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NIGELLA SATIVA L. FROM TRADITIONAL TO CONTEMPORARY MEDICINE: A REVIEW

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ABSTRACT

Nigella sativa L. (Kalonji) has its place in family Ranunculaceae. It is an extensively utilized herbal medicinal plant throughout the world. It is a prevalent plant among all the ancient medicinal systems as Arabian, Chinese, Unani, Ayurveda, Sidha and Tibb. It has been considered by ancient herbalists as 'the Herb from Heaven'. It shows its consumption widely in Europe, North Africa, Asia Minor and Mediterranean region whereas at minor scale in Russia, Egypt, Turkey and France. It is considered imperative because of versatile physiognomies as diuretic, antioxidant, anti-cancerous, anthelmintic, anti-diabetic, appetite stimulant, galactagogue, antihypertensive, liver tonic, blood purifier, carminative, deodorant, digestive, purgative and against dermal problems. *N. sativa* has got its position among the top ranking herbal medicinal plants based upon its scientific evidences. Phytochemically it is very ironic and possesses a wide range of therapeutic agents i.e. p-cymene, carvacrol, transanethole, alcohols, apiole, astragole and other proteins, fats, fibres and most importantly thymoquinones. Thymoquinone is considered as the miraculous bioactive agent. In this review comprehensive effort has put to review and compile various research articles including origin, geography, cultivation record, traditional uses, chemistry, pharmacology and therapeutics.

Keywords: *N. sativa*, Ethnopharmacology, Thymoquinone, Pharmaceuticals, Phytochemicals

INTRODUCTION

N. sativa L. occurs as wild in Southern Europe, Northern Africa, Asia Minor and in the Mediterranean region. It shows its luxuriant growth in warm climates with very less moisture (Iqbal *et al.*, 2010). The plant is versatile for phyto-constituents and numerous therapeutic effects. Thymoquinone is the most operative and integral component of it (Ahmed *et al.*, 2013). *N. sativa* seeds and oil have been extensively consumed in the pharmaceutical industries for treating multiple ailments. The Muslim community has extensively practicing the crop being prophetic medicine and its culinary uses. Worldwide it is treated as a neglected crop because of less production, comparatively costly because it is a climate sensitive crop and unaccommodating climatic conditions cause adverse crop losses at harvesting.

ORIGIN AND HISTORICAL PERSPECTIVE

Currently a rising interest is there in naturally occurring and therapeutically potent phytochemicals because they are fairly non-toxic, economical and accessible in an edible form. During the last 20 years almost 25 % of drugs are unswervingly plants based, another 25% are chemically transformed plant based products (Vuorella *et al.*, 2004). An antioxidizing role is played by Thymoquinone that improves the body's guard system. *N. sativa* oil tempts the uncontrolled cell division, thus facilitates body to steadily eradicate old, un-needed and diseased cells without liberating body toxins. It is taken as native to the Mediterranean region. With the passage of time it has blowout widely throughout northern Africa, eastern Asia, and southern Europe. It initiated its way into Eastern Europe and North America in the past few decades. The plant has an extensive antiquity of folk usage in different civilizations and has been recognized as a "miracle cure" for its ability to treat various ailments and assist the body in its own natural healing process (Goreja, 2003). The Muslim community is extensively practicing it primarily due to the authenticity of prophetic statement that "*N. sativa* is a cure for all, except death"; quoted by a renowned Muslim scholar, Al-Bukhari (Randhawa, 2008). Thus, the hyped status of *N. sativa* among the Muslim community is as *Habbat Albarakah*, with the term "*Albarakah*" portenting its "blessed" standing (Salem, 2005). Black seed has also been narrated in the Isaiah's Old Demonstrations (Bible 28: 25-27). Holy Bible has recognized this seed as remedial measure too (Takuri and Dameh, 1998). Dioskorides (the Greek Physician) used black seed *N. sativa* for treating headaches, nasal jamming, toothache and intestinal parasites. Hippocrates observed *N. sativa* as a cherished medication in hepatic and digestive ailments (Ghoneim *et al.*, 1982). Communal names given to species of this

genus are Devilin-a-bush or Love in a mist. *N. sativa* is frequently called as karayal (English: Small Fennel, Black Cumin; Sanskrit: Kalonji, Kalajira, Kalajaji).

HABITAT AND GEOGRAPHICAL DISTRIBUTION

N. sativa L. has been considered by ancient herbal specialists as 'the Herb from Heaven'. It occurs as wild in southern Europe, northern Africa, Asia Minor and in the Mediterranean region. The plant is under cultivation in other parts of the world too, including Saudi Arabia, Mediterranean countries, northern Africa and parts of Asia, in UAE rarely cultivated in private farms (Sharma *et al.*, 2009). Russia, Turkey, Egypt Middle-East, France and some tropical African regions are also having its cultivation practice (Jansen, 1981). The prominent potential for cultivation, propagation and production of *N. sativa* has been reported in Pakistan but very less in production (Rabbani *et al.*, 2011). India, especially the eastern regions namely Punjab, Himachal Pradesh, Bihar and Assam are also the major producers. Bengal and north-east India re also doing its cultivation practice (Iqbal *et al.*, 2010).

CULTIVATION RECORD

For medicinal and cookery consideration the herb is cultivated all around the world but at minor scale. The herb is also cultivated in Bengal at larger scale**.** It is deeply sensitive to environmental conditions hence its yield prospers principally throughout the Middle East and the Mediterranean Basin which includes India, Bangladesh, Egypt, Sudan, Turkey, Iraq, Iran, and Pakistan. Kalonji is cultivated on dry soil between November and April. The initial material for propagation of this medicinally important herb comprises cultivation from seeds which take 20-25 days to germinate under ideal physical conditions. It can also be propagated by tissue culture technique via callus culture from leaf, stem and root explants (Atal and Kapoor, 1982). Evolutionary evidences regarding initial cultivation of *N. sativa* is still flimsy but some reports quoted that seeds of *N. sativa* have been explored at various locations from ancient Egypt, counting Tutankhamun's tomb (Khare, 2004). Climatic conditions are the biggest factor for it being a neglected crop. *Nigella* cultivation requires warm climate, with less precipitation. The quantity and quality would be adversely affected if a sequential protracted period of cold and wet weather occurs at the harvest time. Fungal diseases can easily attack during wet weather. Its acreage can fluctuate sharply from one season to another due to unfavorable climatic condition

