Journal of Recent Advances in Nanomedicine & Nanotechnology

Juniper Publishers key to the Researchers

Mini Review
Volume 1 Issue 1 - September 2024

J Recent Adv Nanomed & Nanotech

Literature Review: Nano Structured Lipid Carrier Drugs for the Treatment of Different Diseases

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Submission: September 10, 2024; **Published:** September 30, 2024

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Abstract

One cutting-edge method of medication administration is nanostructured lipid carriers, or NLCs. Enhanced bioavailability, controlled release, and targeted administration are just a few of the ways these newer drug delivery systems aim to improve upon older ones. Compared to Solid Lipid Nanoparticles (SLNs), NLCs are more malleable and have a less crystalline structure because they are made of a combination of solid and liquid lipids. The several nanostructured lipid carrier (NLC) drugs used to treat small cell lung cancer are covered in detail in this literature review. Using data collected from a variety of periodicals over the last decade, we have produced statistics on a number of drugs. All research projects and their results pertaining to small cell lung cancer management are included. Medications used to treat this illness are described in depth for the benefit of readers. Since lipid carrier drugs have many positive effects at different doses, we will be concentrating on NLC meds here. Terms like "anticancer drugs," "anti-inflammatory drugs," and "NLC" come up frequently.

Keywords: Nanoparticles; Anti-inflammatory; Anticancer; Solid lipid nanoparticles

Introduction

By combining hot-melt emulsification with sonication, Gilani [1] and colleagues successfully synthesised osimertinib nanostructured lipid carriers (OSM- NLCs) in 2022. To find the best formulation composition, the team employed a Box-Behnken design optimisation. A lung cancer cell line was tested for in vitro cytotoxicity and ex vivo studies were conducted on the final product, OSM-NL Cop. When tested at a negative zeta potential of 24.7 mV, the OSM-NL Cop had a particle size of 162.6 ± 3.5 nm, a polydispersity index of 0.25, and an entrapment efficiency of 80.2 ± 3.9%. The OSM-NLCop exhibited much more drug release (82.52 ± 5.4%), superior permeation, and a 4.8-fold increase in permeation flux when contrasted with pure OSM. The drug release profile of OSM-NLCop was established using the Korsmeyer-Peppas release model and Fickian release kinetics. Furthermore, the IC50 value was lower for the OSM-NLCs, indicating less cytotoxicity when contrasted with pure OSM. Finally, the results indicate that NLCs possess the ability to enhance the therapeutic efficacy of therapy against lung cancer cell lines and are a possible drug delivery vehicle for osimertinib.

Researchers Alhalmi et al. [2] used a heated homogenization-sonication method to create RLX/NRG NLCs (Nanoemulsion Liquid Crystals) in 2022 by combining oleic acid with Compritol 888 ATO. Central composite design (CCD) was used to optimise this technique.

To further characterise and evaluate the improved RLX/NRG NLCs, a variety of technical tools were subsequently employed. Results showed that in the optimised RLX/NRG NLCs, raloxifene had an entrapment effectiveness of 91.05% and naringin 85.07%, with a particle size of 137.12 nm, a polydispersity index of 0.266, and a zeta potential of 25.9 mV. The research also showed that compared to the RLX/NRG suspension, the permeability profiles of the RLX/NRG NLCs were quite superior. It was demonstrated using CLSM photographs that the degree of permeability was 3.5 times higher for the RLX/NRG NLCs' medication compared to the RLX/NRG solution. An in vitro DPPH antioxidant study validated that RLX and NRG had a synergistic impact on antioxidant activity. The combined antioxidant effects of RLX and NRG were more pronounced than those of either compound alone. Wistar rats

were used to evaluate the nano formulations' safety profile using an acute toxicity test. Lastly, our research demonstrates that NLCs have significant potential as a penetrable and weakly soluble oral nanoformulation for codelivery-impaired medicines.

In 2022, "Albaayit [3] and colleagues experimented using diabetic rats caused by streptozotocin to determine whether the anti-inflammatory medicine Zerumbone may hasten the recovery of excisional wounds. To develop ZER-NLCG, the medication was loaded onto a carbopol 940 nanostructured lipid carrier gel. The wound tissue samples were tested for IL-6 and IL-1 levels, tumour necrosis factor (TNF), antioxidant enzyme activity, and hydroxyproline content by the researchers. To further examine the impact on wound healing, histological research was also conducted. According to the findings, ZER-NLCG was the most effective in decreasing levels of proinflammatory cytokines and inflammatory cell infiltration, while simultaneously enhancing antioxidant enzyme activities, hydroxyproline content, and wound tissue granulation."

In 2022, "Varela-Fernandez et al. [4] We out research to examine the potential of keratoconus therapy employing nanostructured lipid carriers (NLCs) loaded with lactoferrin. Particle size, size distribution, surface charge, morphology, loading capacity, stability, cytotoxicity, in vitro release, and ocular surface retention were among the numerous parameters assessed after the NLCs were produced using a double emulsion/solvent evaporation method. The study found that the NLCs had a surface charge of -17.50 ± 2.53 mV, an average size of 119.45 ± 11.44 nm, and a polydispersity index of 0.151 ± 0.045. The loading capacity values reached 75% and the encapsulation efficiency was good. The regulated release of lactoferrin was demonstrated in in vitro release tests. The NLCs exhibited mucoadhesive characteristics in addition to being stable and non-toxic. These results lead the authors to suggest that NLCs might be useful in the treatment of keratoconus as a controlled-release medication delivery device for lactoferrin. This study lays the groundwork for future preclinical studies on lactoferrin-loaded NLCs, which might be a new treatment option for this disease."

In 2022, "Makhdoomi [5] and colleagues studied male mice impacted by AlCl3 neurotoxicity and the neuroprotective effects of silibinin-loaded nanovesicles (Sili-NLCs). A method involving emulsification and solvent evaporation was used to create the Sili-NLCs. Several groups of mice were given AlCl3 over the course of 30 days, and behavioural studies were carried out to assess the neurotoxicity. In order to evaluate histological changes and oxidative damage, brain tissue samples were also collected. The Sili-NLCs exhibited an entrapment effectiveness of 72.65%, a zeta potential of 16.33 mV, and a particle size of 239.7 nm, according to the data. The absorption rate of the Sili-NLCs in the mouse brain was also shown to be 5.7% higher than that of the free drug. Neurotoxicity, histopathological changes, and cognitive impairment caused by AlCl3 were substantially mitigated after treatment with Sili-NLCs. This study concludes that silibinin delivered via NLCs may be more effective than free silibinin treatment in preventing AlCl3-induced neurotoxicity."

