THE HISTOLOGICAL AND PHYSIOLOGICAL STUDY OF MORINGA OLEIFERA

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Abstract

The aim of the study is to clarify the effect of Moringa Oleifera plant on physiological and histological indicators in animals in the previous studies. Studies have shown that Moringa Oleifera plant led to a non-significant decrease in the body weight of rats that have been dosed. Studies have also shown that Moringa plant impairs kidney function and that its kidney wallet in The control group is wider than that of the treated mice, and the results of urea and creatinine were not statistically significant in the groups of experimental animals compared with the control animals, the physiological studies in the liver from liver enzymes were not significantly different as Moringa plant Provides protection and maintains the functional integrity of liver cells, and other studies on mice showed that the Moringa plant led to a significant increase in calcium and phosphorous in the blood of mice suffering from osteoporosis, and other studies showed that Moringa increases the levels of the fertility hormone (Testosterone, Luteinizing Hormone, Follicle Stimulating Hormone) in mice. This research was led to People's awareness of the beneficial effect of this miracle tree (Moringa Oleifera) must be increased, Consumption of Moringa oleifera daily as an herb or even as a spice should be encouraged, The area of cultivation should be increased in Iraq. It should be taken into account for future nutrition research focusing on the use of Moringa as a mineral supplement. It is too early to recommend Moringa oleifera leaves as a drug for the prevention or treatment of diabetes, cardiovascular disease, dyslipidemia, cancer and infectious diseases.

Keywords: Moringa Oleifera, Histological, Physiological, Laboratory Animals.

http://dx.doi.org/10.47832/2717-8234.12.30

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Introduction

Since the beginning of human civilization, medicinal plants have been used by mankind for its therapeutic value. Nature has been a source of medicinal agents for thousands of years and an impressive number of modern drugs have been isolated from natural sources. Many of these isolations were based on the uses of the agents in traditional medicine. The plant-based, traditional medicine systems continues to play an essential role in health care, with about 80% of the world’s inhabitants relying mainly on traditional medicines for their primary health care (1). Medicinal plants are plants inherent active ingredients used to cure disease or relieve pain (2). The medicinal properties of plants could be based on the antioxidant, antimicrobial antipyretic effects of the phytochemicals in them (3)(4).

Herbal drugs constitute major share of all the officially recognized systems of health(5). In India, herbal drugs are an integral part of The Indian System of Medicine (Ayurveda) which is an ancient and mainstream system. Although modern medicines may exist side-by-side with such traditional practice, herbal medicines have often maintained their popularity for historical and cultural reasons. Such products have become more widely available commercially, especially in developed countries. Use of herbal medicines in developed countries has expanded sharply in the latter half of the twentieth century (6).

*Moringa oleifera* is a tropical plant that is fast growing and drought tolerant. It is known by many names including *moringa*, drumstick tree, horseradish tree, ben oil tree and miracle tree (7). It is cultivated in all tropical and subtropical regions such as Pakistan, Arabia, Central America, northern and southern Philippines (8). Belonging to the family Moringaceae, the *Moringa Oleifera* species is the most common of the 13 species in the *Moringa* genus (9). It is usually used in spices and cosmetic oils and has various medical and therapeutic applications (10). The *Moringa* plant has found a great deal of economic and medical uses in the world, as all its parts contain good sources of protein, vitamins, minerals and carotenoids (11), of these parts are leaves, roots, seeds and bark Fruits and flowers (12). The root was used to treat a number of diseases such as rheumatism and constipation, while the leaves were used as a laxative to treat hemorrhoids, headaches, and ear and eye infections (13) and the seeds have a protective effect by reducing liver peroxides (14). Commercially, it is used in water treatment where ground seeds are used to purify murky and dirty water. The oil can be used as a fertilizer and ointment for skin diseases. It was also found to be used as livestock feed (15,16). *Moringa* leaves contain more vitamin A than carrots, more calcium than milk, more potassium than bananas, and more iron than spinach (17,18). Medically, *Moringa oleifera* leaves have traditionally been used as anti-diabetic, anti-bacterial, anti-headache, anti- hypertensive, anti-pyretic, anti-inflammatory (19), lowering cholesterol, diuretics, analgesic, anti-prophylactic and anti-fungal (20). It is also used to help breastfeeding mothers improve milk production after childbirth (21). *Moringa* is rich in simple sugars like rhamnose and its bark contain some alkaloids.(22). *Moringa* is rich in simple sugars like rhamnose and its bark contain some alkaloids.(23)