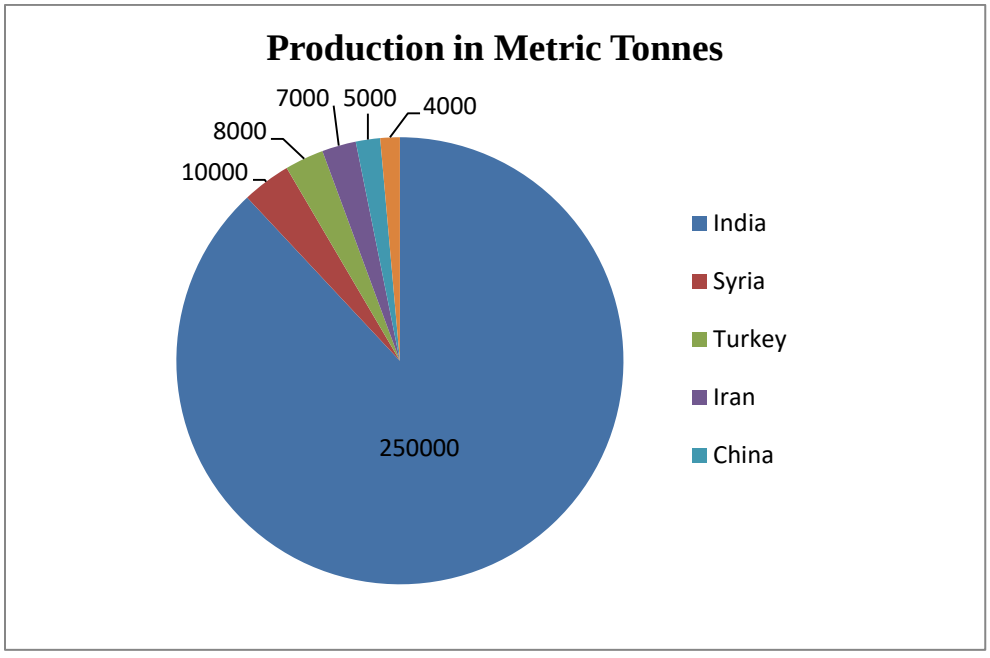

Fig. 1. Kalongi (*N. sativa* L.) Global production, Top six *N. sativa* producing countries.
Source: Commodity Trade Statistics Database | United Nations Statistics Division and World Spices Congress 2012

TRADITIONAL USES

N. sativa is widely used as a household remedy. It has always shown immunomodulatory and immunotherapeutic effects. Various medicinal systems as Unani, Ayurvedic, Chinese, allopathic and Arabian medicines have shown its consumption at a wider scale (Zohary and Maria, 2000). Seeds are utilized for spice, carminative, condiment and aromatic. Several human disorders as indigestion, diarrhea, foul breathing and watering

from mouth etc. are treated by its decoction. Seeds and its oil have been used to cure several diseases (Warrier and Nambia, 2004). The seeds are considered important because of their various characteristics including aromatic, bitter, appetite stimulant, diuretic, galactagogue, anthelmintic, carminative, deodorant, digestive, hair loss preventer and purgative. In various combinations the seeds have been used against obesity. Its oil is also used as a local anesthetic. It has also been used in chronic headache, migraine and hepatic disorders (Randhawa and Alghamdi, 2011). According to previous reports people in the Middle East and South East Asia have been using its seeds traditionally to treat certain diseases counting rheumatism, asthma, bronchitis and related inflammatory diseases. In lactating mothers, seeds increase milk production, stimulate digestion and compete against parasitic toxicities. Numerous skin disorders such as eczema and boils are treated by application of its mild extracts (Ansari and Satish, 2013).

NIGELLA SATIVA CHEMISTRY

Mainstream salutary properties of the plant are because of thymoquinone (Baheshti *et al.*, 2016). The quantity of this compound in *N. sativa* has been determined as 1881mg/kg (Nadkarni, 1976). Many active compounds with variable percentages have been isolated and reported in *N. sativa* as shown in Table 1.

Table 1. The amount of different phyto-constituents in *Nigella sativa* per 100g of Seeds.

Compounds	**Value per 100 g of seeds (%)**
alpha-pinene	13.75
Limonene	2.55
p-cymene	43.58
Carvacrol	2.53
Thymoquinone	30-48
Transanethole	1-4
Longifolene	1-8

Source: (Toma *et al*., 2010)

Numerous esters of unsaturated fatty-acids have also been reported in *N. sativa*. (Usmanghani *et al.*, 1997; Gerige *et al.,* 2009), as presented in Table 2

Table 2. Ester Contents of Nigella sativa per 100g of Seeds.

Esters/ Oils	**Value per 100 g of Seeds (%)**
Linolenic Acid	50-69%
Alcohols	7%
Oleic acid	20%
Dihomolinolenic acid	10%
Carvone	45-60%
Fenchone	1.1%
Myrcene	0.6%
B-pinene	1.3%
Nerole	1.3%
Estragole	1.9%
Carvacrol	3.7%
Apiole	1%

N. sativa also contain variable amount of alkaloids pyrazol, nigellicimine, indazole and α- hederin (Tabrosky *et al*., 2012). Most of the pharmacological potential of *N. sativa* is just due to the presence of quinine contents in various forms of which thymoquinone is the most abundant that seldom occurs as dithymoquinone, dithymohydroquinone and other oligocompounds (Buckingham, 1994). Several other compounds have also been reported as nigellone, compesterol, lophenol, stigmastenol, butyrospermol, 2,4-methylene cycloartanol, tetraxerol, 3-O-(β-D-xylopyranosyl (1→3)- α -L-rhamnopyranosyl, aliphatic alcohols, resins, tannins.

Nutritional composition of *N. sativa* is also rich as reported by Al, Jassir (1992), Atta-ur-Rahman (1995) and Ahmed *et al*. (2013) as shown in Table 3.

Table 3. Nutritional composition of *N. sativa.*

Nutrients	Value per 100 g of Seeds (%)
Carbohydrates	25%
Fibre	8%
Proteins	27%
Fats	28.5%
Total ash	4.8%

The fractionative components of *N. sativa* were isolated from its volatile oil and later on it was being declared that thymoquinone (TQ) is its main constituent (Houghton *et al.*, 1995). Initially nigellone (dimer of TQ) was extracted as the major compound of *N. sativa*, which was later named as dithymoquinone (TQ2). The photodimerization of dithymoquinone resulted in the formation of thymoquinone (TQ) (El-Fatatry, 1975). Thymohydroquinone (THQ) extraction from *N. sativa* seed evaporative oil has also been reported. It also shows anti-neoplastic and anti-inflammatory effects (Fransworth, 1994).

PHARMCOLOGY AND THERAPEUTICS

About 60% of the world's population rely on traditional medicine and in developing countries almost 80% of the population depends almost completely on cultural medical practices, in particular, herbal remedies for their primary health care practices (WHO, 2005; Nickavar *et al.*, 2003). To achieve an effective health care program for developing countries is just impossible by Western medicines alone unless it is complemented by herbal medicine as an alternative medicine (WHO, 2005). It is also reported that sufferers of chronic diseases in developing countries are turning to herbal remedies as alternatives to modern synthetic drugs (Calixto, 2000).