Zhu et al. [6] OA-NLC was "developed with the goal of improving oleic acid (OA) skin permeability and stability. Research conducted in a controlled laboratory setting using a cellular model of ultraviolet B radiation showed that OA-NLC had more beneficial therapeutic effects than OA solution (OA-Sol). A hydrogel matrix was used to incorporate both the OA-Sol and the OA-NLC, making their administration to the dorsal skin of mice easier. When contrasted with OA-Sol-gel, the results demonstrated that OA-NLC-gel had much higher antioxidant and anti-apoptotic activity. These results show that OA-NLC can improve protection against UV-induced oxidative damage and overcome the drawbacks of OA's skin delivery. Hence, more research into skin delivery systems utilising OA-NLC is warranted, since they have great potential."

In 2022, Gendy [7] and colleagues "aimed to improve its effectiveness by creating Nanostructured Lipid Carriers of BBR (NLC BBR). After a thorough pharmaceutical examination, the NLC BBR mixture was given to Wistar rats as a two-week oral pre-treatment. The particle size of the optimised NLC BBR was 130.8 nm.By inhibiting the HMGB1/TLR4/NF-B pathway and lowering levels of TNF-, iNOS, COX-2, and MPO, the NLC BBR was determined to be an effective anti-inflammatory agent. Consequently, it showed a strong protective effect on the liver. In addition, NLC BBR increased the prosurvival protein Bcl-2 and decreased the pro-apoptotic marker Bax, demonstrating anti-apoptotic characteristics. The compound's ability to increase TAC and decrease MDA is indicative of its antioxidant capabilities. Additionally, the upregulation of Beclin-1 and LC3-II showed that NLC BBR treatment promoted autophagy flux. In addition to protecting hepatocytes, this therapy reversed histopathological abnormalities and reduced blood transaminases. Finally, NLC BBR successfully decreased concurrent events during warm hepatic I/RN lesions and offered several protective strategies by modulating HMGB1/TLR4/NF-B inflammatory signalling, autophagy, and apoptosis."

Ma et al. "investigated if the compounds might halt the proliferation of A549 cells by loading nanostructured lipid carriers with kaempferol (KA) and hyaluronic acid (HA). The formulations were found to be appropriate for the administration of cancer therapy based on their characterization and safety evaluation. Once the medication was incorporated into the carrier, the TEM images and DSC curve demonstrated that the particle resembled a spherical. In addition, HA-KA-NLC significantly inhibited the proliferation and migration of A549 cells, indicating potent anticancer activities in vitro. Our recent findings suggest that HA-KA-NLC has potential as a future therapy for non-small cell lung cancer (NSCLC) due to its ability to transport medications to targeted tumours in a safe and efficient manner."

In 2021, "Gadag [8] and his colleagues sought to improve the administration of the medicine RVT to the breast by using

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microneedle arrays and nanostructured lipid carriers (NLCs). Using the Design of Experiments approach, the NLCs were examined for their zeta potential, particle size, polydispersity index, and entrapment efficiency. Research found that as compared to pure RVT, RVT-NLCs administered via the microneedle array allowed for more efficient skin penetration and less skin retention. Additionally, RVT-NLCs showed enhanced internalisation, prevented migration of breast cancer cells, and boosted anticancer activity on MDA-MB-231 breast cancer cell lines."

Hajipour et al. [9] "sought to improve the lung cancer therapy by increasing the absorption of galangin and its cytotoxic effects when administered in combination with doxorubicin (DOX). A nanostructured lipid carrier (NLC-RGD) containing arginyl-glycyl-aspartic acid (RGD) was created to do this. NLC-RGD served as the delivery method for galangin. We used the hot homogenization approach to prepare galangin-loaded NLC-RGD, and we used a variety of techniques to characterise it. The potential for cytotoxicity, uptake, and induction of apoptosis in A549 lung cancer cells was assessed using DOX and the produced nanoparticles. The galangin-loaded NLC-RGD-treated cells were further tested for gene expression levels of certain ABC transporter genes. The NLC-RGD nanoparticles had a high loading capacity (59.3 mg/g), a spherical shape, and an adequate size (120 nm), according to the data. In addition, uptake tests demonstrated that NLC-RGD enhanced integrin-mediated endocytosis, which allowed galangin to accumulate within malignant cells. Compared to DOX alone, the cytotoxicity and apoptotic effects of DOX combined with galangin-loaded NLC-RGD were greater. Gene expression studies also showed that NLC-RGD loaded with galangin downregulated ABCB1, ABCC1, and ABCC2 more effectively than galangin alone. Based on these results, NLC-RGD appears to be a useful adjuvant for enhancing the effectiveness of chemotherapeutic drugs in cancer treatment, thanks to the galangin it delivers."

In a recent study by Wang et al. [10], "DDP-P/PTX NPs, which are co-loaded nanoparticles, were developed to treat non-small cell lung cancer (NSCLC) by delivering paclitaxel and cisplatin. Mice with lung cancer were used to test the nanoparticles' anticancer effectiveness and toxicity in vivo, as well as their in vitro cytotoxicity and drug release behaviour. We measured the DDP-P/PTX NPs to be 112.9 3.5 nm in size. The results demonstrated that the combination of DDP-P and PTX nanoparticles, through a reduction in drug release and a pH trigger, worked synergistically to inhibit cancer cell proliferation. In addition, the DDP-P/PTX NPs exhibited outstanding anticancer effects in vivo, characterised by low systemic toxicity and high tumour dispersion. According to the authors, these results suggest that DDP-P/PTX NPs might be an effective anticancer method for non-small cell lung cancer (NSCLC) therapy."

In 2021, "u and colleagues "investigated the possibility of using (NLCs) loaded with miltefosine (HePC) as a medication to treat breast cancer. Particle size, polydispersity index, drug incorporation efficiency, in vitro release, and other characteristics were assessed for the HePC-NLCs that were synthesised utilising a microemulsion technique. In addition to testing the NLCs' anticancer activity in MCF-7 and SCC-7 cells and tumor-bearing mice, the study also assessed their pharmacokinetics, biodistribution, and liver toxicity in rats. According to the findings, the average particle size of the HePC-NLCs was 143 ± 16 nm, and their narrow polydispersity index was 0.104 ± 0.002. The NLCs demonstrated a decrease in hemolytic potential and a prolonged release of the trapped medication in comparison to the test formulations. In addition, the pharmacokinetics of the HePC-NLCs were better than those of the free medication in rats, with increased blood circulation and decreased clearance rate. In MCF-7 and SCC-7 cells, the HePC-NLCs showed increased cell toxicity, and in tumor-bearing animals, they significantly improved anticancer activity ($P < 0.005$). The potential of HePC-NLCs as a medication delivery method for anticancer therapy was demonstrated by the observation of tumour cell death. Last but not least, the study shown that NLCs loaded with HePC can improve pharmacokinetics, antitumor effectiveness, and apoptotic results."

