route

Excipient	**CAS Nr.**	**Administration route**			
		Oral	**Parenteral**	**Topical**	**Inhalation**
Natural phospholipids					
Lecithin	8002-43-5	55	10	25	10
Soybean lecithin	8030-76-0	60	–	20	20
soybean lecithin	92128-87-5		40	40	20
Synthetic phospholipids					
DMPC	18194-24-6	–	100	–	–
DOPC	4235-95-4	–	100	–	–
DPPG	4537-77-3	–	100	–	–

V. CONCLUSION

Plant-based lecithins have far fewer phosphatidylcholines – a category of phospholipids that have the largest range of physiological actions including prominent hypocholesterolemia, hypolipidemic, and hepatoprotective effects.

In sunflower lecithin the content of phosphatidylcholines exceeds their content in soy lecithin somewhat. The high level of Phosphatidylinositols, a group of phospholipids with key physiological functional qualities, is distinguished with sunflower lecithin, the specificity of which is the focus of modern medicine.

A higher proportion of oleic and linoleic acids in sunflower lecithin is a distinguishing property. The physiological value of this kind of lecithin is rather significant, because mono-ene ω9 acids help to reduce the risk of cardiovascular illness, and acid linoleic is the key element.

The greater amount of phytosterols in sunflower lecithin, compared to soy lecithin, explains the intrinsic hypocholesterolemic and antiatherogenic effects that are apparent.

A high level of bio disposable potassium and magnesium, advantageous to people with cardiovascular disease is described as the composition of mineral sunflower lecithin constituents.

On the basis of the investigations, sunflower lecithin may be inferred to be a promising independent food ingredient as well as a raw material for the production of comprehensive and pharmaceuitous food ingredients in the physiologic field.

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