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Research Article

Checking The Antimicrobial Activity of The Seed Extract of *Nigella sativa* Extract

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ABSTRACT

Black cumin, scientifically known as Nigella sativa, has garnered attention for its potential antimicrobial properties. Our Study suggests that its active compounds, such as thymoquinone, thymol, and carvacrol, exhibit significant antimicrobial activity against a wide range of pathogens. Also other Studies have shown that black cumin extracts possess antibacterial effects against various bacteria, including Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa. Additionally, it has demonstrated antifungal properties against Candida albicans and Aspergillus species. The mechanism behind black cumin's antimicrobial action involves disruption of microbial cell membranes, inhibition of essential enzymes, and interference with microbial DNA replication. These actions collectively contribute to its ability to inhibit the growth and proliferation of pathogens, black cumin's antimicrobial activity extends to multidrug-resistant strains, making it a promising candidate for combating antibiotic-resistant infections. Its natural origin and relatively low toxicity also make it an attractive alternative to synthetic antimicrobial agents. Black cumin exhibits potent antimicrobial activity against a broad spectrum of pathogens, offering potential applications in both traditional and modern medicine. Further research into its mechanisms and clinical efficacy is warranted to fully exploit its therapeutic potential.

INTRODUCTION

The resurgence of herbal medicine in contemporary healthcare systems has garnered

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significant attention, driven by a myriad of factors including historical efficacy, cultural practices, rising healthcare costs, and an increasing demand for natural and holistic treatment options. Herbal medicine, which involves the use of plant-based substances to treat and prevent various ailments, has been a cornerstone of human health practices for millennia. This essay delves into the reasons behind the growing trend of using herbal drugs in recent times, highlighting their benefits, challenges, and the scientific advancements that support their use. Historical Context and Cultural Significance: Herbal medicine has a rich history that dates back thousands of years. Ancient civilizations, including the Egyptians, Chinese, Indians, and Native Americans, have long utilized herbs for medicinal purposes. The extensive documentation in texts like the Ebers Papyrus, the Ayurvedic texts, and the Compendium of Materia Medica highlights the deep-rooted traditions of herbal medicine. This historical backdrop provides a foundation for contemporary interest, as many cultures continue to rely on traditional herbal practices handed down through generations.

Rise of Chronic Diseases and Modern Health Challenges: The modern world faces a surge in chronic diseases such as diabetes, cardiovascular diseases, and cancer. Conventional pharmaceutical treatments often come with significant side effects and high costs, leading many individuals to seek alternative or complementary therapies. Herbal medicine offers a promising avenue for managing chronic conditions, providing options that are perceived to be safer and more affordable. For instance, the use of turmeric (Curcuma longa) in managing inflammation and arthritis, or the application of garlic (Allium sativum) in cardiovascular health, showcases how herbal remedies can play a role in modern health management. Cost-Effectiveness and Accessibility: One of the compelling reasons for the increased use of herbal medicine is its cost-effectiveness. Prescription drugs, particularly for chronic conditions, can be prohibitively expensive, leading many people, especially in low-income regions, to seek more affordable alternatives. Herbal drugs, often derived from locally available plants, offer a more accessible option. This is particularly important in developing countries where healthcare infrastructure may be limited, and traditional medicine is more readily available. Natural and Holistic Approaches: There is a growing preference for natural and holistic approaches to health and wellness. This trend is driven by a desire to avoid synthetic chemicals and to embrace treatments that align with the body's natural processes. Herbal medicine, with its emphasis on using whole plants and plant extracts, fits well within this paradigm. The holistic approach of herbal medicine considers the individual as a whole, addressing not just the symptoms but also the underlying causes of illness, and promoting overall well-being.