Subramaniam et al. [11] "examined the many uses, kinds, and approaches of drug extraction from nanostructured lipid carriers (NLCs) in detail. The research demonstrated the efficacy of NLCs in chemotherapeutic chemistry and underlined the significance of habitat during extraction. The scientists argue that in the long run, safer, more efficient, and more effective delivery of cytotoxic anticancer drugs might be possible with the development of reconstituted lipid carriers. Several methods have been developed to extract nanoparticles from specific tissues. Among these processes include the use of physiological systems to regulate the particle size, supply, and hydrophobicity. Additionally, antibodies and peptides can be manufactured on the nanoparticle's outer layer to target certain cell types. This allows for the unambiguous recognition of foreign cell receptors and proteins."

According to Munawer et al. [12] study, "creating environmentally friendly nanoparticles (NP) from renewable resources is becoming more popular as a less risky alternative to chemical synthesis. Their study is centred around the manufacture of gold nanoparticles (AuNPs) using an aqueous extract of the endophytic Cladosporium sp. (MycoAuNPs) isolated from Commiphorawightii. This is because creating NPs from plants is both significant and feasible. The MycoAuNPs that are made are examined using imaging microscopy, transmission electron microscopy, X-ray diffraction (XRD), and ultraviolet-visible spectroscopy (UV-Vis). The synthesised NPs had a strong absorbance peak at 524 nm, were 5 to 10 nm in size, and had a spherical shape. In addition to EDX profiling, XRD showed the crystal structure, which confirmed the existence of Au and O atoms. The in vitro and in vivo investigations on MycoAuNPs' biological potential were conducted. By triggering apoptosis, mycoAuNPs were found to exhibit anti-cancer action (IC50 38.23

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g/mL) in the MCF-7 breast cancer cell line. In addition, animal models with malignancies showed promise for the prevention of cancer development by MycoAuNPs. In mice with EAC, MycoAuNPs caused a significant decrease in body weight, ascites volume, and longevity. Genomic DNA fragmentation and Giemsa staining verified that the EAC cells had undergone apoptosis. On top of that, there were no negative impacts or extra difficulties observed in healthy animals. Sunlight may be able to break down dyes like Rhodamine B and Methylene Blue, according to the photocatalytic activity of MycoAuNPs. Their study uncovered a wide range of medicinal and catalytic applications for biosynthesized MycoAuNPs."

TiO2 nanoparticles (NPs) were doped with various quantities of silver nanoparticles using a hydrothermal method by Hariharan et al. [13] (Ag NPs). "The ecologically friendly production of Ag@ TiO_2 NPs makes use of aloe vera gel as a capping and reducing agent. The presence of the anatase phase TiO2 was confirmed by the structural property. As the concentration of Ag was increased, the peak intensity also grew. In order to prove that the Ag@TiO_2 NPs were effective photocatalysts, scientists dug more into their optical and morphological properties. Researchers have looked at the visible light photocatalytic activity of Ag@TiO_2 for picric acid oxidation. The enhanced photocatalytic activity of Ag@TiO_2 at a concentration of 0.010 M is explained by its geometrical properties. To further assess the efficacy against malignancy, lung cancer cell lines were also employed (A549). The production of a great deal of reactive oxygen species (ROS) by injecting Ag@ TiO_2 NPs into the body effectively halted the growth of cancer cells. Tests for cell survival demonstrated that Ag@TiO_2 NPs increased anticancer sensitivity by killing cancer cells and limiting their reproduction through visible light absorption. The researchers found that aloe vera gel's therapeutic properties increased ROS production in cancer cell lines, and that 0.015 M Ag@TiO_2 NPs were very effective against lung cancer cell lines. The development of innovative cancer treatments was the focus of Okubo et al. study. Their findings suggests that the histone deacetylase inhibitor vorinostat may have less anticancer efficacy due to its stimulation of the mTOR pathway, despite its approval for cancer therapy. Their reasoning was that vorinostat would have a greater impact on kidney cancer cells treated with fluvastatin, as the former enhances AMP-activated protein kinase (AMPK), a mTOR inhibitor. In vivo and in vitro, the combination of vorinostat with fluvastatin significantly reduced the progression of kidney cancer by inducing strong apoptosis. Fluvastatin blocked vorinostat's activation of the mTOR pathway by activating AMPK, while vorinostat also stimulated ribosomal protein S6. Histone acetylation induced by vorinostat was amplified by fluvastatin as well. Furthermore, aggresome development occurred as a result of the mixture's stress on the endoplasmic reticulum (ER). In addition, they linked AMPK activation with histone acetylation and ER stress generation to form a positive feedback loop. The combination of vorinostat and fluvastatin effectively inhibits the proliferation of cancer cells, according to their research."

For the treatment of breast cancer, Soni et al [14] "explored the possibility of augmenting Raloxifene oral delivery using a nanostructured lipid carrier. In order to achieve better oral effectiveness with less offsite toxicity, they created and synthesised RLN-NLCs utilising a simple and scalable ultrasonication procedure. The solid lipid used was Compritol® 888 ATO, while the liquid lipid was Transcutol® HP. Many in the medical and scientific communities see cancer nanotherapeutics as a game-changing treatment option.

Despite its anti-proliferative characteristics, raloxifene (RLN) has a low oral absorption and has only been utilised in the treatment of breast cancer. Improved RLN-NLCs were 121 nm in size, had a high entrapment efficiency (EE) of 81% for RLN, and were freeze-dried with mannitol to make them more stable in their dry condition for long-term usage. The drug's decreased crystallinity was confirmed by powder x-ray diffraction, which was employed after RLN was encapsulated within the RLN-NLC matrix. There was a 4-hour burst release and a continuous release that might go on for up to 24 hours, as shown in the in vitro release study. Research on the intestinal permeability of RLN-NLCs in vitro shown stronger cytotoxicity towards MCF-7 cells and greater intestinal permeability than that of RLN suspension in vivo. According to in vivo pharmacokinetic research in female Wistar rats, the oral bioavailability of RLN from RLN-NLCs was 4.79 times greater than RLN solution. The study's authors concluded that raloxifene, a novel nanotherapeutic technique, successfully treats breast cancer."

PEGylated liposomes were examined by Singh et al. [15] "in 2020 as a potential therapeutic platform for oral nanomedicine in cancer therapy. Their research shows that using a thin-film hydration approach, they were able to produce PEGylated liposomes that have desirable qualities as a nanocarrier for increasing the oral bioavailability of drugs that are not very water soluble or permeable. As a viable drug delivery carrier for oral medication distribution, this study investigated PEGylation of liposomes as a means of protecting them from the hostile stomach environment. We developed, characterised, and freeze-dried traditional and PEGylated liposomes loaded with exemestane (EXE) to increase their long-term stability in the presence of trehalose. In ex vivo gut permeability and intracellular uptake studies, PEGylated liposomes were discovered to have improved cell absorption and intestine penetrating abilities. In vivo oral bioavailability of EXE was significantly enhanced by PEGylated liposomes compared to both ordinary liposomes and EXE solution. When tested in PBS with a pH of 7.4, PEGylated liposomes released their medication at a slower rate than unmodified liposomes. Evidence from comparing traditional liposomes with those that have been PEGylated shows that PEG enhances the administration of medicine. Their research led them to believe that PEG-coated liposomes provide a solid foundation for cargo delivery via mouth."