*Moringa oleifera* is a fast-growing and drought-resistant tree of the Moringaceae family. It is commonly known with several names including *moringa*, drumstick tree (for the long and slender seedpods), horseradish tree (for the roots taste resembling horseradish), ben oil tree (being rich in behenic acid), and miracle tree (for the medicinal properties) (24)

*Moringa oleifera* is one of the best known medicinal plant. The *Moringa* plant has been consumed by humans (25). It is one of the richest plant sources of Vitamins A, B, C, D, E and K
The vital minerals present in *Moringa* include Calcium, Copper, Iron, Potassium, Magnesium, Manganese and Zinc. It has more than 40 natural anti-oxidants. *Moringa* has been used since 150B.C (29). It is considered a very versatile plant due to its great capacity to provide edible food, which includes different vegetative structures, such as leaves, pod shells, stem, flowers, fruits and seeds. These structures contain bioactive compounds and nutrients(30). Therefore, *Moringa oleifera* provides nutrients that benefit health, making it a key food for food security in areas with fewer economic resources Figure 1 (31). The leaves and young buds of the plant are used as vegetable and can be rubbed on the temples for relieving headache while root and root bark are regarded as anti scorbatic and can be used externally as counterirritants(32). The plant is also known to possess high nutritional value and is used in a folklore medicine to treat various ailments related to pain and inflammation(33). Dried seeds of *Moringa oleifera* are used in ophthalmic preparation, venereal affection anti-inflammatory, purgative and as tonic.

The alcoholic extract of the leaves of *Moringa oleifera* are reported to have analgesic activity(34) and the aqueous extract of *Moringa oleifera* roots also shows antifertility profile(35). The plant is reported to possess wide range of pharmacological effects that include antitumor(36), antipyretic, antispasmodic, antiulcer, diuretic, hypotensive, hypolipidemic, Hepatoprotective, antifungal and antibacterial activities.

2.1 Plant Description

*Moringa oleifera* is a short, slender, deciduous, perennial tree, grows to about 10 m tall, rather slender with drooping branches; branches and stem are brittle, with corky bark; leaves are feathery, pale green, compound, tripinnate, (30-60 cm long), with many small leaflets, 1.3-2 cm long, 0.6-0.3 cm wide, lateral ones somewhat elliptic, terminal onesobovate and slightly larger than the lateral ones; flowers are fragrant, white or creamy-white, (2.5 cm in diameter), borne in sprays, with five(5) at the top of the flower; stamens are yellow; pods are pendulous, brown, triangular, splitting lengthwise into 3 parts when dry,( 30-120 cm long, 1.8 cm wide), containing about 20 seeds embedded in the pith. The pod is tapering at both ends, nine (9) ribbed; seeds are dark brown, with 3 papery wings Figure 2. (43).
Figure 2. Images of *Moringa oleifera* tree, leaves, seeds, and flowers. (24)

3.1 Classification

Kingdom: Plantae  
Super kingdom: Tracheobionta  
Super division: Spermatophyta  
Division: Magnoliophyta  
Class: Magnoliopsida  
Subclass: Dilleniidae  
Order: Capparales  
Family: Moringaceae  
Species: *Moringa*  
Genus: *oleifera* (44)

4.1 Origin and Habitat

*Species* of the family Moringeneric the Moringaceae, that is native to the sub-himalayan tracts of India, Pakistan, Bangladesh and Afghanistan. The rapidly grown tree (also known as Ben oil tree, horseradish tree, drumstick tree benzolive tree, kelor, marango, mlonge, moonga) was utilized by the ancient Romans, Greeks and Egyptian. It is highly valued from time immemorial because of its vast medicinal properties. It is now widely cultivated and has become naturalized in many location in the tropics (43).
5_1 Ecology and Cultivation