Scientific Validation and Integration with Modern Medicine: Advancements in scientific research have provided a robust foundation for the efficacy of many herbal medicines. Rigorous studies and clinical trials have validated the therapeutic properties of various herbs, leading to increased confidence in their use. For example, the anti-inflammatory properties of ginger (Zingiber officinale) and the antimicrobial effects of neem (Azadirachta indica) are well-documented. This scientific validation has facilitated the integration of herbal medicine with modern medical practices, resulting in a more comprehensive approach to healthcare. Regulatory Frameworks and Quality Control: The development of regulatory frameworks and quality control standards has also contributed to the increased use of herbal medicine. Organizations like the World Health Organization (WHO) have established

guidelines for the safe use of herbal medicines, ensuring their quality, safety, and efficacy. These regulations help to mitigate the risks associated with herbal drug use, such as contamination, adulteration, and incorrect dosages, thereby increasing public trust in these remedies.

Fig.1- Herbal the Past and Future

Environmental and Ethical Considerations: The environmental impact of pharmaceutical production is a growing concern. The extraction and synthesis of pharmaceutical compounds often involve processes that are harmful to the environment. In contrast, herbal medicine, when practiced sustainably, can have a lower environmental footprint. Additionally, the ethical considerations of sourcing natural products responsibly and supporting biodiversity are increasingly important to consumers. Sustainable harvesting and cultivation of medicinal plants contribute to conservation efforts and support ethical practices in medicine.

Challenges and Future Directions: Despite the numerous advantages, the use of herbal medicine is not without challenges. Issues such as standardization, dosage accuracy, potential herb-drug interactions, and the need for more extensive clinical trials remain significant hurdles. The future of herbal medicine lies in addressing these challenges through continued research, education, and the development of comprehensive regulatory frameworks. Collaborative efforts between traditional practitioners and modern scientists are crucial in bridging the gap and enhancing the credibility and effectiveness of herbal therapies.

Historical Context and Cultural Significance: Herbal medicine has been used for thousands of years across various cultures. Traditional Chinese Medicine (TCM), Ayurveda, and Native American herbal practices are examples of medical systems that have long relied on herbs to treat various ailments. These traditional systems provide a rich repository of knowledge and practices that continue to influence modern herbal medicine. Cultural Relevance: In many cultures, herbal remedies are not just treatments but part of the cultural fabric. People often trust and prefer remedies that their ancestors used, and this cultural continuity plays a significant role in the persistent use of herbal medicine.

Natural and Holistic: Approaches There is a growing trend towards natural and holistic health approaches. People are increasingly skeptical of synthetic drugs and their side effects. Herbal medicine is perceived as a more natural and gentle alternative, aligning with the broader wellness movement that emphasizes organic, plant-based, and minimally processed products. Preventive Health Care: Modern consumers are more health-conscious and proactive about maintaining their health. Herbal medicines often serve as preventive measures rather than just treatments, promoting overall well-being and boosting the immune system.

Scientific Validation and Research

Increased Research: There has been a significant increase in scientific research validating the efficacy of many herbal medicines. Studies on plants like turmeric (Curcuma longa), garlic (Allium sativum), and ginseng (Panax ginseng) have shown promising results in treating various conditions, ranging from inflammation to cardiovascular diseases.

Integration with Modern Medicine: Hospitals and clinics are increasingly offering complementary

and integrative medicine programs that include herbal treatments alongside standard medical care.

Environmental and Economic Factors

Sustainability: Herbal medicines are often seen as more sustainable compared to pharmaceutical drugs. Many herbs can be grown locally, reducing the carbon footprint associated with the production and transportation of synthetic drugs.

Economic Accessibility: In many parts of the world, particularly in developing countries, herbal medicines are more accessible and affordable than modern pharmaceuticals. This economic factor makes them a vital component of health care for many people.

Fig.2- Current And Future Market Of Herbal Drugs

Regulatory and Market Dynamics

Regulatory Support: Regulatory bodies in various countries are increasingly recognizing and standardizing herbal medicines. This legitimizes their use and assures consumers of their safety and efficacy. The WHO has also been active in promoting traditional medicine practices through various initiatives.