1. Antidiabetic activity

The pathogenicity of *Diabetes mellitus* is mainly concerned with the oxidative stress. *Diabetes mellitus* (DM) is among the most vital inflammations related to endocrines, the condition in which abnormal breakdown of carbohydrates and lipids takes place. Hyperglycemia is an inappropriate condition that is caused by absolute or relative insulin deficiency, affecting human beings widely. Antidiabetic potential of *N. sativa* oil is treated for the presence of thymoquinone for consideration of major phytochemical components of the seeds volatile oil (Ikram and Hussain, 2014). Hypoglycaemic activity of *N. sativa* extracts has been demonstrated by inspecting the antidiabetic efficacy (Sathiavelu *et al*., 2013). *N. sativa* extracts have curative effects for treating diabetes-induced disturbances of glucose (Mohamed *et al.*, 2009). A previous study reported anti-diabetic effect of *N. sativa* water extract done by maceration method; later on amylase activity was determined by DNSA, color reagent and ability to hamper dissemination of glucose across the dialysis membrane that gave maximum hang-up of α-amylase activity and a strong diffusion hindrance for glucose across a membrane dialysis (Mehta *et al.*, 2009). *N. sativa* has also been found to possess maximum anti-diabetic potential towards hepatic gluconeogenesis (Mathur *et al*., 2011). The plant also provides cure against non-insulin dependent diabetes mellitus. Thymoquinone; the active constituents of *N. sativa* shows its antidiabetic activity both in oil and aqueous form. *N. sativa* has also proved valued in diabetic individuals and those with glucose intolerance. Appetite reduction, glucose absorption and hepatic gluconeogenesis are also monitored. The blood glucose level, cholesterol, triglycerides, body weight are also being maintained by its extracts. *N. sativa* simulates glucose induced secretion of insulin from beta-cells in pancreas; improves glucose tolerance as efficiently as metformin (Kaatabi *et al*., 2015). In the long run the glucose reduction of *N. sativa* in patients with type 2 diabetes mellitus on oral reduced glycemic drugs has also been explored by selecting diabetic patients on standard oral hypoglycemic practices, assigned into groups for convenience. Finally, in *N. sativa* group, insulin resistance was notices pointedly lower, while β-cell activity much higher than the baseline values (Murli *et al.*, 2011).

2. Antiosteoporotic effect

Osteoporosis is one of the most enervate health issue developing in humans with aging. Osteoporotic Patients have very fragile bones, which break easily after a minor ordeal. The decreased postmenopausal estrogen ends to the drastic bone. It is mainly thought of as a female disease. Animal model experimentation showed that *N. sativa* and thymoquinone (active element) are referred for the treatment of postmenopausal osteoporosis, diabetic osteoporosis and for fracture healing promotion. The involvement of cure machinery is not clear thus it was assumed that the antiaging and anti-inflammation potential of *N. sativa* or thymoquinone may play vital role in osteoporosis treatment

because this bones ailment is linked to oxidative anxiety and tenderness of tissues. *N. sativa* and thymoquinone were found to be safe for supplementation in human. Both *N. sativa* and thymoquinone have shown potential against osteoporosis (Rukhsar and Batra 2013). From the literature it has been proved that there is a close relation between thymoquinone and bone's healing ability if *N. sativa* is regularly orally administered. In previous studies, it has been noticed that *N. sativa* or thymoquinone work to prevent osteoporosis in two ways either by inhibiting cyclooxygenase and lipoxygenase or by neutralizing free radicals by preventing inflammation from contributing to increased bone re-absorption and loss. Another study reported the potential of TQ to accelerate bone formation and reduction in the retention period for rapid expansion procedure of maxilla (Kara *et al*., 2012). Another study confirmed that *N. sativa* reverses osteoporosis in ovariectomized rats by providing different treatments and observed levels of Ca^{+2}, MDA (melondialdehyde), nitrates, TNFα (Tumor necrosis factor α) and IL6 (Inter Lukein 6) that were raised due to *N. sativa* supplementation (Ansam, 2014). *N. sativa* and thymoquinone may be used for treating diabetes induced osteoporosis (Shuid *et al*., 2012).

3. Antibacterial activity

Worldwide pathogenic bacterial infections have developed a major health peril. Active antimicrobial agents are directly required to overwhelm the issue. Soon after the discovery of thymoquinone, (El- Dakhakhany *et al.*, 1963). The first report regarding antibacterial potential of *N. sativa* oil phenolic fraction was produced by Topozada *et al.* (1965). Thymohydroquinone isolation from the volatile oil of *N. sativa* was noticed to be highly active against gram-positive microorganisms, including *Staphylococcus aureus* (El-Fatatry 1975). Another study narrated the antibacterial and antifungal activities against *N. sativa* ether and methanolic extracts of volatile components against pathogenic bacterial and fungal strains compared to positive controls; tetracycline, cefuroxime and ciprofloxacin (Haloci *et al.,* 2012). The antimicrobial potential of *N. sativa* was reported against pathogenic bacteria (*Streptococcus pyogene, Pseudomonas aeruginosa, Klebseilla pneumoniae* and *Proteus vulgaris*). Results of the tested bacteria showed that 100 mg/mL methanolic extract produced remarkable sensitivity resistance and aqueous extract at 20 mg/mL gave maximum resistance against *Klebseila pneumonia* and *Proteus vulgaris.* Methanolic extract at concentration of 50 mg/mL exhibited significant ($p \leq 0.01$) antibacterial activity against *Streptococcus pyogene*) (Haloci *et al.,* 2012). Another study reported antimicrobial potential of *N. sativa* seed extract against multi drug resistant bacterium *Staphylococcus aureus*. The bacterial strain was collected from 34 diabetic patient's wounds from Nsukka hospital, Southeast Nigeria. *In vitro* antibiotic susceptibility was checked using disc diffusion method and then the same procedure was opted for *N. sativa* oil. The oil showed noticeable dose related antibacterial activity against all the sequesters (Emeka *et al.,* 2015). Another important analysis was done through *in vitro* antibacterial activity of *N. sativa* extracts against clinical identified isolates. Eight organic solvents (aqueous, methanol, ethanol, chloroform, butanol, diethyl ether, *n*-hexane and acetone) extracted and evaluated at 100, 50, 25, 10 and 5 mg/mL conc. Through agar disc diffusion technique against *Enterococcus faecalis*, *S. aureus*, *Acinetobacter junii*, *E. coli*, *Proteus mirabilis*, *Serratia marcescens* and *Enterobacter cloacae*. The effective growth inhibition was ability against the tested strains. (Ishtiaq *et al*., 2013). Black cumin components were characterized by using GC-MS (Burits and Bucar, 2000). Thymoquinone, p-cymene and carvacrol were with the greatest contribution and possess strong antibacterial effect (Ali and Blunden, 2003).