*M. oleifera* is strictly a tropical plant and grows well at lower elevations, both under wet and seasonal conditions, but can be found up to 1300m altitude. It can be grown in various soils but thrives best in fertile, well-drained sandy loams. In India the plant is propagated by planting limb cutting 1-2 m long, from June to August, preferably. The plant starts bearing pods 6-8 months after planting but regular bearing commence after the second year. The tree bears for several years. The plant thrives best on forest zone ranging from subtropical dry to moist through tropical very dry to moist forest life zones. *M. oleifera* reported to tolerate annual precipitation of 4.8 to 40.3 dm, annual temperature of 18.7 to 28.5°C and pH of 4.5 to 8. The plant thrives in subtropical and tropical climates, flowering and fruiting freely and continuously grows best on a dry sandy soil and is Drought resistant. *M. oleifera* is easily cultivated by cutting or by seeds. Seeds can be sown either directly or in containers. No seed pretreatment is required and seeds sprout readily in 1-2 weeks. Plants raised from seed produce fruit of unpredictable quality. Shield budding is successful, and budded trees begin to bear in 6 months and continue to give a good crop for 13 years. As it is essentially a vegetative propagation crop, breeding methods like single-plant selection, mass selection and exploitation and maintenance of vigour are transgressive. Stem cuttings are usually preferred because they root easily. When grown for its roots, seeds are sometimes planted in row like vegetable. (44).

6_1 *Moringa* nutritional value

*Moringa* trees have been used to combat malnutrition, especially among infants and nursing mothers. Three non-governmental organizations in particular- Trees for Life, Church World Service and Educational Concerns for Hunger Organization have advocated *Moringa* as “natural nutrition for the tropics.” Leaves can be eaten fresh, cooked, or stored as dried powder for many months without refrigeration, and reportedly without loss of nutritional value. *Moringa* is especially promising as a food source in the tropics because the tree is in full leaf at the end of the dry season when other foods are typically scarce.

A large number of reports on the nutritional qualities of *Moringa* now exist in both the scientific and the popular literature. Any readers who are familiar with *Moringa* will recognize the oft-reproduced characterization made many years ago by the Trees for Life organization, that "ounce-for-ounce, *Moringa* leaves contain more Vitamin A than carrots, more calcium than milk, more iron than spinach, more Vitamin C than oranges, and more potassium than bananas," and that the protein quality of *Moringa* leaves rivals that of milk and eggs. These readers will also recognize the oral histories recorded by Lowell Fuglie in Senegal and throughout West Africa, who reports (and has extensively documented on video) countless instances of lifesaving nutritional rescue that are attributed to *Moringa* (45). In fact, the nutritional properties of *Moringa* are now so well known that there seems to be little doubt of the substantial health benefit to be realized by consumption of *Moringa* leaf powder in situations where starvation is imminent. Nonetheless, the outcomes of well controlled and well documented clinical studies are still clearly of great value. In many cultures throughout the tropics, differentiation between food and medicinal uses of plants (e.g. bark, fruit, leaves, nuts, seeds, tubers, roots, flowers), is very difficult since plant uses span both categories and this is deeply ingrained in the traditions and the fabric of the community (46).

7_1 Pharmacological properties of *Moringa oleifera*

1. Antimicrobial Activity:

The antimicrobial activities *Moringa oleifera* leaves, roots, barks and seeds were investigated in vitro against bacteria, yeast, dermatophytes and helminthes pathogenic to man. By a disk-diffusion method, it was demonstrated that the fresh leaf juice and aqueous extract from the seeds inhibit the
growth of Pseudomonas aeruginosa and staphylococcus aureus and that extraction temperatures above 56°C inhibit this activity. No activity was demonstrated against four other pathogenic gram positive and gram negative bacteria and Candida albicans. By a dilution method, no activity was demonstrated against six pathogenic dermatophytes (47).

2 _Anti-inflammatory activity:
Methanolic extract of root bark, aqueous extract of roots, methanolic extract of leaves and flowers as well as ethanolic extract of seeds of *Moringa oleifera* has shown anti-inflammatory activity in carrageenin induced paw edema model. Aurantiamide acetate and 1,3- dibenzyl urea, isolated from roots shown this anti-inflammatory activity so they responsible for anti-inflammatory activity of *Moringa oleifera* roots (48).

