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UFASOMES: FROM PRESENT ERA DRUG DELIVERY INNOVATIONS TO FUTURISTIC APPLICATIONS

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ABSTRACT

One or more concentric bilayers made up of amphiphilic molecules cover an aqueous compartment in a vesicular drug delivery device. Because of their capacity to localize drug activity at the location or organ of operation, they are an effective distribution mechanism for targeted drug delivery. The drug activity is sustained at a fixed pace by the vesicular drug delivery mechanism. As a result, the opioid frequency in the body is maintained while the negative side effects are minimized. Unsaturated fatty acid vesicles are known as ufasomes. They are suspensions of closed lipid bilayers made up of fatty acids and their ionized species (soap) that are holding in a pH range of 7 to 9. Fatty acid vesicles are typically prepared using the lipid film hydration process. The most important fatty acid used as a major component in the preparation of ufasomes is oleic acid. The benefits, drawbacks, potential development, and classification of ufasomes are all discussed in this paper.

KEYWORDS: Ufasome, Vesicular Drug Delivery System, Fatty Acid Vesicles, Development, Characterization, Applications.

INTRODUCTION[1]

Ufasomes are vesicles made up of long-chain unsaturated fatty acids that develop when an evaporated film is mechanically agitated in the presence of a buffer solution. Fatty acid vesicles are colloidal suspensions made up of fatty acids and their ionized forms. It is an effective mechanism for delivering drugs to the infection site, resulting in lower opioid toxicity and lesser side effects. A variety of methods have been studied to localize the medication at the site of action and increase the permeation of the biologically active moiety into the tissue, including the creation of vesicular systems such as liposomes. Phospholipids are the primary ingredient of liposomes. Pure synthetic phospholipids are not yet accessible in sufficient amounts, and natural phospholipids are chemically heterogeneous. The main benefit of ufasomes over liposomes is the ready supply of fatty acids. Unsaturated fatty acids like oleic acid and linoleic acid, as well as saturated fatty acids like octanoic acid and decanoic acid, can shape fatty acid vesicles.

The skin is a well-known path for transporting bioactive molecules to particular sites. However, opioid permeation by this pathway is difficult since it serves as a physical buffer between the body and the surrounding world. The stratum corneum, which consists of corneocytes surrounded by lipid regions in the uppermost layers of the skin functions as the primary physical shield. For successful and efficient topical drug distribution, a variety of penetration enhancers may be used. For the treatment of skin diseases, the primary goal of administering medications to the skin is to cause local results at or near the injection point. Dermatopharmacotherapy is a problem that plagues traditional formulations including creams, gels, and ointments (limited local activity). A variety of methods have been investigated to increase the penetration of bioactive moiety into the skin and further localize the medication at the site of action, including the creation of vesicular structures such as liposomes, niosomes, and ufasomes.

Ufasome is an innovative tool for enhancing opioid permeation across the skin. In the preparation of ufasomes, unsaturated fatty acids such as linoleic and oleic acids are used as natural permeation enhancers. Surfactant is often used in conjunction with fatty acids to

enhance skin flexibility and drug movement across the skin membrane. Ufasomes improved medication retention properties inside the cell membrane of the skin cell for a long time.

Fatty acid vesicles are what ufasomes are. The hydrocarbon tails of the membrane fatty acids are directed towards the membrane interior, while the carboxyl groups are in contact with water, forming a bilayer structure. Ufasomes are soap-like suspensions of closed lipid bilayers mostly made up of fatty acids. They normally stay inside a small pH range of 7 to 9.

ADVANTAGES[2]

1. Extends the time a medication is in systemic circulation and decreases toxicity.
2. Since the medication is sent directly to the source, it may achieve selective absorption.
3. Increases bioavailability, especially in the case of poorly soluble drugs.
4. Medicines that are hydrophilic or lipophilic may be introduced into ufasomes.
5. Acts as a continuous release mechanism by delaying the elimination of quickly metabolizable compounds.
6. If the substance is applied topically, it will quickly penetrate.
7. Compared to liposomes and niosomes, ufasomes are less costly because fatty acids are readily accessible.
8. The drug's entrapment quality is appropriate.