4. Antifungal activity

Most of the human and animal skin infections are caused by fungi, *Candida* being at third in nosocomial bloodstream infections worldwide. The *Candida* infection management necessitated the discovery of new antifungal agents to increase the spectrum activity against *Candida* and resistance to the available antifungal drugs (Douglas, 2003). Methanolic extract of *N. sativa* has the maximum antifungal potential against various strains of pathogenic yeasts. Various components of *N. sativa* oil such as β-sitosterol and stigmasterol have anti-fungal potential against *Candida tropicalis.* (Gupta *et al*., 2012). Very less work on the potential of *N. sativa* has been reported against aflatoxin-producing fungi. Thymol was found the most effective chemical against the growth and aflatoxin production of *A. parasiticus*, followed by thymoquinone and thymohydroquinone (Rogozhin *et al*., 2011). Another study reported the efficiency of *N. sativa* with high concentration of thymol and carvacrol as very much sensitive to *Candida albicans.* (Haloci *et al*., 2012). *N. sativa* active constituents as oils obsessed moderate *in vitro* and *in vivo* inhibitory activity against pathogenic yeasts, dermatophytes, non-dermatophytic filamentous fungi and aflatoxin-producing fungi. It has been observed that for more than 90% of cases, *C. albicans* is the most proficient contributory affiliated with serious fungal infection (Douglas, 2003). *Trichophyton violaceum* (MIC 0.1 mg/mL), *Microsporum canis* (MIC 0.1 mg/mL) and *Trichophyton mentagrophytes* (MIC 0.05 mg/mL) were found most susceptible for Thymol (Taha *et al*., 2010).

5. Antidepressant

The most communal and stern mood malady is Depression. The severe symptoms effect feeling, thinking, and other daily happenings as sleeping, eating, or working. In a study the evaluation of antidepressant effect was done through forced swim test (FST) and immobility duration in tail suspension. The oral ingestion of Albino mice was done with *N. sativa* polar extracts, pointedly lessened the immobility time for tail suspension. Lateron the phytochemical investigation of both tests led to the investigation of quinones and its RP-18 column chromatography fractions were (50 and 100 mg/kg) (Elkhayat *et al.*, 2016). In a separate case, *N. sativa* oil was orally administered to the rats for 4 weeks. The antidepressant effect was checked through Forced Swim Test (FST). The rats were placed in a glass tank of water too deep for them to stand in. They were forced to swim, to try to climb out or struggle to stay afloat. Those who struggled for a shorter time before giving up were considered more depressed and those who struggled longest were considered to be the least depressed. The rats which received the N. sativa oil treatment struggled longer before they gave up on the FST and had higher levels of tryptophan in the blood and brain than those without treatment (Perveen, 2013). Similarly, the mice were used to study antidepressant model under thymoquinone functioning. Fifty male Wistar rats divided into 5 groups were treated variably. Forced swim test was thrice performed for every group (in alternative days), and noted the immobility time. Ultimately the animals were put in open-field apparatus, and the central area was noted by crossing number centrally and peripherally. The animals treated with *N.sativa* extract had the higher central crossing number than the Lipopolysaccharides (Randhawa and Alenazi, 2016).

6. Antiviral Property

High prevalence of viral infections, constant appearance of resistant viral strains and no specific treatment, the DE novo development of antiviral agents is essential. *N. sativa* oil rich with thymoquinones was noticed to cure against murine cytomegalovirus infection when injected intraperitoneally in mice for 10 days. Spleen and liver of treated mice indicated the presence of virus titer that was detectable in control mice. Although both in control and treated mice spleen showed similar Ctotoxic T- Lymphocyte activities on day 10 after infection. Serum level was also high in *N. sativa* treated mice (Saleem and Hossain, 2000). *N. sativa* was also observed to enhance helper T cell (T4) and suppressor T cell (T8) ratio and increased natural killer cell activity in healthy volunteers (El-Kadi and Kandil, 1986). *N. sativa* oil showed potential to cure the patching symptoms of Zucchini Yellow Mosaic Virus on leaves of *Cucurbita pepo.* (Abdel Shafi, 2013). Oral administration of *N. sativa* dosage as 450 mg 3 times a day for 3 months in patients with HCV indicated safe, lessened viral load, and enhanced oxidative stress (Mahmoud *et al.*, 2013). Another study demonstrated that monofloral honey from *N. sativa* had powerful anti-HIV-1 characteristics performed by quantitative polymerase chain reaction (PCR) assay and high pure viral nucleic acid kit with less maximal effective concentration (EC_{50}) values of 37.5, 88, 70, 88, 105 and 5µg/mL (Bahbahani *et al*., 2014). *N. sativa* was testified as an effective antiviral agent against papaya ring spot poty virus, using *Chenopodium amaranticolor* a local laceration host i.e. 25-100% inhibition zone at different dilutions (Muraya *et al*., 2005).

7. Anticancerous activity

The salutary value of many drugs is based not only on its clinical efficacy, but also on its lacking toxic side-effects (Salomi *et al.*, 1992). The literature supports the statement that thymoquinones and other category compounds dihydrothymoquinones and nano thymoquinones in *N. sativa* are the main constituents in efficacy against the acute and chronic disease (Randhawa and Alenazi, 2016). Norfazlina *et al.* (2013) investigated the cytotoxicity effects of *N. sativa* extracts on critical Human myeloid leukemia cell line (HL60) and observed apoptosis s mode of cell death. Chinese and Saudi Arabian researchers re-confirmed the anti-cancer stuff of the innocuous and ordinary *N. sativa* seed oil for presence of significant category compounds called thymoquinones. *N.sativa* seed oil has been used as an outmoded medicine for eras against many diseases such as cancer, cardiovascular complications, diabetes, asthma and kidney disease. Its seeds are safe and effective agent against cancer in the blood system, lungs, kidneys, liver, prostate, breast, cervix and skin (Khan *et al.*, 2011) The molecular mechanism behind its anti-cancer role is still unclear. Whereas some studies suggest that body's defense system is strengthened by antioxidative role of thymoquinones. The old, un-needed and weaker cells are eliminated from body through apoptotic mechanism of Thymoquinones. In another study, it was reported that *N. sativa* oil could be helpful potentially for people having radiation treatment for cancer. Radiation therapy affects the cancer patients with severe side effects during and after the treatment. *N. sativa* oil has been done on the oxidant/antioxidant system in the liver tissue of irradiated rats and exposed some of the rats to a single dose of gamma radiation. Experimentally it was recommended that the use of *N. sativa* oil before radiation treatment, and for 10 days afterward, protects the effecters from acute harmful radiation effects (Cikman, 2014).