NLCs have been demonstrated to be an efficient bioactive chemical and drug delivery mechanism in the field of nutritional

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supplementation, according to Salazar et al. [16] "Natural lipid caps (NLCs) are the newest commercially viable lipid nanoparticles. They have several advantages over other nano delivery technologies. Food surfactants and lipids of lower grade that have been approved by the FDA or EMA are among the alternatives. It is possible to synthesise NLC without using an organic solvent, and the method may be easily scaled up to large batch quantities using high pressure homogenization. They provide a lot of leeway for customising the loading and release of medications. If the particle size of the NLC is less than 200 nm, it can be sterilised using filtration, self-injury, or gamma irradiation. It is also possible to include NLCs into food systems prior to processing. They are also sprayable and may be lyophilized."

Pillai and Ramalingam [17] "evaluated Approaches to diagnosing and treating non-small cell lung cancer (NSCLC) have evolved substantially since the publication of the Surgeon General's report on smoking and lung cancer fifty years ago. Early identification of lung cancer is now a fact. New technologies, such as positron emission tomography and endobronchial ultrasonography, have improved the precision of non-small cell lung cancer staging. Success rates for treating early-stage non-small cell lung cancer (NSCLC) with multimodality approaches have improved. Patients in the early phases of their condition are being treated with systemic treatment. Recent years have seen the introduction of tailored treatments based on cancer genetics, marking the initial strides towards personalised medicine."

Perez-Moreno et al. [18] "performed research on cancer of the lung. After adenocarcinoma, the most prevalent histologic subtype of non-small cell lung cancer is squamous cell carcinoma (SCC) of the lung. Treatments for SCC have lagged behind those for adenocarcinoma, despite recent advances in EGFR tyrosine kinase inhibitors, bevacizumab, and ALK inhibitors. But there's mounting evidence that genetic defects play a major role in SCC. Therefore, understanding the molecular genetics of adenocarcinoma will take a back seat to molecular characterisation of SCC patients using current profiling technologies in the not-too-distant future. Prospective clinical studies focusing on genetic faults, such as phosphoinositide 3-kinase amplification, discoidin domain receptor 2 mutation, and fibroblast growth factor receptor 1 amplification, should enrol patients with SCC who demonstrate these flaws."

Miles et al. [19] "Every year, more than 35,000 individuals are affected by small cell lung carcinoma (SCLC), a kind of primary lung malignancy that accounts for 16% of all occurrences of lung cancer. The rapid spread of SCLC is well-known, and when identified, two-thirds of patients already have advanced disease. The severe public health burden that is SCLC persists even though the median survival time is just 10 months and the two-year overall survival rate is only 10%. Chemotherapy is the current gold standard for people who do not have localised symptoms. Nevertheless, there is still disagreement about whether or not to continue thoracic radiation therapy with a successful clinical result. Radiation oncologists face a problem while treating ES-SCLC patients who often arrive with advanced disease stages and many metastases. It is still difficult to decide to use thoracic radiation treatment on these individuals, particularly those with a satisfactory performance status, because no randomised trials have shown that it is successful in treating them."

Sohoni et al. [20] "looked at human NSCLC tumours and found that, compared to benign lung, NSCLC tumours exhibited increased glycolysis and glucose oxidation. In oxidative metabolism and the OXPHOS process, which is a mitochondrial energy production mechanism, heme plays an essential role. In this work, we showed that NSCLC cells exhibited elevated levels of heme synthesis and absorption, mitochondrial heme, oxygen-utilizing hemoproteins, oxygen consumption, ATP generation, and key regulators of mitochondrial biogenesis compared to non-tumorigenic cells. Human non-small cell lung cancer (NSCLC) tissues showed an upregulation of heme and mitochondrial activity-related proteins and enzymes, in contrast to normal tissues. Reduced heme uptake, cellular heme concentration, and NSCLC cell tumor-initiating potential were all effects of engineered heme-sequestering peptides (HSP). Adding heme significantly counteracted the effects of HSP on tumorigenic activity. When human NSCLC was xenografted onto mice, HSP2 significantly shrank the tumours. Reduced oxygen consumption and ATP levels were seen in tumours that had been treated with HSP2. Overexpressing the rate-limiting heme synthesis enzyme ALAS1 or the uptake protein SLC48A1 allowed us to produce NSCLC cell lines with accelerated heme synthesis or uptake, respectively. This allowed us to further illustrate the role of heme in boosting tumorigenicity. These cells enhanced tumour development, migration, and invasion in mice. Significantly, tumours generated by cells with improved heme synthesis or absorption exhibited elevated oxygen and ATP consumption. This research proves that NSCLC cells' elevated OXPHOS and tumorigenicity are caused by an increase in heme flow and function. It is possible that heme flow and function might be targeted in the development of lung cancer treatments."

Zappa and Mousa [21] "More over half of lung cancer patients die within a year of their diagnosis, and the 5-year survival rate is around 18%; 2016 assessed the lung cancer prognosis as poor. Not only are environmental and genetic variables known to increase the likelihood of getting non-small cell lung cancer (NSCLC), but smoking is also a major risk factor. The stage of a patient's lung cancer determines which of various treatments are available to them, including surgery, radiation, chemotherapy, and targeted therapy. Improvements in genetics and biomarkers testing have led to the discovery of specific mutations, allowing for more targeted therapy for individual patients."

According to a study conducted by Molina et al. [22] in 2008, "Lung cancer accounts for a disproportionate share of cancer-related deaths worldwide, including in the US. Lung cancer is

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more common among ex-smokers in the US and Canada, but it's on the rise in nations like China, where smoking has become more popular in the last 20 years. About 2/3 of adult males in China smoke, which is equivalent to 1/3 of the global smoker population. Precise staging upon diagnosis is essential for deciding on the best course of therapy for the 85 percent of lung cancer cases in the US that are not small cell lung cancer. Surgical resection is the gold standard for curing non-small cell lung cancer, but unfortunately, it is still not a cure for over 70% of patients. Patients with metastasized illness benefit from chemotherapy, and stage III lung cancer patients are advised to have radiation and chemotherapy together. New anticancer drugs, such as those that block angiogenesis and epidermal growth factor receptors, are changing the game for lung cancer treatment and may eventually boost survival rates."