GENERALIZED WAY OF FORMATION[3]

For the manufacture of ufasome, only non-oxidized materials are used. Stock solutions of oleic and linoleic acids in chloroform containing 10% oleic and linoleic acids are made and processed at 20°C. 0.02 ml of the stock solvent is evaporated in a test tube on a water pump and then dried with a stream of nitrogen in most preparations. Since intense shaking on a vortex blender, the fatty acid layer is fully broken up in 0.2 ml of 0.1 M tris-hydroxymethyl aminomethane buffer, pH 8–9. Ufasome suspensions formed as a consequence of this procedure are stable for at least 24 hours. In certain studies, the particles are prepared using an ultrasonic generator with a titanium microtip. During irradiation, a current of nitrogen is used to expel air from the buffer, and the suspension is blanketed with the gas. An ice-water bath helps to keep the temperature constant.

METHODS OF PREPARATION[4]

Thin Film Hydration Method

Vesicle forming occurs in a small pH range in this process. It includes combining fatty acid with an organic solvent in a flask with a round rim. This approach necessitates a very strong fatty acid concentration. The liquid is evaporated before the organic solvent has fully evaporated. Finally, a thin fatty acid film is produced, which is hydrated with a pH-appropriate buffer.

By Addition of Alcohol

The addition of an alcohol of the same chain length as the fatty acid results in the forming of fatty acid vesicles in this process. The fatty acid vesicles display good stability across a broad pH spectrum, which is the main benefit of this system. In the presence of pre-added fatty acid vesicles and liposomes, the pace of vesicle forming may be accelerated. This saves time, since this process takes a long time to complete.

Autopoetic Process

Because of the random pH transition, fatty acid vesicles develop when an aqueous fatty acid solution is applied to a water-buffered solution. When half of the carboxylic acids in a fatty acid ionize, there is a potential for vesicles to develop. The hydrocarbon chain forms a bilayer arrangement opposite the aqueous compartment, reducing the hydrocarbon chain's contact with water.

KEY ISSUES IN MANUFACTURING OF UFASOMES[5]

Selection of fatty acid

The 12 to 22 carbon fatty acids seem to be ideal for the formulation of stable ufasomes, based on analysis of natural membrane phospholipids and knowledge from pressure region measurements on fatty acid surface films. In reality, the C-18 acids were the focus of the majority of the research since they demonstrated the most potential in early trials. Only oleic acid (*cis*-9-octadecenoic acid) and linoleic acid (*cis*-9,12-octadecenoic acid) shaped membranes, enabling the ufasomes to satisfy these requirements. In an oleic acid membrane, palmitic acid is tolerated up to 33% by weight, and stearic acid is tolerated up to 5% by weight. The preparations are not improved by charging the membrane with minimal concentrations of oleic, linoleic, or stearic acid amides. Oleic acid stayed uncontaminated by peroxides for at least 6 weeks, although linoleic acid formed major peroxide after 2–3 weeks, according to stability testing.

Addition of cholesterol

Cholesterol has the unusual capacity to modulate membrane fluidity, elasticity, and permeability in lipid vesicles. It essentially fills in the holes left by other lipid species' incomplete packaging. In the presence of higher cholesterol concentrations, the ability of vesicles to retain solute declines rapidly. Furthermore, no increase in membrane impermeability occurs at any cholesterol concentration. Researchers contrasted glucose leakage from ufasomes containing 17 percent incorporated cholesterol by weight to leakage from spheres containing 17 percent incorporated cholesterol by weight. According to their findings, glucose leakage from vesicles of 17 percent added cholesterol was higher than glucose leakage from cholesterol-free oleic and linoleic acid ufasomes.

pH

Fatty acid vesicles may only develop in a specific pH range (7–9), where roughly half of the carboxylic groups are ionized. Fatty acids form unstructured precipitates below this range, whereas they are too soluble above. At an 80 mM total concentration, a titration curve of the oleic acid/oleate method will distinguish three regions for micelle, vesicle, and oil droplet formation. Micelles (higher ratio of ionized to protonated molecules) are the dominant aggregation species at higher pH, while oil droplets grow at lower pH. It's much simpler to recognize fatty acid vesicle systems at concentrations only above the essential vesiculation concentration, or CVC, at which vesicle formation is observed. Monomers and nonvesicular aggregates join into a bilayer configuration at the essential vesiculation concentration, forming colloidal vesicle suspensions. It's also worth noting that diluting a fatty acid micellar solution to neutral pH results in the random development of vesicles with a broad size distribution.