8. Antiasthmatic activity

The spasmic attacks in the bronchi of the lungs was reported as Asthma, resulting in difficult breathing. It may lead to some allergic reaction or even upto hypersensitivity. The pathophysiology of asthma is basically related to Inflammation. Many cell types and multiple mediators are involved in it eventually resulting in the diseased condition. A study reported that thymoquinone causes the relaxation in tracheal smooth muscles. The relaxing effect of TQ to treat bronchial asthma is just a traditional practice (Al-Majed *et al.,* 2001). The LD_{50} value of thymoquinone as 10 mg/kg for the first time was reported by El-Dakhakhani (2000) after intraperitoneal injection in rats. Later on it was also suggested that *N. sativa* has a relatively potent antiasthmatic effect on asthmatic airways (Boskabady *et al*., 2010).

9. Antiparasitic activity

Almost 3.5 billion people worldwide were sufferred from some type of parasitic infection. All of them are not inhabitants of third world countries. Many of the infected people belong to developed countries and they are so highly contagious that even sometime a very mild contact with infected items can affect them. Ali *et al.* (2016) studied the antiparasitic effect of orally ingested *N. sativa* in the patients of Schistosomiasis, a disease caused by *Schistosoma mansoni. A* significant reduction in total worm burden was observed by application of *N. sativa* oil in diseased mice. Resultantly *S. mansoni* layed pointedly reduced number of eggs in the liver of treated mice. The tegmental surfaces of oral and ventral suckers of worms were observed through SEM and confirmed the considerable changes in the tubercles by presence or absence of spines. The tegmental surface was just damaged after treatment with *N. sativa* seed oil. Hence the effectiveness of oil was proved. After observing the antimalarial effectiveness of *N. sativa* water extract in *Mus muculus* mice infected with the *Plasmodium berghei* NK65 parasite. The results indicated a sharp reduction in the number of parasitaemia and the level of nitric oxide due to the presence of thymoquinones and antioxidant nature of *N. sativa* (Linda and Etty, 2012). A very much resembling work was carried out by Eida *et al*. (2015) in which antiparasital effect of *N. sativa* was studied against *Dientamoeba fragilis,* the causative agent of irritable bowel syndrome. The prescribed drug against the infection is metronidazole that was also run in comparison. After number of treatments, the pathological investigation of cecal tissue of the infected untreated group, it was noticed that there was complete disappearance of pathology with the highest *N. sativa* dose (500 mg/kg). 500 mg/kg and the other lower concentrations produced less severe pathological changes than in untreated animals. Literature has proved that *N. sativa* oil effects on the immune system and helpful as remedial against parasitic infections by *Aspiculuris tetraptera* and *Hymenolepis nana* (Ayaz *et al*., 2007). Emeka *et al.* (2014) worked on *N. sativa* oil in a combination form with chloroquine in the treatment of malaria against *P. berghei* in mice using different doses. After 4 days 86% suppression in *N. sativa* extract alone whereas 99.9% suppression in combination of both was observed. Complete parasitaemia clearance was obtained on 15^{th} day of treatment for both separately and in combination. The study indicated that the use of *N. sativa* seed and oil extract as dietary supplements in combination with chloroquine have potential in enhancing the efficacy of chloroquine. Another study explored the efficacy of *N. sativa* oil against *Hymenolepis nana,* the dwarf tapeworm, causative agent of zoonosis disease. It is one of the most common causes of cestode infections in rodents and human beings (Al- Megrin, 2016). In this study they used laboratory mice to check the inhibitory effect of *N. sativa* against *Hymenolapis nana*. The results exhibited the 100 % efficacy of 2.5 and 5 mL/kg oil dose against *H. nana* (Al-Megrin, 2016).

10. Anti-inflammatory

Inflammation is the body's vigorous part towards invulnerable response. The body heats up itself after an injury or infection against foreign intruders as bacteria, viruses and heals up the spoiled tissues. The active constituent TQ from *N. sativa* is probable mediator against body inflammation (Bashir *et al*., 2015). In a comparative investigation of diclofenac sodium and *N. sativa* seed ethanolic extract, the inflammation was produced by injecting 50 uL of 5% formalin in the paw of albino rat. A significant inflammation reduction was noticed in case of ethanolic extract treatment, whereas diclofenac sodium required longer duration (Bashir *et al*., 2015). Inflammation is the biggest factor for the development of solid tumor malignancies. TQ has been a strong reducing factor of pancreatic ductal adenocarcinoma and apoptosis and an ameliorative agent for inflammation supplementary carcinoma (Navdeep *et al*., 2009). In another comparative study of *N. sativa* ethanolic extract and diclofenac sodium, the analgesic effect on nociceptive response induced by acetic acid was monitored and observed that the effect was milder as compared to diclofenac salt (Bashir and Qureshi, 2010). Similarly, the increase in paw volume was being noticed by injecting Kaoline in rat paw as a result of inflammation but weekly administration showed marked reduction in paw volume (Islam *et al.,* 2013). The exogenous administration of *N. sativa* oil was also monitored and inhibited the chronic oedema induced by formaldehyde whereas acute oedema was induced by carrageenan. Thus concluded that L-

arginine plays supportive role for proper functioning of *N. sativa* oil (Abdulbasi and Owoyele, 2014). Most of studies have reported that oil and other active ingredients, in certain, thymoquinone, possess antinociceptive and anti-inflammatory effects and recommended *N. Sativa* as a potent analgesic and anti-inflammatory agent (Amin and Hosseinzadeh, 2016).

11. Anthelmintic

Historically *N. sativa* has been in practice as a traditional medicine for treating a variety of ailments in humans and animals including parasitic diseases concerned with its Anthelmintic potential. Al-Shaibani *et al*. (2008) investigated the anthelmintic efficacy of *N. sativa* against the gastrointestinal nematodes in sheep via egg hatch assay and faecal egg counts reduction test *in vitro* and *in vivo*, respectively. *In vitro* studies revealed that aqueous and ethanolic extracts of the plant at variable concentration exhibited ovicidal effects. Another important activity was done by Shah *et al.,* (2015) for the investigation of anthelmintic activity of *N. sativa* in comparison to oxfendazole medicine in broilers after experimental induction of *Ascaridia galli* infection. Broiler chicks (130 day old) were divided into 5 groups with variable treatments and ultimately determined the efficacy of N. *sativa* as 70.83%. The drug efficacy depended on total worm reduction after treatment.

