Role Of Olive Oil in Skin Health and Topical Drug Delivery A Review

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Abstract—**Olive oil has gained considerable attention in the pharmaceutical, cosmetic, and dermatological fields due to its multifunctional role in promoting skin health and enhancing topical drug delivery. Derived from the fruits of the olive tree (Olea europaea L.), olive oil is rich in monounsaturated fatty acids, particularly oleic acid, along with numerous bioactive compounds such as polyphenols, flavonoids, tocopherols, squalene, carotenoids, and phytosterols. These constituents contribute to its wide range of biological activities, including antioxidant, anti-inflammatory, antimicrobial, moisturizing, and wound-healing effects (2). The antioxidant components of olive oil help protect the skin against oxidative stress caused by environmental pollutants and ultraviolet radiation, thereby reducing premature skin aging and cellular damage. Its emollient and moisturizing properties assist in maintaining skin hydration, improving elasticity, and strengthening the skin barrier, making it beneficial for the management of various dermatological conditions such as eczema, psoriasis, dermatitis, and dry skin disorders (5).**

In addition to its therapeutic effects on skin health, olive oil plays a significant role in topical and transdermal drug delivery systems. The high concentration of oleic acid acts as a natural permeation enhancer by disrupting the tightly packed lipid structure of the stratum corneum, thereby facilitating improved penetration of active pharmaceutical ingredients through the skin. Olive oil also serves as an effective carrier for lipophilic drugs, enhancing their solubility, stability, and bioavailability. Its compatibility with a wide variety of excipients has led to its incorporation into numerous dosage forms, including creams, ointments, lotions, gels, emulsions, nanoemulsions, microemulsions, liposomes, solid lipid nanoparticles, and nanostructured lipid carriers. These advanced delivery systems offer advantages such as controlled drug release, targeted delivery, increased skin retention, and improved therapeutic efficacy (11).

I. INTRODUCTION

Olive oil is one of the most important natural oils widely used in pharmaceutical, cosmetic, food, and nutraceutical industries due to its remarkable therapeutic and nutritional properties. It is rich in monounsaturated fatty acids, especially oleic acid, along with bioactive compounds such as phenolic antioxidants, tocopherols, flavonoids, and squalene. These constituents provide antioxidant, anti-inflammatory, antimicrobial, cardioprotective, moisturizing, and wound-healing effects. Because of these beneficial properties, olive oil has gained increasing scientific attention as a functional ingredient in advanced formulation systems (1).

Over the past two decades, significant research has been conducted on olive oil formulations, particularly nanoemulsions, microemulsions, nanocapsules, and self-nanoemulsifying drug delivery systems (SNEDDS).(3) Earlier studies mainly focused on the antioxidant activity and health benefits of olive oil phenolic compounds and their role in reducing oxidative stress, cardiovascular diseases, and chronic inflammatory disorders. Later research expanded toward the development of pharmaceutical and nutraceutical delivery systems using olive oil as a lipid carrier (2).

Nanoemulsion technology has become one of the most promising approaches for olive oil formulation because it enhances the solubility, stability, bioavailability, and therapeutic effectiveness of lipophilic compounds. Several formulation techniques such as high-pressure homogenization, ultrasonication, microfluidization, and phase inversion methods have been investigated for preparing stable olive oil nanoemulsions with small droplet sizes and improved physicochemical properties(3). Studies also reported that formulation

parameters including viscosity, surfactant concentration, zeta potential, and polymer stabilization significantly influence the stability and performance of olive oil emulsions (4).

Research papers included in this review demonstrated the wide range of applications of olive oil formulations in topical drug delivery, functional foods, targeted cancer therapy, nutraceuticals, and cosmetic preparations. Olive oil nanoemulsions were found to improve skin permeation, controlled drug release, antioxidant activity, and oral bioavailability. In addition, natural stabilizers such as xanthan gum and gum acacia have been successfully incorporated to enhance formulation stability and sustained-release behavior (6).

Recent advancements in nanotechnology have further expanded the therapeutic potential of olive oil-based delivery systems. Modern studies have explored olive oil liquid nanocapsules for targeted delivery against pancreatic cancer stem cells and the use of olive-derived phenolic extracts in functional food formulations. These innovations indicate that olive oil is not only a nutritional ingredient but also a multifunctional excipient and carrier system for advanced pharmaceutical applications (9).

The collective findings from the fifteen reviewed papers highlight important concepts such as antioxidant activity, nanoemulsion formulation, ultrasonication, high-pressure homogenization, topical delivery systems, controlled drug release, bioavailability enhancement, phenolic compounds, omega-3 delivery, nanocapsules, stability analysis, viscosity optimization, targeted therapy, and nutraceutical applications. Together, these studies establish olive oil as a promising and versatile component in modern formulation science and nanomedicine (11).

II. USES OF OLIVE OIL IN PHARMACEUTICAL PRODUCTS

Olive oil is widely used in the pharmaceutical industry because of its medicinal properties, stability, and compatibility with the human body. It functions both as an active ingredient and as an excipient in many pharmaceutical and healthcare products (2).

1. Carrier Oil in Medicinal Formulations

Olive oil is commonly used as a carrier or base oil in pharmaceutical preparations. It helps dissolve fat-soluble substances and improves the absorption of active compounds in the body.

2. Ingredient in Capsules and Syrups

It is used in soft gelatin capsules, vitamin supplements, and herbal syrups to enhance the delivery and effectiveness of medicinal ingredients (3).