3 _Anti-cancer activity:
Various extracts of leaves and ethanolic extract of seeds of *Moringa oleifera* shows anti-tumor activity in in-vitro tests. Thiocarbamate and inhibitor of tumor promoter teleocidin B-4- induce Epstein- Barr virus (EBV) activation in Raji cells (48).

4 _Anti-diabetic activity
Aqueous extract *Moringa oleifera* leaves shows anti-diabetic activity on glucose tolerance in Goto-Kakizaki and wistar rats. This was supported by Jaiswal D et al., according whom aqueous extract of *Moringa oleifera* leaves shows antidiabetic control and thus exhibit glycemic control (49).

8_1 Phytochemistry
Phytochemicals are, in the strictest sense of the word, chemicals produced by plants. Commonly, though, the word refers to only those chemicals which may have an impact on health, or on flavor, texture, smell, or color of the plants, but are not required by humans as essential nutrients. An examination of the phytochemicals of *Moringa* species affords the opportunity to examine a range of fairly unique compounds. In particular, this plant family is rich in compounds containing the simple sugar, rhamnose, and it is rich in a fairly unique group of compounds called glucosinolates and isothiocyanates (50,51). For example, specific components of Moringa preparations that have been reported to have hypo-tensive, anticancer, and antibacterial activity include 4-(4-O-acetyl-a-L-rhamnopyranosyloxy)benzyl isothiocy-anate (1), 4-(a-L-rhamnopyranosyloxy)benzyl isothiocy-anate (2), niazimicin (3), pterygospermin (4), benzyl isothiocyanate (5), and 4-(a-L- rhamnopyranosyloxy) benzyl glucosinolate (6). While these compounds are relatively unique to the *Moringa* family, it is also rich in a number of vitamins and minerals as well as other more commonly recognized phytochemicals such as the carotenoids (including B-carotene or pro-vitamin A). These attributes are all discussed extensively (52) and will be the subject future review in this series (Fig.3).
Fig. 3: Structures of selected phytochemicals from *Moringa* spp.: 4-(4'-O-acetyl-a-L-rhamnopyranosyl)benzyl isothiocyanate [1], 4-(L-rhamnopyranosyl)benzyl isothiocyanate (2), niazimicin (3), pterygospermin (4), benzyl isothiocyanate (5), 4-(a-L- rhamnopyranosyloxy)benzyl glucosinolate (50)

9.1 Composition of *Moringa oleifera*

The composition of *Moringa oleifera* varies according to climatic changes, crop management, or the maturity of the plant at the time of harvest, as well as on the type of treatment after harvest, and depends on the growing area in which it is grown (53).

1. Primary Metabolites

*Moringa* leaves are a rich source of minerals, such as calcium, potassium, zinc, magnesium, iron, phosphorous and copper (54). The paper has characteristics by containing a high content of protein due to the presence of amino acids that make up about 30% of its weight and it is comparable to powdered milk that contains 35% (55-56). Its protein content is 29.4 g protein/100 g dry weight in leaves (57). As for carbohydrates, its level is lower (8.1%) (58). Where it was noted that *Moringa oleifera* leaves contain high levels of β-carotene as well as provide more vitamin A than carrots and pumpkin (59). It is also a good source of vitamin B (60). It contains more vitamin C than oranges, where a large part of this calcium is in the form of calcium crystals (61). *Moringa oleifera* is richer in potassium and iron than bananas and spinach, respectively (62). *Moringa oleifera* seeds are high in monounsaturated/saturated fatty acids (MUFA/SFA), sterols and tocopherols, as well as proteins rich in sulfur amino acids (63). *Moringa oleifera* seeds oils are also called behen oil, which is the trade name given to *Moringa oleifera* oil. The main fatty acids present in *Moringa oleifera* oil are behaine, linoleic, stearic, palmitic, oleic, arachidic, linolenic, eicosenoic, hepta-fatty acids, with oleic acid being the main unsaturated fatty acid. The seeds are a rich source of calcium and magnesium, respectively (65,64).