Market Growth: The herbal medicine market has seen substantial growth. This market expansion is fueled by consumer demand for natural products, which in turn drives more investment into research, development, and marketing of herbal medicines.

Personal Empowerment and Knowledge

Access to Information: The internet has made information about herbal medicine widely accessible. People can easily research and learn about the benefits and uses of various herbs, which empowers them to make informed choices about their health care.

Self-care and Autonomy: There is a growing movement towards self-care and personal health autonomy. Herbal medicine allows individuals to take control of their health by using natural remedies that they can often grow or source themselves.

Fig.3- Black Cumin Seed

Black cumin, also known as Nigella sativa, is a flowering plant native to the Mediterranean region, but it is also found in parts of Asia and Africa. For centuries, black cumin seeds, often referred to as "black seeds," have been used in traditional medicine systems such as Ayurveda, Unani, and Tibb-e-Nabawi (medicine of the Prophet). The seeds and oil of black cumin have been revered for their therapeutic properties, earning them the moniker "the seed of blessing" in Islamic tradition. This comprehensive analysis delves into the medicinal value of black cumin, exploring its phytochemical composition, pharmacological properties, and potential health benefits.

Phytochemical Composition

The therapeutic efficacy of black cumin is attributed to its rich phytochemical profile. The seeds contain a variety of bioactive compounds, including:

1. Thymoquinone (TQ): The primary active constituent, thymoquinone, is known for its

potent antioxidant, anti-inflammatory, and antimicrobial properties.

2. Volatile Oils: Including p-cymene, α-thujene, thymohydroquinone, and dithymoquinone.
3. Fixed Oils: Rich in unsaturated fatty acids such as linoleic acid and oleic acid.
4. Alkaloids: Nigellidine and nigellimine.
5. Saponins: Alpha-hederin.
6. Other Components: Proteins, vitamins (such as B1, B2, B3), and minerals (such as calcium, iron, and zinc).

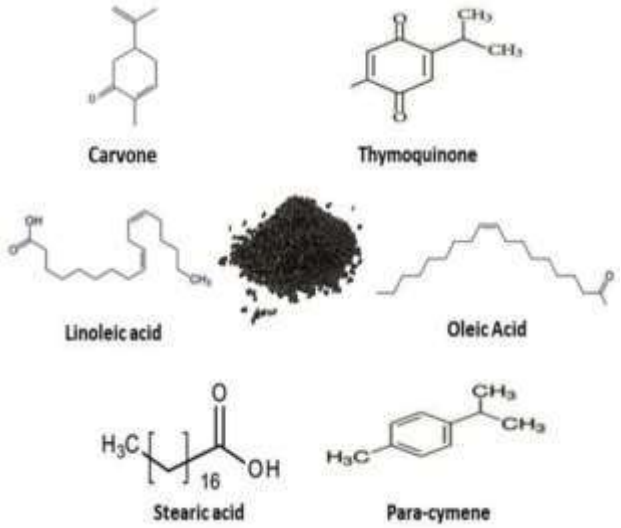

Fig4- Chemical Constituent of Black Cumin

These constituents collectively contribute to the multifaceted medicinal properties of black cumin.

Antioxidant Properties: Oxidative stress, resulting from an imbalance between free radicals and antioxidants, is implicated in the pathogenesis of various chronic diseases. Black cumin seeds exhibit strong antioxidant activity, primarily due to thymoquinone. Studies have shown that TQ effectively scavenges free radicals, thereby protecting cells and tissues from oxidative damage. The antioxidant potential of black cumin can help mitigate the risk of chronic conditions such as cardiovascular diseases, neurodegenerative disorders, and cancer.