12. Antifertility activity

Parandin *et al.* (2012) observed the influence of *N. sativa* on fertility prospective of gonadotropins and testosterone in rats by dividing rats in certain control and experimental groups. At the end of experiment the results were analyzed on the basis of certain factors as body and reproductive organs heft, mobility, number and life of sperms, sperm reserve in epididymaous, sperm production on daily basis, hormonal concentrations in blood, the levels of gonadotropins and fertility index. They observed a momentous difference in blood hormonal concentrations, sperm life their count, luteinizing hormone viability and level among the groups with low and higher doses as well. In another study, it was proved that *N. sativa* is a highly potent agent for improving semen quality, sperm viability, sperm mobility and semen quantity after oral administration of *N. sativa* dust for 3 months period in Wistar albino rats and concluded it to be a strong agent for treating male infertility (Marbat *et al.,* 2013). A new report suggested that intraperitoneal utilization and oral administration of crude *Nigella* oil exhibited a significant increase in the weight of seminal vesicle as well as substantial increase in sperm count, sperm quality and wall thickness of testicular seminiferous tubules (Al- Zuhairy, 2012). Another study proved that regular oral consumption of *N. sativa* powder may be accommodating for the proper functioning of Luteinizing hormone, follicle stimulating hormone and testosterone (Wim and Hop, 1991). If there is deficiency in these hormones it may lead to hypogonadism and sterility which may require replacement treatments.

13. Antioxidant

The energy generation takes place in the cells by attaining the availability of molecular oxygen (O_2) as ultimate electron acceptors in the electron transport (Novo and Parola, 2012). The free radicals or reactive O2 species are nonorganic molecules. If ROS level increases it may lead to acute damage or even cell death, known as oxidative stress. The oxidative disturbance occurs in the cells as a consequence of equilibrium alteration in reactive oxygen species production and antioxidative processes (Alenzi *et al.,* 2013). TQ as the chief component of *N. sativa* has been observed to be a strong antioxidant in literature. TQ is known as superoxide scavenger, hydroxyl radical and singlet molecular oxygen are produced by its actions. The robust antioxidant properties of TQ may be due to redox properties of its quinine structure and an unobstructed crossing of morphological obstacles. Hence it gains easy approach to sub cellular stalls and enables the reactive oxygen species rummaging effect (Badary *et al.,* 2003). Asma (2012) reported the presence of phenols, flavonoids, superoxides, hydrogen-peroxide and a direct correlation between all these free radicals producing agents and the effective performance of thymoquinone. Another study supported the presence of antioxidants in *N. sativa* much more than the standards α-tocopherol through ferric thiosulphate, thiobarbituric acid and total antioxidant assay supporting the antioxidant efficacy of thymoquinone (Nvdqeep *et al*., 2009). Thymoquinone suppresses the FeNTA-produced oxidative stress, hyperproliferation of cells and kidneys carcinogenesis of Wistar rats (Khan *et al.,* 2005). In another investigation the antioxidant potential of *N. sativa* oil with reference to TQ in different fractions showed strong antioxidant potential against DPPH (Diphenyl Picryl Hydrazyl Radical), ABTS (2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid), nitric oxide and hydroxyl radicals (Ahmed and Beg, 2014). Compounds isolated from *N. sativa* have substantial scavenging qualities attributed to prevention of chain initiation, transition metal ion binding, peroxides decomposition, reduction capacity and radical scavenging ability (Diplock, 1997; O'Ktay *et al.,* 2003).

14. Testicular protective

Ischemia is the characteristic condition in which testicle's blood supply is cut off resulting in torsion when the spermatic cord twists. In a study the effect of thymoquinones (TQ) was investigated on unilateral testicular ischemia-reperfusion injury in mice. The animals were divided into different groups: control. Thymoquinone treatment decreased Malondialdehyde torsion and Oxidative stress index values and at the same time has no effect on total antioxidant capacity and myeloperoxidase activity. Thymoquinone treatment resulted in expressively reduced histological damage associated with reperfusion injury (Gokce *et al*., 2010). In another study, the ischaemic reperfusion injury was treated with Thymoquinones from *N. sativa*. Control and experimental groups were labeled by total 24 rats. Initially 720° clockwise direction caused the torsion. Resultantly seminiferous tubule diameter was decreased due to I/R. Haseena *et al.* (2015) narrated the outcome of *N. sativa* powder on testosterone and luteinizing hormone level of streptozotocine induced diabetic rats. Basically 3 groups were designed having 6 rats in each, one as normal control and the other as diabetic control and the last one for *N. sativa* seed powder application (300 mg/kg body weight). The observed testosterone (ng/dl) level of normal control rats was 82.78 $\pm$ 8.26, diabetic rat was 41.62 $\pm$ 7.28 and cured with *N. sativa* rats was 71.34 $\pm$ 6.58. LH (ng/dl) level of normal control rats was 0.46 $\pm$ 0.12, Diabetic rats was 0.20 $\pm$ 0.06 and treated with *N. sativa* rats was 0.30 $\pm$ 0.09. The level of testosterone was decreased in diabetic rats as compared to normal. In *N. sativa* treated rates, the level of tosterone increased significantly and the level of LH was decreased significantly in diabetic rats.