Selection of buffer

Tris hydroxymethyl aminomethane is a commonly employed ufasome preparation buffer. Borate, glycine-hydroxide, and bicarbonate solutions, on the other side, create spheres. The type of solute to be incorporated determines the buffer used. For example, in the case of glucose entrapment in vesicles, ufasomes prepared in bicarbonate did not hold glucose, while borate preparations could not be checked for retention due to the creation of a glucose buffer complex. With tris, the optimal weight of buffer must match the weight of fatty acid used to shape membranes; therefore, to form ufasomes from 1 mg of fatty acid, 0.1 ml of 0.1 M tris at pH 8 is needed.

Electrolyte

The production of ufasomes is hindered by most electrolytes. When the spheres have been stabilized in the required buffer, they may be subjected to phosphate or chloride solutions while still retaining the occluded glucose.

Peroxidation

Peroxidation's primary impact on ufasome membranes is to interrupt the natural bilayer structure of fatty acid molecules. Peroxidation of a bulky hydrophilic group will deform the hydrophobic membrane interior, enabling water-soluble molecules to migrate more easily. The degree of fatty acid peroxidation may be greatly influenced by the method of preparation. Over the brief periods needed for hand vortexing, no peroxidation occurred. When subjected to 30-W irradiations during a more aggressive ultrasonic resuspension, linoleic acid oxidized at 0.1 percent per minute in air-saturated buffers. This process did not achieve extensive oxidation of even oxidation susceptible linoleic acid since the longest exposure time was 3 minutes. However, Hicks and Gebicki discovered that nitroxide radicals, butylated hydroxytoluene, and alpha-tocopherol would resist linoleic acid membrane peroxidation.

Divalent cations

Enzymatic and non-enzymatic catalytic mechanisms are involved in lipid peroxidation (LPO). Nonenzymatic lipid peroxidation depends strongly on transition metal ions. Just a few metals that experience a valency shift requiring a single electron transfer will catalyze quick peroxidation in unsaturated lipids. Lipid peroxidation has been shown to be influenced by non-variable valence state metals such as calcium, magnesium, and zinc, which cannot participate in redox-coupled homolysis. Calcium ions have a biphasic influence on LPO, which implies that they may both activate and suppress the enzyme. Researchers looked at calcium's biphasic activity in liposomes (made from egg yolk lecithin) and ufasomes (from linoleic acid and methyl linolenate). In the presence of ascorbate or hydroperoxide, as well as Fe^{2+}, LPO was induced in liposomes and ufasomes. Ca^{2+} induced LPO in lipid by interfering with negatively charged lipid groups (phosphate groups of lecithin, carboxyl groups of linolenic acid), displacing bound Fe^{2+} ions and the concentration of free Fe^{2+} ions, which engage directly in LPO catalysis, at low concentrations (10^{-6}-10^{-5}). Ca^{2+} based inhibitory activity was dependent on its association with superoxide anion radicals at high concentrations (10^{-3}). Other cations with large charge density are also capable of releasing Fe^{2+} ions attached to negatively charged groups of lipids and reacting with superoxide free radicals, but it's not only Ca2+ ions that have this biphasic effect on LPO. In the absence of Ca^{2+} ions, it was discovered that adding La^{3+} ions to linolenic acid ufasomes at a concentration equivalent to Fe^{2+} ions stimulated LPO. On the combined activity of equimolar concentrations of Ca^{2+} and La^{3+} (when their overall concentration surpassed that of Fe^{3+}), an impact of inhibition of linolenic acid peroxidation was detected.

CHARACTERIZATION OF UFASOME[6]

Particle Size and Size Distribution

Using Photon Correlation Spectroscopy, a particle size analyzer is used at a fixed angle of 90 degrees and at 25 degrees Celsius to evaluate the average diameter and size distribution of ufasome suspensions. The suspensions were passed into a polycarbonate membrane after being diluted with phosphate buffer (pH 7.4). Until sizing, this is done to reduce interference in particulate matter.