Sajid et al. [23] "tested *A. nitida's* methanol extracts from the bark and leaves were tested for their ability to suppress the development of human non-small cell lung cancer (NCLC) cell lines A-549 and H460 in vitro. Following therapy with ANL and ANB, the proliferation of both cancer cell lines was considerably slowed down. Cancer cell lines A-549 and H460 showed reduced cell migration, colony growth, and survival when exposed to ANL and ANB. Using rhodamine-phalloidin as a stain, A-549 and H460 treated with ANL and ANB showed changed actin structures. Inducing a G1 phase cell cycle arrest and shrinkage, both extracts are effective. In A-549 and H460 cancer cells, ANL and ANB treatment downregulated NF-B, cyclin D1, and PI3-K protein levels while inhibiting the production of the anti-apoptotic proteins Bcl-2 and Bcl-xL. Furthermore, contrary to what was observed in vitro, C57BL/6 J mice implanted with B16F10 (Mouse Melanoma Cancer Cell Line) cells showed a substantial decrease (p 0.01) in the number of nodules per lung and the levels of various proteins when administered ANL and ANB intraperitoneally (10 mg/kg bw and 20 mg/kg bw, respectively). Based on these results, more study into ANL and ANB as potential treatments for lung cancer is warranted."

In the study by Kowalczyk et al. [24], "the induction of apoptosis in grade IV glioma cells was examined after treatment with extracts from the aerial parts and roots of M. trifoliata plants that were (MtAPV and MtRV, respectively) and from soil (MtAPS and MtRS, respectively). This study presents the first comparison of the biological effects of four different extracts"

M. trifoliata against glioblastoma cells. "In this investigation, the researchers found that M. trifoliata plant root extracts were cytotoxic to grade IV glioma cells but had no effect on normal human astrocytes. A variety of polyphenolic chemicals were identified by a high-performance liquid chromatography (HPLC) investigation.Apoptosis, G2/M phase cell cycle arrest, decreased mitochondrial membrane potential, and altered expression of pro- and anti-apoptotic genes and proteins, including Bax, Bcl-2, Cas-3, TP53, and p53, were discovered to be associated with the inhibition of human grade IV glioma cell growth that was mediated by the MtRV extract.This finding lends credence to the idea that M. trifoliata might be a useful tool in the fight against human glioblastoma cell lines. But we need more studies to figure out how to utilise it therapeutically."

Saravanakumar et al. [25] "examined Analysed the metabolites of Toxicodendron vernicifluum in vitro, in animals, and computationally for their antioxidant, anti-lung cancer, and antibacterial characteristics. All of the extracts significantly and dose-dependently reduced 1, 2-diphenyl-1-picrylhydrazyl (DPPH), according to the results. Total flavonoid concentration (TFC) varied from 1.02 to 15.62% and total phenol content (TPC) from 2.12 to 89.25% in the extracts, respectively. Methanolic bark extract (MBE) had the strongest DPPH scavenging activity because it contained more total flavonoid C and TFC than the other extracts. When tested against human lung carcinoma, only the MBE extract showed sufficient anti-cancer activity (therapeutic index value: 22.26). Murine A549 cancer cells were killed by MBE because it produced reactive oxygen species (ROS), induced apoptosis, halted cell proliferation in the G1 phase, and suppressed survivin, a protein that prevents cancer cells from surviving. The MBE's greater zone of inhibition was 13.5 mm against methycilin-resistant Staphylococcus aureus (MRSA), 11.3 mm against E. coli, and 10.2 mm against Pseudomonas aeruginosa, Salmonella enterica subp. enterica, and Salmonella enterica, respectively."

B. cereus, "indicated that this extract had significantly higher antibacterial activity than the other extracts. With a reduced minimum inhibitory concentration, the MBE also demonstrated strong antibacterial activity (MIC). The MBE in particular shown greater antibacterial action against MRSA."

Damodaran et al. [26] Chemotherapy, "radiation, and surgical excision are the mainstays of cancer management. Nevertheless, these approaches are not without their share of unwanted side effects. On the other hand, herbal remedies are gaining traction as a means of combating cancer. Although there has been no reported use of Calotropis gigantea in cancer care, it is extensively utilised in traditional medicine. As a result, we set out to analyse the cytotoxic activity and phytochemical profile of the methanolic leaf extract of C. gigantea. Cell lines HeLa, MCF7, and A549 were exposed to varying doses of C. gigantea methanolic leaf extract (0, 100, 200, 300, and 400 µg/mL). For research on growth inhibition, the reference medicines employed were cisplatin and camptothecin. Polyphenols, tannins, alkaloids, steroids, terpenoids, and flavonoids were among the phytoconstituents found in the methanolic C. gigantea leaf extract. The cancer cell lines HeLa (IC50 = 117.92 µg/mL), MCF7 (IC50 = 43.65 µg/mL), and A549 (IC50 = 27.32 µg/mL) were in vitro shown to be cytotoxic by the extract. The results showed that C. gigantea had cytotoxic effects on cervical, breast, and lung cancer cell lines in vitro, which means that the crude extract may be used to treat cancer."

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Taymouri et al. [27] "produced biotin-enhanced nanostructured lipid carriers: NLC. We optimised SUN loaded biotin targeted NLCs (biotin-SUN-NLCs) using an irregular factorial design after creating them using the emulsion-solvent diffusion and evaporation technique. Optimal NLC morphology was studied using scanning electron microscopy. A549 cells were used to evaluate the cytotoxicity of several substances, including biotin-SUN-NLCs, blank NLCs, free SUN, and SUN-NLCs, using the MTT assay. The enhanced formulation exhibited spherical particles with an average size of 125.50 nm, an average EE of 85.10%, a zeta potential of 10.23 mV, and a PdI value of 0.3 throughout an 8-hour period, resulting in a drug release efficiency of around 62.85%. The cytotoxicity of biotin-SUN-NLCs was much greater than that of free SUN and SUN-NLCs."

Huangetal.[28]"assessedtheeffectsofanAntrodiacinnamomea ethanol extract (ACEE) on tumour formation in lung cancer cells both in vivo and in vitro. The levels of JAK2 and phosphorylated STAT3 were both reduced by ACEE in LLC cells. In a murine allograft tumour model, oral administration of ACEE significantly inhibited the development and spread of LLC tumours, while having no effect on serum biological parameters or body mass. The usage of ACEE increased caspase-cleavage and decreased STAT3 phosphorylation in tumours of mice. In addition, ACEE prevented nude mice from developing human tumour xenografts."

Muniaraj et al. [29] "For a potential anticancer medication derived from cyanobacteria, in silico molecular docking was performed to determine the best fit between the bioactive chemicals found in cyanobacteria and the receptor responsible for generating lung cancer. The docking score that Lyngbyastatin (Lyngbya majuscula) produced was the highest. Using a human lung cancer cell line (A549) and its methanolic extract, this study assessed L. majuscula's anticancer potential. A molecular docking study was conducted with cyanobacterial chemicals and the EGFR tyrosine kinase. Lyngbyastatin emerged as the top chemical after the docking analysis. The existence of this chemical in *L. majuscula* prompted the use of the MTT technique and other conventional cell viability experiments to evaluate the cytotoxicity of this organism. The DNA fragmentation test was used to identify DNA laddering, and DAPI labelling was used to study the morphology of A549 cells treated with the methanolic extract of the algae."