Anti-inflammatory: Effects Chronic inflammation is a common underlying factor in many diseases, including arthritis, diabetes, and inflammatory bowel disease. Black cumin exerts significant anti-inflammatory effects, which are primarily mediated by thymoquinone. TQ inhibits the synthesis of pro-inflammatory mediators like prostaglandins, leukotrienes, and cytokines. By modulating inflammatory pathways, black cumin can alleviate symptoms and reduce the progression of inflammatory diseases.

Immunomodulatory Effects: The immune-modulating properties of black cumin are another key aspect of its medicinal value. Thymoquinone enhances the body's immune response by stimulating the activity of various immune cells, including macrophages, lymphocytes, and natural killer cells. This immunostimulatory effect can help in enhancing the body's defense mechanisms against infections and diseases.

Anticancer Properties: Black cumin has garnered attention for its potential anticancer properties. Thymoquinone has been found to induce apoptosis (programmed cell death) in cancer cells, inhibit cell proliferation, and suppress metastasis. It exerts these effects through various mechanisms, including the modulation of tumor suppressor genes, inhibition of angiogenesis (formation of new blood vessels that feed tumors), and activation of apoptotic pathways. Research has demonstrated the efficacy of black cumin against various cancer types, including breast, colon, prostate, and pancreatic cancers.

Hepatoprotective Effects: The liver is a vital organ involved in detoxification, metabolism, and various other physiological functions. Black cumin exhibits hepatoprotective effects, protecting the liver from damage caused by toxins, drugs, and diseases. Thymoquinone and other constituents help reduce oxidative stress, inflammation, and apoptosis in liver cells, thereby promoting liver health and function.

Cardioprotective Effects: Cardiovascular diseases (CVD) are leading causes of morbidity and

mortality worldwide. Black cumin contributes to cardiovascular health through several mechanisms:

Antihypertensive: It helps lower blood pressure by modulating nitric oxide levels and improving endothelial function.

Anti-lipidemic: Black cumin reduces cholesterol and triglyceride levels, thereby mitigating the risk of atherosclerosis.

Anti-thrombotic: It prevents the formation of blood clots, reducing the risk of heart attacks and strokes.

Anti-diabetic Effects: Diabetes mellitus is a metabolic disorder characterized by hyperglycemia and insulin resistance. Black cumin has shown promising antidiabetic effects by improving insulin sensitivity, enhancing glucose uptake, and reducing blood sugar levels. Thymoquinone also protects pancreatic β-cells from oxidative stress and inflammation, thereby preserving their function and insulin secretion.

Gastroprotective Effects: Black cumin is beneficial for gastrointestinal health. It has been used traditionally to treat various digestive ailments, including dyspepsia, diarrhea, and indigestion. Its gastroprotective effects are attributed to its ability to reduce gastric acid secretion, enhance mucosal defense, and inhibit the growth of Helicobacter pylori, a bacterium implicated in peptic ulcer disease.

Fig.5- Medicinal Benefits of Black Cumin

Neuroprotective Effects: The neuroprotective properties of black cumin are of great interest, particularly in the context of neurodegenerative diseases like Alzheimer's and Parkinson's. Thymoquinone exhibits neuroprotective effects by reducing oxidative stress, inflammation, and apoptosis in neural cells. It also enhances cognitive function and memory, making it a potential therapeutic agent for managing neurodegenerative conditions.

Respiratory Benefits: Black cumin has been traditionally used to treat respiratory conditions such as asthma, bronchitis, and allergies. Its bronchodilatory effects help in relaxing the bronchial muscles, thereby improving airflow and alleviating symptoms of asthma. Additionally, its anti-inflammatory and antimicrobial properties help in managing respiratory infections and inflammation.

Dermatological Applications: Black cumin is also beneficial for skin health. Its antimicrobial and anti-inflammatory properties make it effective in treating various skin conditions, including acne, eczema, and psoriasis. Black cumin oil is often used topically to soothe irritated skin, reduce inflammation, and promote wound healing.