Shape and Surface Morphology

Transmission Electron Microscopy can be used to analyze morphological parameters such as sphericity and accumulation of drug-loaded ufasomal dispersion (TEM). One drop of the chosen ufasomal dispersion may be tested on a carbon film-covered copper grid that has been negatively stained with 1% phosphotungstic acid. The sample is then permitted to dry for 10 minutes at room temperature before being analyzed by TEM.

Differential Scanning Calorimetry
Differential Scanning Calorimetry is used to investigate the physical condition of the substance within the oleic acid vesicles. The vesicles were mounted in a standard aluminum pan and scanned at a rate of 2°C/min.

Entrapment Efficiency
Ultracentrifugation at 25000 rpm for 3 hours at 4oC can be used to calculate the drug's entrapment effectiveness. UV spectroscopy may be used to measure the entrapment efficiency using the supernatant. The following equation can be used to calculate the volume of the entrapped drug as a percentage:
Entrapment efficiency (%) = (Amount of drug added initially - Amount of drug determined in the filtrate spectrophotometrically) / Amount of drug added initially × 100

***In Vitro* Drug Release**
The aim of this analysis is to determine the drug's release rate and kinetics from ufasomes. Franz diffusion cells may be used to do this. The Franz diffusion cell has two compartments: a donor compartment and a receptor compartment. In these two compartments is a polycarbonate membrane with a pore size of 50 nm. The donor compartment contained 1 ml of ufasomal dispersion, while the receptor compartment contained phosphate-buffered saline (PBS), pH 7.4, which was stirring at a steady pace with a magnetic stirrer and held at 37°C. At pre-determined times, aliquots of samples are removed and supplemented with equivalent amounts of fresh PBS (pH 7.4).

pH-Dependent Stability
The influence of pH on the stabilization and drug release activity was tested by incubating optimized vesicular dispersion with buffers of pH 8.5, 7.4, 6.5, and 5.5. The samples are collected at fixed times and centrifuged for 30 minutes at 14,000 rpm. The supernatant may be used to test the free medication produced. The following method can be used to measure the volume of drug that has been leached:
% Drug diffused = Amount of free drug / Total drug × 100

DYNAMIC NATURE OF UFASOMES[7]

Since fatty acid vesicles are made up of single-chain amphiphiles, one of their most noteworthy characteristics is their complex existence. Fatty acid vesicles are distinguished from traditional vesicles made of double-chain amphiphiles and micelles made of single-chain surfactants by dynamic properties. The reality that the protonation/ionization ratio of the terminal carboxylic acid can be modified to create a number of fatty acid aggregates. The formation kinetics of ufasome is studied by researchers. Dialyzing fatty acid/soap monomers via a cellulose acetate membrane was used to compare the forming kinetics of micelles and vesicles from a saturated fatty acid/soap monomer solution. The rate of attainment of equilibrium was measured starting with an asymmetric distribution of fatty acid/soap molecules between two chambers divided by the dialysis membrane, one containing aggregates (micelles or vesicles) and the other containing just the buffer solution. Micelles emerged in the diffusate chamber, and the fatty acid/soap concentrations in both chambers were equal. The achievement of an equilibrium condition in the case of vesicles, on the other hand, was significantly hampered (the concentration in the diffusate increased very slowly after the solution was saturated with monomers). The amount of amphiphiles in vesicles is usually much higher than in micelles. The findings of the dialysis studies with fatty acid vesicles indicate that forming fatty acid vesicles has a far higher energy barrier than forming fatty acid (soap) micelles. The addition of an alkaline soap solution to an intermediate pH buffer solution is a simple method of preparing fatty acid vesicles. As a condensed solution of sodium oleate micelles is applied to a buffered solution at pH 8.5, oleic acid/sodium oleate vesicles develop spontaneously due to partial protonation of the oleate molecules induced by the pH decrease from around 10.5 to 8.5. The size and lamellarity of the vesicles produced are polydisperse. When alkaline micelles are applied to buffered vesicles, fatty acid vesicles evolve spontaneously.