The docking scores were used to select 12 compounds from a pool of 75 bioactive compounds that were tested with the Epidermal Growth Factor Receptor tyrosine kinase. One of these compounds, lyngbyastatin, stood out as very effective. An IC50 value of 14.82 ± 0.62 µg/mL was recorded in the MTT technique, indicating that L. majuscula exhibited notable anticancer activity against the A549 cell line. Most of the cells that were treated shrank significantly in size, and they no longer looked stretched. The treated cells showed sheared DNA in the DNA profile, but no fragmentation. These findings demonstrated that the methanolic extract of the algae had strong anticancer effects on the A549 cell line, indicating that L. majuscula might be an interesting option for future research into the isolation of bioactive anticancer chemicals.

In 2018, "Citrus flavonoid 2'-hydroxyflavonone (2HF) inhibits renal cell carcinoma growth via a VHL-dependent mechanism, as found by Awasthi and colleagues. Furthermore, the group discovered that 2HF inhibits the enzyme glutathione S-transferases (GSTs), which is involved in the production of glutathione-electrophile conjugates. In order to delve deeper into 2HF's anti-cancer capabilities, the researchers tested its sensitivity in SCLC and NSCLC cell lines and looked into how the Ral-interacting protein (RLIP76) played a part in 2HF's action mechanism. Through decreasing several signalling pathways, such as CDK4, CCNB1, PIK3CA, AKT, and RPS6KB1 (P70S6K), the study demonstrated that 2HF decreased the proliferation and development of SCLC and NSCLC. Together with 1-chloro-2, 4-dinitrobenzene, the researchers discovered that 2HF enhanced doxorubicin accumulation within cancer cells. Lastly, in-vivo investigations in mice with xenografts of SCLC and NSCLC validated the results of the in-vitro research and shown that 2HF, when administered orally, inhibited the progression of both lung cancer types.Based on these results, 2HF is likely to inhibit Rlip as a mechanism of action, and it has the potential to be an effective drug in the treatment of lung cancer."

Latha et al. [30] "investigated bio-inspired gold nanoparticles (AuNPs) derived from Justicia adhatoda leaf extract and assessed their anti-cancer efficacy on A549 human lung cancer cell line. As an environmentally friendly alternative, AuNPs were synthesised utilising an aqueous extract of Justicia adhatoda leaves. The bio-synthesized AuNPs were confirmed and characterized by various spectral studies, including UV-Vis spectroscopy, Scanning Electron Microscopy (SEM) with EDAX, Transmission Electron Microscopy (TEM), Fourier Transform Infrared Spectroscopy (FTIR), and Surface Enhanced Raman Spectroscopy (SERS). Using a fluorescent microscope, we examined the cytomorphology and nuclear morphology of the A549 cell line, and the MTT reduction test was used to measure cell viability."

An ultraviolet-visible peak at 547 nm was seen in the UV-Vis spectra. Research using scanning electron microscopy and transmission electron microscopy established the presence of uniformly sized spherical nanoparticles, measuring an average of 40.1 nm. The binding strength of the C=O group of amino acids to the surface of the nanoparticles was verified by FTIR analysis. Importantly, the MTT experiment showed that our results suppressed the growth of the A549 cell line, with an IC50 value of 80 µg/mL. Propidium iodide labelling and studies of cell morphology established that apoptosis was the cause of cell death.

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This study demonstrates the anticancer potential of bio-synthesized AuNPs, suggesting that these nanoparticles can be used for the treatment of human lung cancer cells (A549) and may be exploited for drug delivery in the future.

Asatiani et al. [31] "examined the fruits and/or mycelial tissues of Grufolafrondosa, Cordycepsmilitaris, Ganodermatsugae var. Using four different human cancer cell lines-HPAF-II for pancreatic cancer, HCT116 for colon cancer, PC3 for prostate cancer, and T47D for breast cancer-the anticancer effects of Jannieae, Hericium erinaceus, Trametes versicolor, Coprinus comatus, and Tremella fuciformis were assessed. Hydrogen, chloroform, ethyl acetate, and ethanol were isolated from these fungi. The most efficient extracts in suppressing cell viability, as measured in dose-dependent reductions of 40-95%, were those from *C. militaris*, *T. versicolor*, and *H. erinaceus*, out of all the studied extracts. Particularly active were the chloroform and ethyl acetate extracts, which demonstrated anti-proliferative activity against all cell lines and the most marked reduction in cell viability. Nevertheless, the viability of all cell lines that were evaluated was unaffected by the tested extracts at low doses (25-50 μg/ml). These findings provide more evidence that certain mushroom extracts have an effect on human cancer cells and may hold promise as all-natural cancer treatments and preventatives."

Jiao et al. [32] "2018 Research on NSCLC cells has shown that *M. tenacissima* extract (MTE) has a potent anti-proliferation impact; however, the mechanisms by which this occurs remain unclear. Apoptosis and autophagy are two crucial systems that control the survival or death of cancer cells. In this work, we looked at the possible anti-proliferative mechanisms of MTE in NSCLC cells in relation to these processes. To determine how quickly H1975 and A549 cells proliferated, the MTT test was employed. Cytotoxicity was assessed by labelling cells with Annexin V and PI, as well as by measuring the expression and activity of caspase 3. Autophagy flux proteins were identified by Western blotting with and without autophagy inducers and inhibitors. Lyso Tracker staining and endogenous LC3-II puncta were followed using confocal microscopy. Autophagic vacuole formation was monitored by acridine orange staining."

Vinothkumar et al. [33] "investigated plumbagin's tumor-suppressing effectiveness in a zebrafish model. A zebrafish transplant was performed using human non-small lung cancer cell lines that had been grown in vitro. Histological analysis verified the progression of the tumour. We let the tumour grow in vivo and gave the fish plumbagin orally for three days in a row. Subsequently, transcriptome analysis was used to track tumour suppression capability. Using IBM SPSS, the pixel integrated density was transformed into relative gene expression. Compared to the control group, tumour diameters were reduced after plumbagin treatment, indicating tumour suppression. The expression of the p53 gene was also upregulated. Results from in vivo zebrafish investigations support the conclusion that plumbagin is a potent anti-tumor agent when applied to human cancer cells."