Traditional and Modern Applications: In traditional medicine, black cumin seeds and oil have been used for a wide range of ailments. Modern research has validated many of these traditional uses, providing scientific backing for its therapeutic potential. Here are some applications of black cumin in both traditional and modern contexts:

Traditional Applications:

1. Treatment of respiratory ailments
2. Management of digestive issues
3. Enhancement of lactation in nursing mothers
4. Relief from headache and migraines
5. Use as a general tonic to improve overall health

Modern Applications:

1. Development of nutraceuticals and dietary supplements
2. Inclusion in topical formulations for skin care
3. Use in adjunctive therapy for cancer treatment

Dosage and Safety: The appropriate dosage of black cumin depends on various factors, including age, health status, and the condition being treated. Generally, black cumin oil is consumed in doses ranging from 1 to 3 teaspoons per day, while seed powder is taken in doses of 1 to 2 grams daily. It is important to consult with a healthcare provider before starting any new supplement regimen, especially for pregnant or lactating women, and individuals with underlying health conditions.

While black cumin is generally considered safe for most people, excessive consumption may lead to adverse effects such as gastrointestinal discomfort, allergic reactions, or interactions with certain medications. Therefore, it is crucial to adhere to recommended dosages and consult with healthcare professionals when necessary.

Black cumin (Nigella sativa) holds significant medicinal value, supported by a rich tradition of use and a growing body of scientific evidence. Its wide range of pharmacological properties, including antioxidant, anti-inflammatory, antimicrobial, immunomodulatory, anticancer, hepatoprotective, cardioprotective, antidiabetic, gastroprotective, neuroprotective, and dermatological effects, make it a versatile natural remedy. As research continues to uncover the molecular mechanisms underlying its therapeutic effects, black cumin is likely to gain further recognition and application in modern medicine. Its integration into contemporary health practices offers a promising avenue for improving health outcomes and managing various diseases naturally and effectively.

The use of black cumin as a herbal medicine dates back to ancient civilizations. It has been mentioned in several historical texts, including the Bible, where it is referred to as "fitch," and the works of renowned Greek physician Dioscorides. In Islamic tradition, it is considered a prophetic medicine, with the Prophet Muhammad reputedly stating that black cumin is a remedy for all diseases except death. Traditional medicine systems such as Ayurveda and Unani have also long recognized the therapeutic potential of black cumin, particularly for treating infections and inflammatory conditions.

Antimicrobial Properties mechanisms of Action:

The antimicrobial efficacy of black cumin is due to several mechanisms:

1. Disruption of Cell Membranes: Thymoquinone and other volatile oils in black cumin disrupt the integrity of microbial cell membranes, leading to cell lysis and death.
2. Inhibition of Enzyme Activity: Black cumin compounds inhibit the activity of enzymes crucial for microbial metabolism and survival.
3. Interference with DNA Synthesis: Thymoquinone interferes with the replication and transcription of microbial DNA, preventing their proliferation.
4. Modulation of Immune Response: Black cumin enhances the body's immune response, aiding in the elimination of pathogens.

Antifungal Properties of mechanisms of Action

The antifungal activity of black cumin involves several mechanisms:

1. Disruption of Fungal Cell Membranes: Thymoquinone and other components disrupt fungal cell membranes, leading to cell death.
2. Inhibition of Ergosterol Synthesis: Ergosterol is a crucial component of fungal cell membranes. Black cumin inhibits its

synthesis, compromising cell membrane integrity.

3. Induction of Apoptosis: Black cumin induces programmed cell death in fungal cells, thereby reducing fungal load.
4. Modulation of Immune Response: Enhances the body's immune response to fungal infections.

Therapeutic Applications

Infectious Diseases: Black cumin is used to treat a range of infectious diseases caused by bacteria, viruses, fungi, and parasites. Its ability to disrupt microbial membranes and inhibit replication makes it a valuable natural remedy.