2. Secondary Metabolites

The different parts of *Moringa oleifera* are good sources of glucosinolates, flavonoids phenolic acids (56-65), carotenoids (66), tocopherols (67). Alkaloids, saponins, tannins, steroids, phenolic acids, alkaloids, carotenoids, polyphenols, isothiocyanates, phytates, glucosinolates, flavonoids and...
terpenes can be found in the Moringa oleifera leaf (68). Among glucosinolates, benzyl 4-0-(a-L-rhamnopyranosyloxy)-glucosinolate is the most pre-dominant (glucomoringin) (56).

Its leaves include 11 phenolic acids (gallic acid, caffeic acid, chlorogenic acid, o-coumaric acid, p-coumaric acid, ellagic acid, gentisic acid, sinapic acid, syringic acid) (69,70) and their derivatives (coumaroylquinic acids and their isomers, feruloylquinic and caf-feoylquinic), 26 flavonoids (present mainly as flavonol and glycoside: quercetin, rhamnetin, campferol, apigenin and myricetin (68). Flavonoids include flavonol glycosides (glycosides, rutinosides and malonylglycosides) of quercetin "kaempferol " (0.05-0.67%) isorhamnetin and lignans (isoloculariresinol, medioresinol, epipinoresinol glycosides and secoisoloculariresinol) (71,65). Furthermore, there is a difference according to geographical area, showing higher phenolic content in Pakistan than in India, Thailand, Nicaragua and even in the United States (72,73).

10_1 Biological Effects of Moringa oleifera

The bioactive compounds present in Moringa oleifera give disease prevention and treatment benefits, such as antimicrobial (74), anti-inflammatory (75), anticancer, anti-diabetic, antioxidant, hepatoprotective, and cardioprotective (76,77). Primary and secondary metabolites may also contribute to these applications. Primary metabolites are proteins, sugars and lipids that show positive effects on chronic diseases such as cancer, cardiovascular disease, diabetes and obesity. Secondary metabolites are secondary molecules, such as phenolic compounds, halogenated compounds, sterols, terpenes and small peptides(78). Moringa oleifera reduces inflammation by inhibiting inflammatory enzymes and proteins in the body, and the concentration of the leaves can significantly reduce inflammation in cells (79). Moringa oleifera contributes to controlling the growth of unwanted microorganisms, due to its low pH values and presence of pterigospermin (80). Moringa oleifera roots have antibacterial benefits and are known to be rich in antimicrobial agents . It was found that the bark extract has antifungal activities, while the bark and stem juice shows an antibacterial effect against Staphylococcus aureus (81). Studies have shown the anticancer effect of several compounds, namely glycosyl isothiocyanates, niacin, benzylcarbamate and b-sitosterol, which have antitumor properties against lung, breast, skin, esophageal and pancreatic cancers. These compounds are found in high concentrations in the leaves and seeds of the plant (82). Moringa oleifera is rich in ascorbic acid, which provides an anti-diabetic effect by aiding insulin secretion, and another compound found in Moringa oleifera that produces this effect is myricetin (83 -84). Moringa plays an important role in protecting the liver from damage, oxidation and toxicity due to the high concentrations of polyphenols in its leaves and flowers. Moringa oil can also restore liver enzymes to normal levels, reducing oxidative stress and increasing the protein content of the liver. The flowers and roots of the Moringa oleifera plant contain a compound called quercetin, which is known to protect the liver . The leaves and seeds of Moringa oleifera have been found to help lower blood pressure. This is due to compounds called glycosides . Moringa oleifera leaf extract has also been found to significantly reduce cholesterol levels due to the action of B-sitosterol (85).

11_1 Toxic or adverse effects

Moringa oleifera roasted Moringa seeds contain potential mutagenic agents such as 4-(a-erramnopranosyloxy)-benzyl glucosinolates, which increase the proportion of micronucleated erythrocytes, indicating a certain degree of genotoxicity (86). The leaf contains a high concentration of saponins, which can be harmful to vegetarians, as their consumption reduces the bioavailability of divalent and trivalent minerals such as zinc and magnesium (87).
12-1 Moringa oleifera applications in the food industry

*Moringa oleifera* has several uses due to its composition. The seed powder is used to purify water and get rid of a large amount of suspended matter in rivers and turbid water, making it a natural coagulant for water treatment. The seed oil can be used as a fertilizer, and it is also used for cosmetics such as soaps and perfumes (88).