Robinson et al. [34] "evaluated the antioxidant and cytotoxic effects of Tecoma stans extracts on lung cancer cell lines in comparison to the medicine vincristine. We used the MTT assay to look for cytotoxic effects, and the standard DPPH assay to look for antioxidant ones. The results of the DPPH experiment show that compared to L-ascorbic acid, the antioxidant capacity of T. stans methanolic extract is stronger at higher doses. They demonstrated promising antioxidant capabilities at 20 g/mL. The absorbance at 517 nm ranged from 0.201 to 0.0203, which is lower than the ascorbic acid absorbance of 0.023. The cytotoxic action was examined using the MTT assay, and it was shown that cell mortality rises with increasing extract concentration. At a concentration of 100 g/mL, 99% cell inhibition, or cytotoxic action, is achieved."

Kaur et al. [35] "While squamous cell carcinoma (SqCC) has been the most common kind of lung cancer (LC) at our centre thus far, researched adenocarcinoma is the most common histological type in industrialised nations. In order to ascertain if there has been a shift in the histological distribution, we provide here our ongoing evaluation of the epidemiological trend of LC. A retrospective study was conducted encompassing all individuals who were diagnosed with LC within a 4-year span (March 2011–February 2015). A comparison was made between the present data set and our previously published data (2008-2011) in terms of demographics, histology, and staging. Patients were categorised as never smokers (SI = 0), light smokers (SI = 1-100), moderate smokers (SI = 101-300), or heavy smokers (SI ≥301) using the smoking index (SI), just as previously."

"Arnold [16] and his colleagues examined the treatment patterns and results in a 2016 research that looked at Non-Small Cell Lung Cancer (NSCLC) in young individuals. For NSCLC cases that happened between 2003 and 2009, the researchers used data from the National Cancer Data Base. We classified patients as young if they were between the ages of 20 and 46 and old if they were between the ages of 47 and 89. Survival rates, treatment choices, tumour features, and patient demographics were all examined in the study. The main goals were to determine the patients' overall and relative survival rates after 5 years. Of the 173,856 patients included in the research, 5,657 were in the age bracket of 20–46. Compared to older patients, younger patients had better survival rates and got more aggressive therapy throughout the process. During stage I, a sizable portion of the younger patients (64%), compared to a smaller percentage of the older patients (55%), had surgery alone ($p<0.0001$)."

The elder group had hazard ratios of 1.84, 1.62, 1.18, and 1.14 for stages I through IV, respectively, with all four phases exhibiting better survival ($p<0.0001$). For stages I and II, there was a 25% absolute difference in 5-year overall survival between the younger and older groups; however, for stages III and IV, the corresponding

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differences were 9% and 2%. Overall and relative survival were better in younger patients with NSCLC compared to older individuals, with the advantages being more pronounced in the early stages, according to the study's findings. Although younger patients with advanced-stage NSCLC had more aggressive therapy and had fewer comorbidities, their overall and relative survival were only slightly better than older patients.

Mustafa et al. [36] "examined lung cancer, also known as a lung tumour, is the leading cause of cancer-related mortality among males and the second-most cause among females, behind breast cancer. There were 1.6 million fatalities caused by lung cancer globally in 2012. Some of the things that can increase your risk include smoking, being around radon gas, asbestos, breathing secondhand smoke, air pollution, and your genes. Like other cancers, this one develops when tumour suppressor genes are either silenced or oncogenes are activated. Lung cancer may be classified into two basic types: small-cell lung carcinoma (SCLC) and non-small-cell lung carcinoma (NSCLC). Metastases, hypercalcemia, myasthenia syndrome (muscle weakness), weight loss, weakness, fever, and blood in the cough are some of the clinical manifestations. Diminutive appetite, aches in the bones, and neurological symptoms are all signs of metastatic illness. Radiographs of the chest and computed tomography (CT) scans are the principal diagnostic tools. The TNM (tumour, lymph node, and metastases) approach is used for staging lung malignancies, which are categorised according to histological type. Treatment options include surgery, radiation, and chemotherapy, depending on the kind of cancer. While 16.8% make it through the first five years in the US, fewer than 10% do so in England as a whole. Preventing lung cancer, quitting smoking, and screening those aged 55–80 with a history of smoking are all important steps. Taking vitamin A, D, or E regularly over the long term won't lower your risk of lung cancer. A decreased risk is associated with a higher consumption of fruits and vegetables. Diet and lung cancer are not clearly linked."

Hsieh et al. [37] "further said that one feature of many human cancers is uncontrolled cell growth. Research has shown that plant medicines and herbal extracts can be a rich source of effective anticancer medications. The antiproliferative effect of an n-BuOH soluble Kalanchoe tubiflora fraction was demonstrated to be achieved by inducing mitotic catastrophe. Here, we showed that the water-soluble fraction of Kalanchoe tubiflora (KT) caused cell cycle arrest and senescence-inducing actions in A549 cells. Using 2D-PAGE to evaluate protein expression levels after KTW treatment, we discovered changes in proteins related to energy metabolism and ageing. After administering KT-W to A549 xenografted nude mice, researchers found that the tumour growths were significantly reduced."

Ahmed et al. [38] analysed the results of incorporating finasteride nanoparticles (NPs) into a drug nano solution engineered to sing from the base up. Particle size analysis and NP melting improvements were utilised in conjunction with the reaction area design to assess the implications of structural variability. Using transmission electron microscopy (TEM), the better formulation is morphologically marked. We examined the elemental physicochemical interactions. To analyse crystallinity change, X-ray powder diffraction (XRPD) was employed. Freezing NPs causes them to become more crystalline than the nano suspension in the same water-based solution. Following their synthesis, the NPs were placed into solid gelatin tablets and tested for in vitro disintegration and pharmacokinetic behaviour. The TEM imaging results revealed the altered NP's similarity in shape. Interaction between components was not detected. The use of XRPD assured the successful transformation of crystals into advanced NPs. A melting temperature that was more than 2.5 times higher in pharmaceutical tablets than in pills containing NP medicines was found. Ostwald maturation and the Gibbs free energy of nano suspension formation hindered crystal development after lyophilization. Drug NPs have superior pharmacokinetic properties when contrasted with microparticles and medications. Frozen nanoparticles (NPs) based on drug nanosuspension formulation can improve the stability, solubility, and in vitro elimination of water-soluble medicines, which can affect medication bioavailability. In the TEM picture, the form of the modified NP is visible. Interaction between components was not detected. The use of XRPD assured the successful transformation of crystals into advanced NPs. The melting point was about 2.5 times higher for NP medication-filled tablets compared to commercially available, pure-dose pills. Ostwald maturation event and Gibbs free energy crystal formation was reduced after lyophilizing the nanosuspension. The pharmacokinetic properties of the drug and drug microparticles were inferior to those of the drug NPs. They reasoned that nanosuspension drug production using frozen nanoparticles (NPs) is a good way to make water-soluble drugs more stable, more soluble, and easier to eliminate in vitro, all of which can impact medication development.