Skin Infections: Topical applications of black cumin oil are effective in treating skin infections caused by bacteria and fungi. Its anti-inflammatory properties also help reduce symptoms like itching and redness.

Respiratory Infections: Black cumin is used in traditional medicine to treat respiratory infections such as bronchitis, pneumonia, and asthma. Its antimicrobial properties help eliminate pathogens, while its anti-inflammatory effects reduce airway inflammation.

Gastrointestinal Infections: The antimicrobial activity of black cumin against Helicobacter pylori makes it useful in treating gastrointestinal infections and peptic ulcers.

Adjunctive Cancer Therapy: Black cumin's antimicrobial properties help reduce the risk of infections in cancer patients undergoing immunosuppressive therapies. Additionally, its anticancer properties, including apoptosis induction and inhibition of metastasis, make it a promising adjunctive therapy.

The use of black cumin (Nigella sativa) as a herbal drug to treat microbial and fungal infections is supported by a rich historical tradition and a growing body of scientific evidence. Its broad-spectrum antimicrobial and antifungal properties are primarily attributed to its phytochemical constituents, particularly thymoquinone. Through various mechanisms, including disruption of microbial cell membranes, inhibition of enzyme activity, and modulation of immune response, black cumin effectively combats a range of pathogens. Its therapeutic applications span from treating skin and respiratory infections to serving as an adjunctive therapy in cancer treatment. As research continues to elucidate the molecular mechanisms underlying its antimicrobial and antifungal effects, black cumin is poised to play an increasingly significant role in natural and integrative medicine.

MATERIALS AND METHODS:

Plant material

- ✓ Seeds of *Nigella sativa* were collected from Dubrajpur, Birbhum India.
- ✓ Grind into a coarse powder with the help of a suitable grinder.
- ✓ Then the grinded fine power was shieving by 24 mess.
- ✓ The powder was kept in an airtight container and kept in a cool, dark and dry place.

EXPERIMENATAL PROCEDURE

Preparation of seed extracts:

Using an electric blender, N. sativa seeds were mashed into a fairly coarse powder. To prepare organic extracts, they needed to soak Using a

conical flask sealed with cotton wool, three sections of 150 g of the dry powder each were separated and placed in 600 mL of analytical organic solvents (chloroform 95%, diethyl ether 99%, and petroleum ether 40–60°C). The combination was continuously shaken for 48 hours at room temperature using a Memmert shaker. 50 g of the dry powder were soaked in 300 mL of distilled water, and the mixture was heated to 50°C for 30 minutes to create the aqueous extract. After that, the mixture was continuously shaken for 48 hours while kept at room temperature.

Collection of *Nigella sativa* Petroleum Ether extract

1. The supernatant was extracted from the viscous mixture by centrifuging it for five minutes at 2000 rpm.
2. Whatman filter paper no. 2 was used to filter the organic extracts and the aqueous supernatant independently under empty.
3. Through the use of Rota vapor, the filtrates were dried off.
4. The temperature of the rotating water bath was set to 55°C.
5. To maintain a consistent dry weight, the organic extracts were stored under a vacuum fume hood for the whole night.
6. For later usage, the extracts were weighed and kept in covered containers in a refrigerated at 4°C.

PREPARATION OF NUTRIENT AGAR MEDIA

Nutrient Agar

A great agar medium for verifying purity prior to biochemical or serological testing is nutritional agar, which has nutrients that are appropriate for the subculturing of a broad variety of bacteria. Besides, the addition of agar solidifies nutrient agar, which makes it suitable for the cultivation of microorganisms.

Preparation nutrient agar

- Suspend 28g of nutrient agar powder in 1L of distilled water.
- Mix and dissolve them completely.
- Sterilize by autoclaving at 121°C for 15 minutes.
- Pour the liquid into the petri dish and wait for the medium to solidify.

✓ Preparing the agar in the clean environment to prevent any contamination.

✓ Once the agar solidifies, the agar is ready to use.