15. Cardioprotective effect

Vegetables, fruits, aromatic plants, medicinal plants, leaves, flowers and roots which act as guard system to contest against diseases are known as phytochemicals. They all possess natural biochemical. A variety of phytoconstituents have been reported in variable amounts in *N. sativa* as alkaloids pyrazol, nigellicimine, indazole and α-hederin, thymoquinone, Nigellone, compesterol, lophenol, stigmastenol, butyrospermol, 2,4-methylene cycloartanol, tetraxerol, 3-O-(β-D-xylopyranosyl (1→3)- α -L-rhamnopyranosyl, aliphatic alcohols, resins, tannins, proteins, carbohydrates, vitamins, reducing sugrs, glycosidal saponins and minerals (Nickavar and Mehta, 2003). An important peril component for cardiovascular diseases and a serious public health problem worldwide is Hyperlipidemia. Certain phytochemicals produce their cardio-protective possessions due to their antiaging, antiangiogenic, anti-ischemic, inhibition of platelet aggregation and anti-inflammatory activities that lessen cardiovascular disorder's risks. In a study, it was noted that thymoquinone consumption cuts down the values of total cholesterol, Low density Lipoproteins, triglycerides and thiobarbituric acid reactive substances concentration on the lipid profile of rabbits fed upon cholesterol rich diet (Hammad *et al.*, 2014). It was also noted that daily 2 g dosage of *N. sativa* powder for two months duration have a significantly reduced level of LDL, triglycerides with increased High Density Lipoproteins level (Bamosa *et al.*, 1997). The cardioprotective issues of *N. sativa* oil was also noted in another experiment by dividing adult albino rats into 3 groups (each having 8): control, injected with lead acetate thrice a day for 8 weeks and in group 3 *N. sativa* oil was orally administered prior to lead acetate injection. Myocardial damage was evaluated by laboratory and pathological studies. *N. sativa* oil intake synthesized substantial standardization of the biological strictures and restored the histological characteristics. (Marwa *et al.*, 2013). *N. sativa* and TQ caused the protective effect on dyslipidemia that momentously decrease hepatic HMG-CoA reductase (Razavi and Hosseinzadeh, 2014). The reduced effect of total cholesterol, thioglycol and LDL whereas increased HDL level upon feeding on Rich cholesterol diet mixed with *N. sativa* oil to albino rats was noticed (Alnaqeeb, 2011). The hypotensive effect of *N. sativa* was observed related to symptomatic reduced arterial blood pressure, serum LDH upon feeding of 400 mg/kg of *N. sativa* extract to albino rats (Sayed *et al.*, 2009). *N. sativa* volatile oil and methanol extract reduce triglyceride and increase HDL as well as decrease hepatic HMG-CoA reductase activity (Ahmad and Al-Mottaleb, 2013). In another report, initially myocardial injury was induced in rats by injecting cisplatin. The rats were divided into four groups as group 1 control and 3 experimental groups. Cisplatin group showed a significant increase with reference to congestion, edema and pycnotic nuclei comparing with other groups. Thymoquinone group unveiled noteworthy increase in production of antiapoptotic protein Bcl-2, equating with cisplatin group at $p<0.05$ (Adali *et al.*, 2016).

16. Analgesic

Any substance, chemical or drug which is administered to get pain relief comes under the umbrella of analgesic. Analgesic activity is also supported by another activity in which *N. sativa* polyphenols were orally and intraperitoneally administered to wistar rats and the noticeable abdominal cramps reduction was there (Ghannadi *et al.*, 2005). Anti-analgesic effect in rats induced by 0.6% acetic acid through intraperitoneal injection of ethanolic *N.*

sativa extract (Bashir and Qureshi, 2010). *N. sativa* germinating seeds have reducing effect on inflammation much higher than the extracts due to the presence of high metabolic rates (Hayat-ul Islam *et al*., 2013). Ethanolic extracts of *N. sativa* reduced pain in albino mice induced by acetic acid writhing test. *N. sativa* extract was injected intraperitoneally as 50 mg/kg. The extract showed milder analgesic effect in comparison with diclofenac (Ibrahim and Al-Rashidi, 2016).

17. Dermatological problems

N. sativa seed and oils promote wound healing in farm animals (Ahmed *et al.,* 2013). It has been found to possess the antineoplastic potential (Salomi *et al*., 1992). Thymoquinone, the active ingredient obtained from *N. sativa* has shown to exert potent bioactivity against squamous cell carcinoma *in vitro*. Cell proliferation and cytotoxicity induction have been observed to be inhibited by it. *Trichophyton verrucosum* isolated from cattle suffering from trichophytosis suspected animals indicated hair loss, scurf scales, crusts and keratinization. Later on *N. sativa* extract was applied in pure form and in combination with enilconazole on the infected area and observed vigorous antifungal effect (Balicki, 2016).

18. Effect on hormones level

N. sativa oil is rich in phyto-constituents for treating enormous ailments. The effect of variable dosages of *N. sativa* and its ingredients was checked on certain menopausal precincts of ovary-ectomized (OVX) rats. OVX rats were divided into different groups and controlled for 21 days: positive control by equine estrogen whereas negative control by distilled water or olive oil. Uterotrophic assay was used to investigate estrogenic activity. There was indication to use *N. sativa* in the treatment of postmenopausal symptoms and possibility of a replacement to hormone replacement therapy for post menopause in humans (Parhizkar *et al.,* 2011). The estrogenic activity of *N. sativa* was observed through cornification assay in ovariectomized rats. Forty rats weighing 250-350 g were used in assay. *N. sativa* powder was orally ingested to rats for 21 consecutive days with variable dosage, and compared with equine estrogen. Vaginal cornification occurred when *N. sativa* was supplemented by indication of estrogenic activity with *N. sativa* and resultantly an auxiliary for hormone therapy. *N. sativa* oil and its bioactive fractions have the tendency to protect testis against oxidative stress (Danaldi *et al*., 2013). Anti-aging property of thymoquinone is accredited to the quinine structure of thymoquinone fragment (Gokce *et al*., 2011). Reactive oxygen species scavenging effect is being facilitated by subcellular fractions (Badary *et al.,* 2000). Thymoquinone inhibits nonenzymatic lipid peroxidation. It may lead to suppressed oxidation and fortification of the antioxidant enz

ymes of testes (Ismail *et al*., 2010). The concentration of antioxidants is lowered in blood glucose, thus reactive oxygen species enhanve the hypoglycemic effect of N.sativa oil. The number of Leydig cells is increased in rat testes by application of *N.sativa* oil (Mukhallad *et al.,* 2009). The oil also stimulates 17 L-hydroxysteroid dehydrogenase activity in addition to unsaturated fatty acid production (Gromadzka-Ostrowska *et al.,* 2002).

19. EFFECT ON BODY SYSTEMS

19.1 Hepatotobillary system

Various kinds of liver disorders may be produced due to inapt use of drugs, excessive utilization of alcohol and some toxins. Liver function is scarcely stimulated by any drugs that produce defense against liver damage and regenerate the hepatic cells too (Boyd, 1970). The liver normal physiology is disrupted by the harmful aspects of environmental factors, use of chemical drugs and by the excessive use of contaminated food at such a level that may end to other ancillary physiological changes (Sharma *et al.,* 1995). An important study was done by Paul (2011) to demonstrate the hepatoprotective effect of *N. sativa* against paracetamol induced liver damage. For this purpose they divided animals into groups of four (each having 15 rats), based on their diet as; Serum bilirubin, serum alanine aminotransferase, serum aspartate aminotransferase and serum alkaline phosphatase. It was noticed that in group A and B the level of serum ALT, AST and ALP was quite normal whereas in group C the level of serum was elevated because of oral administration of paracetamol. These elevated levels were anatagonized by prior administration of *N. sativa* oil. Serum level in group D was less as compared to group C hence concluded that *N. sativa* oil had no change in enzymes and serum albumin whereas paracetamol administration elevated the level up to toxicity.