STABILITY CONSIDERATION IN UFASOME FORMULATION[8]

The decrease in the free energy of the fatty acid-water system is crucial for the long-term survival of ufasome membranes. Since the acids enter a different step at pH 8, the membrane does not form spontaneously. Under the right conditions, though, even gentle mechanical agitation is enough to induce bilayer forming. The enhanced entropy of water that occurs as a result of the hydrophobic interactions of the directed hydrocarbon chains accounts for a large part of the energy liberated in this phase. Mutual repulsions of the ionized carboxyl head groups in the bilayer reverse the enticing contact. Electrolytic dissociation reduces the resilience of fatty acid films which may lead to their rupture. The existence of screening counter ions will reduce charge repulsion by lowering the degree of head group dissociation, forming stable complexes between protonated and ionized carboxyl headgroups, or decreasing the degree of head group dissociation. Any of these pathways may play a role in ufasome membrane stabilization. The lowering of pH at the particle surface, which is beneficial to membrane stability, reduces lateral charge repulsions. In many cases, a decrease in ionization increases membrane stability. To begin with, in contrast to anions, protonated molecules are almost insoluble in water. Second, lateral headgroup repulsion is reduced; as the second charge is removed from a film of tightly packed headgroups, the average gap between charges rises by around 40%, halving coulombic repulsions. Third, protonated acid molecules (AH) and anions (A-) form a sequence of closely bound complexes, the most typical of which is a 1:1 complex. Free energy modifications resulting from hydrophobic interactions, the entropy of demixing

correlated with dimer formation, and a free energy reduction resulting from the formation of hydrogen bonds between protonated and ionized carboxyl groups make up the energy for binding. Due to the existence of a negative charge near to the hydrogen involved in bonding, studies of interactions in dicarboxylic acids have shown that extraordinarily strong hydrogen bonds develop between COOH and COO groups. Headgroup hydrogen bonding with water, complicated forming of ionized and neutral acid molecules, and hydration of dissociated carboxyl groups both lead to the stabilization of ufasome membranes. Furthermore, the same dispersion and hydrophobic associations that bring micelles and membrane interior regions together often keep the hydrocarbon regions of fatty acids together.

MICROSCOPIC STUDIES[9]

The electron microscopy of sectioned vesicular structures showed the organization of biological membrane components such as fatty acid and phospholipid. However, it was generally understood that the requisite fixing and staining necessitates harsh chemicals, which can trigger distortion of these fragile structures, resulting in loss of definition and the creation of objects. Less abrasive methods may also be used to mitigate those concerns. The freeze-fracture technique is one of the most effective techniques for working with natural components. The identification of birefringence is an even gentler process. Electron microscopy of negatively stained specimens used to research the ufasome structure revealed that they did not withstand the preparatory steps. Both attempts to stain ufasomes for electron microscopy with neutralized potassium phosphotungstate failed to yield specimens with any internal structure.

Freeze fracturing and etching

Next, the ufasome suspension is equilibrated for 10 minutes with 17 percent glycerol before being frozen. After that, the ufasome suspensions are quickly frozen into copper helmets with Freon and eventually stored in liquid nitrogen. Fracturing takes place at 110°C and 2×10^{-6} Torr pressure in a Balzers microtome. The temperature is elevated to 100°C for 1 minute for etching. Following cutting, a layer of platinum and carbon is accumulated on the fracture face at a 45° angle to a thickness of 3 nm. The most efficient way for washing replicas is to float them off the metal helmet into the water, which is eventually mixed with methanol until the solution is 80 percent alcohol. Both signs of fatty acid were eliminated in 30 minutes. A Hitachi HS8 electron microscope is then used to test the replicas. The appearance of ufasomes produced from oleic or linoleic acids did not vary, according to the researchers. Since ufasome preparations included a strong proportion of water, ice made up a significant portion of the freeze broken face, which had a rather uneven surface. Etching the surface, especially, if the ufasomes had been pre-equilibrated in glycerol, resulted in a strong differentiation between ice and the particle surface. The exposed exterior and inner surfaces of the fatty acids are smooth, while the underlying ice is normally granular. The area between the membranes is rough as well, showing that it was once packed with water.

Birefringence

The large variability of inter-membrane distances typically found in ufasomes may explain the disparity in birefringent particle frequency. The intrinsic variable of the various types of birefringence found in multi-lamellar particles is normally positive and negative in symbol. The perpendicular alignment of lipid molecules to the membrane surface produces a positive sign portion, whereas the parallel arrangement of neighboring membranes produces a negative “form” component. The level of birefringence declines as the gap between adjacent membranes grows. Freeze-etched ufasome preparations revealed that irregular multi-membrane particles or massive water-filled spheres are much more normal than symmetrical particles that would be predicted to produce high birefringence.