Storage condition and shelf life for nutrient agar

Store the dehydrated medium at 10-30°C.

Once the nutrient agar is prepared in the petri dish, store at 2-8°C.

Composition of Nutrient Agar

Typical Formula	Nutrient Agar (gm/litre)
Beef Extract	5 gm
Distilled Water	100 ml
Peptone	5 gm
Sodium chloride	3 gm
Agar	25 gm

INOCULATON OF BACTERIAL SUSPENSIONS:

1. 6 sterile petri plates are taken and numbered as 1,2,3,4,5,6,7&8.
2. The nutrient agar media which is cooled to 45° C after autoclaving, is poured on the sterile petri plates to form a thick layer (6 mm) and allowed to rest undisturbed for 2 hours.
3. After 2 hours when the media solidifies, from test tube 0.5 ml of bacterial suspension is taken and inoculated in petri plate (1), in an aseptic condition (laminar air-flow chamber).
4. In the same way inoculation in done in petri plate (2,3,4,5,6,7,8) from suspension of test tube 2,3,4,5,6,7 & 8.
5. In the petri plates hole are bored with cork borers and the plated are placed in BOD incubator to incubate for 72 hours.

Bacterial species used:

The bacterial strains (ATCC, CDL, Kolkata) used were E. coli (ATCC 8739), B.Subtitis (ATCC 6633).

METHOD OF ANTIBIOTIC ASSAY:

After 72 hr of incubation, formulation are added to the culture media in different media.

Formulation	Micro Organisms	Amount of sample added
PHF treated	E. coli B. subtilis	0.5µl,1µl,2µl
Black seeds extract		0.5µl,1µl,2µl
Standard		0.5µl,1µl,2µl

DISCUSSION

The information of the preparatory appraisal of the in vitro anti-microbial impact of N. sativa seeds uncovered that fluid extricates did not contain antibacterial and/or anti-fungal constituents, at slightest beneath the conditions of the current ponder, which are in completely understanding with other thinks about on the same plant species. The extricate was found to be incapable on standard and healing center strains of C. albicans, S. aureus and P. aeruginosa[15]. Be that as it may, other considers have appeared that such extricates of these seeds seem have an inhibitory impact on the development of the yeast C. albicans in the liver, spleen and kidneys of tainted mice[19] . This disputable comes about can be clarified by: (a) The diverse procedures utilized for extraction[14,15,17], (b) The contrasts between in vivo and in vitro studies[15,19], (c) The affectability and the exactness of the anti-microbial test, (d) The concentration and the viability of the constituents in the extricates, (e) The conditions of seed collections and the season[15], (f) The capacity and the conservation strategy of the extricates and (g) Most past ponders focused on the unstable oil and its constituent, thymoquinone[3,4,18,20-22] . Three natural solvents were utilized to extricate settled oil constituents from seeds of N. sativa, these included: diethyl ether, chloroform and petroleum ether. The to begin with two solvents have been utilized widely[14-16], whereas the third one was never utilized some time recently at slightest with seeds of N. sativa. The settled oil of natural solvents had more successful anti-bacterial impact against Gram-positive than Gram-negative microscopic organisms. Gram-negative microbes have an external film, which make their cell divider impervious to anti-microbial specialists. It is conceivable that the clear ineffectualness of N. sativa natural extricates was to a great extent due to this penetrability boundary. On the other hand, Gram-positive microscopic organisms are as it were composed of peptidoglycan cell divider and so are more helpless to anti-microbial agents[17,31]. In spite of the fact that petroleum ether extricate was a unrefined one, it demonstrated predominant over the standard anti-microbial, chloramphenicol, when testing against S. aureus, S. epidermidis and B. subtilis. This seem be clarified by the nearness of powerful anti-bacterial constituents in tall concentrations in the extricate. Additionally, the particular mode of activity of dynamic chemical constituent against microorganisms is credited to their chemical composition and morphology[31]. The extricate was too dynamic on K. pneumonia or maybe than E. coli, which shows a higher concentration of the extricate is required to restrain the development of E. coli. Since, both are Gram-negative microscopic organisms with viable porousness obstruction. Comparable impact of the extricate was watched on yeast (C. albicans). The standard strain was harsh and more resistance to the extricate than clinical separate. This implies that they are diverse strains and the inhibitory impact of the extricate is dose-dependent[14,16]. Such discoveries require encourage examination. It is worth to say that S. aureus is the causative specialist for the larger part of essential skin