13_1 Effective medicinal chemical compounds in the moringa plant

Medicinal plants contain many active substances, which differ according to their chemical (89), including:

1. **Flavonoids**

are phenolic compounds found in abundance in fruits and vegetables. Their chemical structure includes 15 carbon atoms with two phenolic groups attached to three carbons. Flavonoids play a vital role in reducing the risk of many diseases, as they act as an anticoagulant (90), and they inhibit oxidative stress that results from the generation of free radicals, as well as protecting the body from cancer and heart diseases (91 ). Among the most important flavonoids found in the flavonoids are kaempferol, quercetin, and saponines that are spread in various parts of the plant. Flavonoids improve the protective enzyme system in humans and protect it from age-related diseases (92). The flavonoids in the morin tree provide protection of the human body from oxidative stress resulting from heavy metal pollution such as cadmium and lead.

2. **Vitamins**

*Moringa* is characterized by containing many vitamins such as vitamin E, vitamin C, vitamin A and vitamin (92)

**Vitamin E**

Vitamin E is one of the antioxidant compounds in the *Moringa* plant, (93) It comprises a group of eight compounds, four tocotrienols and four tocopherols, and the more fluid biologically active form is tocopherol - which scavenges the lipid peroxyl radical by breaking down the lipid peroxyl radical. The chains leading to its formation (94), and this has a role in reducing complications of type 1 and type 2 diabetes by accelerating the antioxidant pathway to reduce oxidative stress (95).

**Vitamin C**

is an important antioxidant organic acid. The active and reduced part of it is called ascorbic acid. It is found in all parts of *Moringa* (96). Vitamin C is important in promoting skin health through its role It also contributes to the absorption of calcium and iron and strengthens capillary walls (97). In addition, it inhibits oxidative damage and protects against it by neutralizing reactive oxygen species (ROS). It is also important in regulating blood sugar levels(98)

3. **Plant sterols Phytosterols**

Sterol is an essential element in the membranes of eukaryotic organisms, as its role is to control the fluidity and permeability of the membrane. Through competitive inhibition (99,100) *Moringa* is a plant rich in dietary sterols such as stigmasterol campesterol, sitosterol, which is a precursor to hormones, as it stimulates the ducts of the mammary glands to produce milk by increasing estrogen, as well as It is introduced as a raw material in the pharmaceutical industry to treat malnutrition in children under the age of 3 years (101), as it is an important source of beneficial compounds and is also used as a raw material in the pharmaceutical industry (102).
4. Fatty Acids

Fatty acids are carboxylic acids that have a long unbranched aliphatic chain and constitute the basic units of triglycerides or fats, and they are either saturated or unsaturated (103), the Moringa plant is rich in saturated and unsaturated fatty acids (104), as Moringa seeds are one of the parts that contain the most important unsaturated fatty acids, such as oleic acid, linoleic acid, and - Linolenic acid - which are among the unsaturated essential unsaturated fatty acids that fall within the fatty acids of group 3 - Omega longer this (105) . Fatty acids are a source of energy in case the body needs large amounts of ATP(106)

14.1 Protective effects of Moringa oleifera leaves against chronic diseases

![Diagram showing the protective effects of Moringa oleifera leaves against chronic diseases](image)

**Figure 4.** Protective effects of MO leaves against chronic diseases: cardiovascular disease, by lowering plasma lipids including triglycerides (TG) (107) decreasing blood pressure (108) and reducing oxidative stress (109); diabetes, by lowering plasma glucose (110), reducing insulin resistance (111) and increasing B cell function (112); NAFLD, by reducing hepatic lipids (113), reducing liver enzymes (113) and decreasing hepatic inflammation and cancer, by reducing DNA damage (114), viability of cancer cells (115) and increasing apoptosis (116).