RECENT INNOVATIONS IN CONVENTIONAL UFASOMES[10]

Because of questions about the colloidal stability of carboxylic acid vesicles, ufasome uses in the area of drug distribution remain mostly unexplored. However, several recent researches have shown that using new forms of fatty acids or blended structures of other surfactants may help with drug distribution.

New Type of Fatty Acids

The fatty acid cis-4,7,10,13,16,19-docosahexaenoic acid (DHA) was found to self-assemble into vesicles between pH 8.5 and 9.

Extension of The pH Range

Since roughly half of the carboxylic acid must be ionized, a small pH range is usually ideal for the development of fatty acid vesicles. The pH spectrum may be increased, however, by employing the following novel approaches.

a) ***Amphiphilic additives, such as linear alcohols or a surfactant containing a sulfate or sulfonate head group***: Vesicles are produced utilizing mixtures of decanoic acid and decanoate type at pH 6.4 to 7.8, although the pH for vesicle formation may be reduced to at least 4.3 by incorporating sodium dodecylbenzene sulfonate (SDBS).

b) ***Alter the scale of the hydrophilic head group of fatty acids synthetically***: Fatty acids with an oligo (ethylene oxide) unit intercalated between the hydrocarbon chain and the carboxylate head group have been shown to improve vesicle stability at lower pH. The existence of a large polar community has two effects: it lowers the phase transfer temperature and lowers the pH area where vesicles can grow.

Insensitivity toward Divalent Cation

Even at low concentrations, divalent cations such as Mg^{2+} and Ca^{2+} induce vesicle precipitation. In the presence of ionic solutes, fatty acid glycerol esters may be added to stabilize the fatty acid vesicles.

Enhancement of Stability by Cross-linking Fatty Acid Molecules by Chemical Bonds

To improve the consistency, a fatty acid (soap) with a polymerizable moiety (e.g., sodium 11-acrylamidoundecanoate: SAU) may be used. Polymeric SAU vesicles were discovered to self-assemble into vesicular aggregates and to be stable at high temperatures.

Mixture of Fatty Acid Vesicle and Surfactant-Based Vesicles

Tetradecyltrimethylammonium hydroxide (TTAOH) and fatty acids are a model framework for mixed vesicles. Unilamellar and multilamellar vesicles were produced when roughly the same amounts of TTAOH and fatty acid were combined.

APPLICATION OF UFASOMES[11]

Various therapeutic agents may be delivered transdermally using drug-loaded ufasomes. Anti-inflammatory, anti-fungal, anti-osteoarthritic, anti-cancer, and other medications loaded in ufasomes have been used for transdermal distribution.

Anti-fungal Drugs

Novel formulations such as niosomes, liposomes, ethosomes, microemulsions, and micelles have been produced for transdermal distribution of these medications to reduce the disadvantages of traditional formulations such as allergic reactions and poor penetration capacity. Ufasomes are more sophisticated devices that have been designed specifically for this function. An in-vitro drug release analysis indicated that the drug released from the ufasomal dispersion was maintained. A five-day drug release from ufasomes was verified in an in-vivo analysis. As opposed to other commercially available formulations, this suggests its suitability for long-term therapy.

Anti-cancer Drugs

The US Food and Drug Administration has licensed 5-fluorouracil (5-FU) for use as a topical remedy for basal cell carcinoma (BCC). Itching, eczema, redness, and low penetration through the skin are all recorded side effects of the advertised formulation. Since the medication is encapsulated within the vesicles, ufasomes are used to reduce side effects. They have the potential to increase opioid penetration and delay drug release. The fatty acid vesicles remained somewhat intact in the refrigerator. The fatty acid vesicles infiltrated the stratum corneum and stored the substance in the epidermal layer of the skin, according to ex-vivo skin permeation tests.