diseases such as cellulites, injury and wound-related diseases, particularly when related with co-morbid conditions and/or bacteremia, may lead to extreme complications and healing center affirmation. In a few cases they can be a cause of broad dismalness and mortality[30] . S. aureus produces a few naturally dynamic items, counting hemolysins, nuclease, coagulase, lipase, exotoxins, fibronectin-and collagenbinding proteins and enterotoxins. Insusceptibility to S. aureus is essentially by means of complement-mediated slaughtering by neutrophils and cell-mediated insusceptibility may optionally contribute to pathogenesis of a few lesions[32]. Skin pole cells can identify and be actuated by attacking microscopic organisms by means of different receptors. Neutrophil collection and bacterial clearance at the locales of subcutaneous P. aeruginosa disease are impeded in the nonattendance of pole cells. This shows that skin pole cells are fundamentally imperative for the amassing of neutrophils and the clearance of microscopic organisms at the locales of infection[33] . No past reports have been distributed for assessing the productivity of petroleum ether extricate on the clearance of subcutaneous S. aureus contamination. The power of the extricate to restrain the development of S. aureus both in vitro and in vivo was altogether tall, which gives an prove for the nearness of exceedingly dynamic anti-bacterial specialists in that extricate. Such extricate might have had bactericidal impact and/or stimulatory impact on pole cells and enlistment of neutrophils at the location of disease. In this manner, advance considers ought to be taken after to separate unadulterated dynamic anti-microbial specialists for testing particular anti-microbial impact. Additionally, histological assessment of the contaminated and treated skin biopsies ought to too be examined to illustrate the impact of the extricate on the incendiary handle.

CONCLUSION

The research aimed at investigating the antimicrobial and antifungal properties of black cumin (*Nigella sativa*) has yielded promising results. The study demonstrated that black cumin exhibits significant antimicrobial activity against a range of bacterial and fungal pathogens. This was evidenced by the inhibition zones observed in agar diffusion tests and the reduction in microbial growth in broth dilution assays. The active compounds in black cumin, notably thymoquinone, have been identified as key contributors to its antimicrobial efficacy. These compounds disrupt the microbial cell membrane integrity and inhibit essential enzymatic functions, leading to the death of the microorganisms. The study found that black cumin was particularly effective against common bacterial strains such as *Escherichia coli* and *Staphylococcus aureus*, as well as fungal strains like *Candida albicans*. The results indicate that black cumin could be a potent natural alternative to synthetic antimicrobial agents, which are often associated with adverse side effects and the development of resistance. The broad-spectrum activity of black cumin suggests its potential application in treating various infections, particularly those caused by antibiotic-resistant bacteria and opportunistic fungi. However, while the in vitro results are encouraging, further research is necessary to evaluate the in vivo efficacy and safety of black cumin. Clinical trials will be essential to determine appropriate dosages, potential side effects, and the overall therapeutic value in human subjects. Additionally, studies should explore the synergistic effects of black cumin with conventional antibiotics to enhance its antimicrobial potential. The antimicrobial and antifungal properties of black cumin highlight its promise as a natural therapeutic agent. This research supports the continued exploration and development of black cumin as an adjunct or

alternative to conventional antimicrobial treatments, potentially addressing the growing concern of antibiotic resistance and providing a natural solution for managing infectious diseases.

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