In a study alcohol induced gastric mucosal injury in rats was cured by oral intake of *N. sativa* oil (10 mL/kg body weight, orally) and TQ (10 mg/kg body weight, orally). The results marked that *N. sativa* oil cause ulcer reduction. Gastric lesions can also be treated by *N. sativa* oil application (Kanter *et al.,* 2005)

Gani and John (2013) evaluated the hepatoprotective effect of *N. sativa* by inducing D galactosamine induced hepatotoxicity (D- GaIN) by dividing rats into four groups, each having six rats, D-GalN administered, *N. sativa*

extract administered and pretreatment prior to D-GalN administration. By application of these extracts it was concluded that there is rise in the diagnostic marker enzymes of hepatic function indicate that membrane permeability is altered and damaged during D-GalN/LPS toxication. *N.sativa* extracts show their protective effects towards tissues and avoid leakage of the enzymes to the serum. An important study was done by Muneera *et al*. (2015) regarding proportional evaluation of *N. sativa* and simvastatin (medicine) for curing hyperlipidemia and hepatotoxicity induction. Both synthetically prepared simvastatin and *N. sativa* are considered effective against lipid lowering tendency. *N. sativa* and simvastatin have momentous upgrading in the lipid profile of rats after treating with simvastatin. The p value indicated that both simvastatin and *N. sativa* were equally effective against hyperlipidemia. *N. sativa* improves biochemical and histopathological profiles and reduces liver destructed areas (Farrag *et al.,* 2007).

19.2 Nervous System

The comparative salvation of neuronal structure and/or function is known as neuroprotection. Many of the central nervous system (CNS) disorders are treated at wider level under the umbrella of neuroprotection. Certain nervous disorders as neurodegenerative diseases, stroke, traumatic brain injury, spinal cord injury, and acute management of neurotoxin consumption are also diagnosed and treated under neuroprotection. Neuroprotection objects to check or sluggish disease progression and secondary injuries (*Casson et al.*, 2012). It may be termed as cognitive disfunctioning or neuropsychiatric disorders. A vital role is played by phytochemicals from medicinal plants for maintaining chemical neurotransmitter balance (Kumar and Khanum, 2012). In a study it was being investigated that whether *N. sativa* extract improves behavioral and cellular abnormalities or not? Anxiolytic, locomotor activity of extracts (1 g/kg of body weight) was evaluated in both stressed and unstressed animal models (Hayat-ul-islam *et al*., 2015). *N. sativa* has been used at a wider scale to treat nervous system ailments such as epilepsy, memory hurt and neurotoxicity etc. In another study thymoquinone antianxiety effects induced by GABAergic acid and Nitriergic acid were being monitored in rats (Baheshti *et al.,* 2016). Neuroprotection is the relative defense of neuronal structure and/or function (Casson *et al.,* 2012).

19.3 Immune system

Immune modulation is the condition in which any immune response is being altered at some desired level. Quinones isolated from *N.sativa* have the characteristic modulatory effects on the lymphatic system. The immune system of male rabbits was suppressed by inducing dexamethasone. Resultantly, Total leucocytes count and lymphocytes, monocytes and eosinophils percentages were significantly decreased. The oral administration of *N. sativa* showed a certain immunomoderating effect. Of the immunological aspects, cellular immunity was potentially enhanced in intact and dexamethasone-induced immunosuppressed- male rabbits. Health care is monitored and maintained by continuous use of traditional phytotherapies (Al-Saaidi *et al.*, 2012).

19.4 Gastrointestinal System

An unevenness of aggressive and protective factors is gastroenteritis. The mucosal lining is continuously visible to the injurious and hazardous acids, pepsin and bile acids and other drugs effects. All these gents may be responsible for pathogenicity of stomach and the digestive tract infections. Medicinal herbs have ever been considered as traditional medicines (Satyanarayan and Purohit, 2002). In a study the gastric effect of *N. sativa* was noticed by intraperitoneal application of ZnS and Nicotinic acid whereas oral administration of *N. sativa* powder for consecutive two weeks in separate groups. Prior to this 40% ethanol was orally administered as well as intraperitoneally injected to mice to induce gastric lesions. All the treatments and were observed individually by incised explosion of stomach and duodenum. The gastric secretion and sections both were examined and observed significant increase in gastric secretion whereas significant decrease in gastric volume and reported a vigorous improvement in gastric disorders treated by *N. sativa* extract as compared to ZnS or NA (Abbas *et al*., 2010).

19.5 Urinary Disorders

Kidney disease is also known as nephropathy. The direct damage to the kidneys causes a sudden loss in kidney functions because of acute renal failure. *N. sativa* has renal has renal defensive effects against acetaminophen-induced renal injury in rats (Ahmed *et al.*, 2013). Thymoquinone (the putative component of *N .sativa*) has been so effective in anticipation of kidney stones and renal failure (Hayatdavoud *et al.,* 2016) In a study the serum creatinine level of diseased kidneys was being monitored and histopathology of kidney was quite normal and without any degeneration. inflammation, necrosis, and tubular after *N. sativa* treatment (Dollah *et al.,* 2013). In another study the effect of hexane seed extract of *N. sativa* on cadmium induced renal dysfunction in rats was observed by monitoring creatinine, urea, ALT and AST. There was significant increase in all the parameters among Cd treated

group and suggested *N. sativa* as a better cure for renal dysfunction (Onoshe and Mdusolumuo, 2014). In rats the toluene exposure resulted in nervous ailments that was monitored and ultimately cured by thymoquinone application. Rats were divided into four experimental groups: control, toluene treated, toluene with *N. sativa* extract and toluene with thymoquinone. The distorted nerve cells were mainly absent in thymoquinone and *N. sativa* extract treated rats (Kanter, 2008). Gentamicin induced nephrotoxicity (oxidative stress and inflammation) was being monitored after thymoquinone application. Gentamycin produced nephrotoxicity by increasing serum TNF-α, urea, creatinine and renal lipid peroxidation. TQ showed almost similar marked renoprotective effect against GM-induced nephrotoxicity (Mahmoud *et al.*, 2014).

CONCLUSION

Medicinal plants have been in practice since human civilization. Currently a lot of research is done on the biological exploration of medicinal plants as they are believed to be safe for human use and reduce pressure on the synthetic pharmaceuticals. Almost 80% of the world from under developed and developing countries are directly relying on medicinal plants. Plants before medicinal use are investigated on some scientific lines as phytochemical analysis. Biological evaluation is done through some tests e.g. antibacterial, antifungal, anthelmintic, antiviral and antioxidant assays. From the survey *N. sativa* is reported to be in use since human civilization because of its effective micro and macromolecules and miraculous therapeutic potential. It possesses antiparasitic, anticancerous, antidiabetic, cardioprotective, anthelmintic, antimalarial, antioxidant antimicrobial, antifungal, antifertility and anti-inflammatory activities. Except this it is much appreciated to maintain the body systems as hepatobillary, reproductive, digestive, respiratory, hormonal and nervous systems. In future some advanced studies at the molecular and genetic level can be investigated.

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