3. Use in Topical Preparations

Olive oil is added to creams, lotions, ointments, and balms because of its moisturizing, soothing, and skin-protective properties. These products are useful in treating dry skin, burns, irritation, and minor wounds (4).

4. Laxative Preparations

Traditionally, olive oil has been used as a mild natural laxative to relieve constipation and support healthy digestion (6).

5. Antioxidant and Anti-Inflammatory Products

Due to the presence of antioxidants such as polyphenols and vitamin E, olive oil is included in formulations designed to reduce inflammation and protect body cells from oxidative stress (8).

6. Nutritional Supplements

Olive oil is widely used in dietary and nutritional supplements because it contains healthy monounsaturated fatty acids that support cardiovascular health and help maintain cholesterol balance (10).

7. Massage and Therapeutic Oils

Pharmaceutical and wellness industries use olive oil in massage oils and therapeutic products because it softens the skin and improves hydration (11).

8. Drug Delivery Systems

In modern pharmaceutics, olive oil is utilized in emulsions and lipid-based drug delivery systems to improve the solubility, stability, and bioavailability of certain drugs (14).

III. CONCENTRATION OF OLIVE OIL IN PHARMACEUTICAL PRODUCTS

The concentration of Olive oil used in pharmaceutical formulations varies depending on the type of product, method of administration, and therapeutic purpose. It may act as an active ingredient, carrier oil, solvent, or excipient in different preparations (3).

Common Concentration Ranges

Pharmaceutical Product	Typical Concentration of Olive Oil
Creams and lotions	5–40%
Ointments and balms	10–60%
Massage and therapeutic oils	20–100%
Soft gelatin capsules	Variable, often used as filling oil
Herbal syrups and liquid formulations	1–10%
Emulsions and drug delivery systems	5–30%
Nutritional supplements	Depending on formulation requirements

IV. MARKET FORMULATION

Product Type	Example Marketed Formulations
Moisturizing creams	Olive oil skin creams, moisturizing lotions
Medicated ointments	Herbal healing ointments, burn relief creams
Soft gelatin capsules	Vitamin E capsules with olive oil base
Baby care products	Baby lotions and diaper rash creams
Massage oils	Therapeutic olive massage oils
Anti-aging products	Olive oil night creams and antioxidant serums
Medicated soaps	Olive oil cleansing bars and herbal soaps
Hair care products	Olive oil shampoos and scalp treatment oils
Nutritional supplements	Olive oil dietary capsules and omega supplements
Herbal preparations	Ayurvedic and herbal formulations containing olive oil

Harmful effects of Olive oil in Pharmaceutical Products with Concentration

Although Olive oil is generally considered safe and biocompatible, excessive concentrations or improper use in pharmaceutical formulations may produce certain undesirable effects. The harmful effects depend on the concentration used, route of administration, formulation type, and individual sensitivity (5).

Possible Harmful Effects According to Concentration

Concentration of Olive Oil	Pharmaceutical Use	Possible Harmful Effects
1–5%	Syrups, emulsions, capsules	Usually safe with minimal adverse effects
5–20%	Creams, lotions, topical products	Mild skin irritation or greasiness in sensitive individuals
20–40%	Ointments, massage oils	May clog pores, cause acne, or reduce skin breathability
40–60%	Heavy topical formulations	Excessive oiliness and delayed absorption on skin
Above 60%	Pure oil preparations	Possible allergic reactions, gastrointestinal discomfort, or formulation instability

V. CONCLUSION

Olive oil has emerged as a highly valuable natural ingredient in pharmaceutical, cosmetic, and nutraceutical formulations because of its antioxidant, anti-inflammatory, moisturizing, and therapeutic properties. Over the years, research has demonstrated that olive oil not only provides nutritional benefits but also serves as an effective carrier system in advanced drug delivery technologies. The presence of bioactive compounds such as oleic acid, phenolics, tocopherols, and flavonoids contributes significantly to its medicinal and protective effects.

The development of olive oil nanoemulsions and microemulsions has greatly enhanced the application

potential of olive oil in modern formulation science. Studies reviewed in this paper showed that formulation techniques such as ultrasonication, high-pressure homogenization, and phase inversion methods successfully produce stable nano-sized emulsions with improved bioavailability, controlled drug release, and enhanced skin permeation. The incorporation of stabilizers and polymers such as xanthan gum and gum acacia further improves viscosity, stability, and sustained-release properties.

Research findings also demonstrated the diverse applications of olive oil formulations in topical drug delivery, functional foods, nutraceuticals, and targeted cancer therapy. Olive oil-based formulations have shown excellent biocompatibility, reduced irritation, enhanced therapeutic efficiency, and improved patient compliance. Additionally, recent studies on olive oil nanocapsules and self-nanoemulsifying systems indicate promising future applications in precision medicine and advanced targeted drug delivery systems.

Despite these advantages, certain limitations such as oxidative instability, high surfactant concentration, and formulation complexity still require further investigation. Future research should focus on large-scale industrial production, long-term stability studies, toxicity evaluation, and the development of cost-effective formulation methods.

Overall, the reviewed studies confirm that olive oil is a promising multifunctional component for innovative pharmaceutical and nutraceutical formulations. Continuous advancements in nanotechnology and formulation strategies are expected to expand the therapeutic and commercial applications of olive oil-based delivery systems in the future.

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