Anti-inflammatory Drugs

The usage of non-steroidal anti-inflammatory medications (NSAIDs) is the first phase of therapy for rheumatoid arthritis (RA) (NSAID). Slow-acting disease-modifying antirheumatic drugs (DMARDs) have recently been recommended for the early treatment of RA in order to avoid or minimize joint injury. When fatty vesicles were used instead of simple drug solution or carbopol gel, the volume of drug permeated through rat skin was three to four times greater. When fatty acid vesicles are used, a skin permeation assay indicates that up to 50% of the administered dosage is found in the skin. As a result, utilizing this method may help to minimize RA inflammation. As fatty acid vesicular gel was linked to pure drug gel, the transdermal permeation was found to be around 4.7 times greater. When the fatty acid vesicular gel was linked to the same volume of the commercial substance, there was a significant decrease in edema. As a result, fatty acid vesicles-based medication gels could be more successful at treating inflammation than commercially available gels.

Anti-osteoarthritic drugs

Collagen and proteoglycans, which are found in the human body, are important for joint rebuilding and the production of synovial fluid, which lubricates the joints. Glucosamine supplementation promotes their production in the body. As a consequence, glucosamine has long been recommended in the care of osteoarthritis. As a result, glucosamine sulfate fatty vesicles are packed and spread in carbopol gel for topical distribution to manage osteoarthritis. On rodents, the drug concentration in the vesicle-based gel was observed to be 6-fold higher than in the simple carbopol gel. The medicine was also published consistently on the gel of fatty acid vesicles. As a consequence, this formulation may be used as a depot formulation for treating osteoarthritis.

CONCLUSION

Ufasomes are suspensions of closed lipid bilayers made up of fatty acids, and their soap is limited to a specific pH spectrum. The hydrocarbon tails of fatty acid molecules are arranged against the membrane interior in ufasomes, while the carboxyl groups are in contact with water. The stability of ufasome formulation is determined by factors such as fatty acid selection, cholesterol level, buffer, pH variety, and so on. Ufasomes have a lot of medicinal promise and can be used to cure a number of skin disorders. Since the medication is emitted in a controlled or prolonged way, adverse effects on the skin such as swelling, scratching, and other allergic reactions may be diminished. Because of the controlled release of the medication, fatty acid vesicles have also been shown to be particularly effective in the treatment of skin diseases in conditions such as AIDS. Because of their lower cost, fast penetration capacity, and strong entrapment performance, ufasomes are considered a better alternative to liposomes for topical drug delivery.

CONFLICTS OF INTEREST

No conflict of interest is declared.

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REFERENCES

1. Patel DM, Jani RH, Patel CN. Ufasomes: A Vesicular Drug Delivery. Syst Rev Pharm, 2011; 2(2): 72-8.
2. Kumar P, Singh SK. Oleic acid nanovesicles of minoxidil for enhanced follicular delivery. Medicines, 2018; 5(3): 103.
3. Meraz CA, Rodriguez VA. Clotrimazole Loaded Ufosomes for Topical Delivery: Formulation Development and In-Vitro Studies. Molecules, 2019; 24(17): 3139.
4. Lakshmi VS, Manohar RD, Mathan S, Dharan SS. Ufasomes: A Potential Vesicular Carrier System. J Pharm Sci Res, 2020; 12(10): 1332-5.
5. Kumar L, Verma S. Fatty acid vesicles acting as expanding horizon for transdermal delivery. Artif Nanomed Biotechnol, 2017; 45(2): 251-60.
6. Salama AH, Aburahma MH. Ufasomes nano-vesicles-based lyophilized platforms for intranasal delivery of cinnarizine: preparation, optimization, ex-vivo histopathological safety assessment and mucosal confocal imaging. Pharm Dev Technol, 2015; 21(6): 706-15.
7. Nair AJ, George A. Ufasome: A potential phospholipid as a novel pharmaceutical formulation. Int Res J Pharm, 2014; 5(4): 250-3.
8. Jain S, Jain V, Mahajan SC. Lipid based vesicular drug delivery system. Adv Pharm, 2014; 2014: 1-12.
9. Patel SA. Review on ufasomes and vesicular drug delivery system. Pharm Res, 2013; 9(1): 32-43.
10. Verma S, Bhardwaj A. Oleic acid vesicles: a new approach for topical delivery of antifungal agent. Artif Nanomed Biotechnol, 2013; 42(2): 95-101.
11. Rajalakshmi R, Aiswarya R, Kumar AR, Kumar SS, Nair SC. Ufasomes: Unsaturated Fatty Acid Based Vesicular Drug Delivery System. Int J Appl Pharm, 2021; 13(2): 76-83.