In 2015, Kelly K [39] Research on the categorization of lung cancer was carried out by and colleagues. Their research established a clear histological distinction between small cell and non-small cell lung cancers. Coughing up blood, shortness of breath, and chronic coughing are the most typical signs of lung cancer. Other systemic symptoms, such decreased appetite and weight loss, might also be present. Those at high risk who exhibit symptoms should initially have chest radiography for diagnosis. Computerised tomography or positron emission tomography could be necessary if other diagnostic methods fail. In cases when a strong suspicion of cancer exists. Tumour staging, functional assessment, and tissue diagnosis are all parts of this examination procedure. Determining the best course of treatment and making an accurate prognosis estimate all depend on these three simultaneous processes. To diagnose non-small cell lung cancer, doctors look for certain mutations in patient samples. Modern, tailored molecular therapies are available for use in the event that mutations are detected. The patient's family doctor should be involved in their care from the beginning to the end to make sure

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their wishes are honoured.

In 2015, Al-Sheddi et al. [40] tested two cell lines, HepG2 and A-549, to determine the cytotoxicity of seed oil from Portulaca oleracea. After incubating the cell lines with oil at different concentrations for 24 hours, cellular viability and morphology were examined by means of phase contrast inverted microscopy, the MTT test, and the NRU test. In both the HepG2 and A-549 cell lines, the results demonstrated a reduction in cell viability and changes in cellular morphology that were concentration dependant. According to the MTT test, cell viability in HepG2 cells was 73%, 63%, and 54% at concentrations of 250, 500, and 1000 ng/ml; in A-549 cells, it was 82%, 72%, and 64%; and in the NRU test, it was 83%, 68%, and 56%. At 100 g/ml and lower dosages, A-549 cells did not cause cytotoxicity. However, in the MTT and NRU tests, HepG2 cell viability was reduced by 14% and 12%, respectively. Both cell lines shrank in size and lost their distinctive form when exposed to increasing concentrations of Portulaca oleracea seed oil. Portulaca oleracea seed oil was shown to have a strong anti-cancer effect and to have a negative effect on the proliferation of human lung cancer (A-549) and liver cancer (HepG2) cell lines, according to the research.

Liu et al. [41] investigated nicotine-induced NSCLC development to determine the molecular mechanism of NF's anti-cancer activity. The effect of NF on the proliferation of A549 (a human lung adenocarcinoma epithelial cell line) before or after nicotine therapy was determined utilising a cancer cell proliferation assay. When NF and nicotine were present, the TOP-Flash reporter assay was utilised to investigate the Wnt/-catenin signalling activity in cancer cells. Flow cytometry was used in conjunction with a FITC-Annexin V and PI detection kit to quantify apoptosis. There was a downregulation of c-myc, cyclin D, and VEFG-A expression by NF, in addition to downstream targets of -catenin. Another possible explanation for NF's apoptotic effects is that it reduced the Bcl-2/Bax ratio. Not only did NF considerably lessen the harm that nicotine-induced liver malfunction caused, but tumour xenograft nude animals were also unable to support the proliferation of non-small cell lung cancer (NSCLC) cells. The remarkable power of NF to inhibit nicotine-induced NSCLC progression stems from its ability to reduce Wnt/-catenin signalling activity. The findings of this study provide new evidence for the value of this time-honored method of treatment and point to a promising alternative to current approaches of NSCLC prevention and therapy.

Grose et al. [42] projected the survival time of a lung cancer patient. This study examined the therapeutic usefulness of risk stratification in lung cancer patients using the Glasgow Prognostic Score, a famous objective measure of the systemic inflammatory response. Between 2005 and 2008, the research included all patients with newly diagnosed lung cancer who attended the multidisciplinary meetings (MDTs) at four different Scottish centres. Through a prospective data collection process, 882 individuals with newly confirmed diagnoses of lung cancer were analysed, regardless of subtype or stage. Death occurred at an average interval of 5.6 months (IQR 4.8-6.5). Three distinct groups underwent survival analysis based on mGPS score. For the mGPS 0 cohort, the most important predictors were performance status, weight reduction, NSCLC stage, and palliative care given. There was a strong correlation between the mGPS 1 group's performance status, NSCLC stage, and the radical therapy they received. The mGPS 2 group only showed statistical significance for performance status and weight loss. In comparison to other studies, this one shows how mGPS may be used to provide more objective risk categorization for lung cancer patients. The use of mobile GPS for cancer survival prediction has been previously validated by study.

Ganie et al. [43] performed research on the surgical removal of lung cancer in 2013. When it comes to cancers, lung cancer is by far the most common and deadly. Although cancer incidence and mortality rates have been on the decline in certain nations, the situation is concerning in emerging nations like Kashmir valley where cigarette smoking is on the rise and is a major cause of cancer fatalities. We must discover effective strategies to control and cure lung cancer immediately since this global health catastrophe is of enormous proportions.

West et al. [44] The clearest explanation for the dramatic shift in the past decade is lung cancer. As a generally aggressive malignancy, the prognosis for advanced lung cancer is bleak. Nevertheless, new opportunities for targeted treatment and improved outcomes have emerged as a result of the discovery of many molecular pathways underpinning the genesis, development, and prognosis of lung cancer. Based on certain reversible genetic anomalies, we classify lung cancer patients into "molecular subgroups" in this research. Each subtype may be identified by molecular testing, and treatments for each subtype can be developed accordingly. We hope that this work will be useful for both researchers and cli nicians since it will help with therapeutic decision-making and provide the groundwork for future studies.

Raloxifene Hydrochloride Solid Lipid Nanoparticles were produced for increased bioavailability, according to research by Kushwaha et al. [45] from 2013. To enhance its oral availability (SLN), raloxifene was combined with Pluronic F68, a surfactant, and Compritol 888 ATO, a lipid carrier. Using a solvent emulsification/evaporation approach, raloxifene loaded with SLN was prepared by adjusting the amount of surfactant used and the speed of homogenization. Considerations for SLN's characteristics include lipid and drug crystallinity, surface shape, entrapment efficacy, zeta strength, and particle size. Using a dialysis bag distribution approach, researchers investigated in vitro drug extraction on a 6.8 pH phosphate buffer. Their investigation indicated that the capture effectiveness was between 55.6 and 66.6 percent, and that the particle sizes of the whole structure varied from 250 to 1406 nm.

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Conclusion

The use of nanostructured lipid carriers to transport drugs has enormous potential because of the many benefits they provide over more conventional methods. They are a flexible platform for treating a variety of illnesses because they can increase bioavailability, give controlled release, and provide targeted delivery. Expanded clinical uses and better patient outcomes are possible benefits of ongoing research and development, which is expected to overcome present obstacles.

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How to cite this article: Anjali S, Jyoti S. Literature Review: Nano Structured Lipid Carrier Drugs for the Treatment of Different Diseases. J Recent Adv Nanomed & Nanotech. 2024; 1(1): 555555.