1.2 Effect of Moringa Olifeera plant in Kidney function

The researchers (117) conducted an experiment on rats and found that Moringa oleifera solution impairs kidney function in rats. The dose concentration of 250, 750, 750 mg/kg body weight of Moringa oleifera extract was used for a period of one twenty days. Histological examinations of the rats' kidneys noted that the capsular spaces of the kidneys of rats of experimental appeared wider than those of rats of control. As for the evaluations of the activities of alanine and aspartate transaminases in the kidneys of rats from the control and experimental groups. He found significant
activities of alanine and aspartate Transaminases in experimental mice compared to control mice. The evaluation of urea concentrations in the serum of control and experimental groups noted that there was a significant higher activity of urea concentrations in the serum of experimental mice compared to control mice. Changes in behavioral activities and mean body weight (g) of control group up and experimental rats during the experimental procedure. The researchers administered orally administered 1585 kg/mg to the rat. The results obtained with urea and creatine did not show a significant difference compared to the control group. However, there was an increase in kidney function. The results of histology of the kidneys showed no destruction of the kidney structure, as The results showed a decrease in the movement of the treated animals after an hour of treatment. And it was noted that taking Moringa oleifera for 60 days did not have a significant effect on blood parameters compared with the control group.

2-2 Discussion

Traditional use of Moringa oleifera plants as anti-diabetic, anti-bacterial, anti-headache, anti-hypertensive, anti-fever and anti-inflammatory. This study did not observe any behavioral abnormalities in rats. This means that Moringa oleifera leaves may not have had any harmful effects on the body’s organs such as the brain, cerebellum and inner ear that control behavioral functions, balance and balance. The control group rats gained a statistically significant increase in body weight while the rats suffered a non-significant decrease in body weight during the experimental procedure. Furthermore, statistical analyzes showed a significant decrease in the mean body weight of rats. Means that Moringa oleifera leaves probably had no significant differences which were opposite effects on the overall morphology of the kidney as no gross abnormalities were observed in the kidneys of the control rats. However, histological examinations showed normal cellular structure of the kidneys of the rats, while the capsular areas of the rats’ kidneys in the control group appeared wider than those of the treated rats (117). The researchers conducted experiments on guinea pigs where they administered intraperitoneal Moringa oleifera extract for 3 weeks and then administered doses 3.6-4.6-7.0 mg/kg. The results showed mild tubular fibrosis with interstitial inflammation (glomerulonephritis).

There were no significant differences in the percentage of animal weight gain throughout the period of administration of the extract at all doses compared to control animals. This observation may indicate that the extract did not alter the metabolic processes of the treated animals which may subsequently affect hormones and body weight. It was observed that the food intake of all treated animals was reduced compared to the control animals without a subsequent decrease in the body weight of the animals. Moringa oleifera may serve as a dietary supplement. It has also been reported to contain a profile of an important mineral and a good source of protein, vitamins, B-carotene, amino acids, and several phenols (Siddhuraju and Becker, 2003; Holist, 2011). The results also showed that there were no significant differences in all blood parameters of the test animals compared with the control group. The results of urea and creatinine also showed no significant differences in all groups of experimental animals compared with control animals. The results of the blood chemistry confirmed the histological report of the kidney, which showed no damage to the kidney cells. However, there was a slight increase in urea and creatinine levels in the treated animals. Thus, there is a need for caution in the long-term consumption of this medicinal plant as it may exhibit nephrotoxicity in the long term.(118)

that lower doses (3.5 and 4.6 mg/kg) affect mainly the glomeruli, while the higher dose (7.0 mg/kg) has a global effect on the kidney tissues (affecting; glomeruli, tubules, and interstitial spaces surrounding the tubules). These findings mean that the toxicity of methanolic extract of Moringa oleifera roots to the guinea pig’s kidneys is both time-dependent and dose-dependent. The reversal
group retained features of distortion of histo-architecture of kidney tissues, which means that injuries inflicted on the kidney tissues are irreversible.(119)

3_2 Effect of Moringa Olifera in Liver functions

The researchers(118) administered orally administered 1585 kg/mg to the rat. The results obtained the hepatic enzymes markers (SGOT, SGPT, ALP) were not significantly different from the control. However, slight reductions in the values of SGOT were observed at all the doses compared with the control. The liver histology results showed no destruction to the hepatocyte and the architecture except slight congestion of the hepatocytes in the treated groups. Results showed a non-significant decrease in the values of SOD and CAT at 500 mg/kg and 1500 mg/kg while non significant increase were observed in the values of MDA at 500 mg/kg and 1500 mg/kg as compared with the control group. There were no significant differences in the sperm motility and abnormality between the control group and the treated groups. However, there was significant reduction in the sperm.

The researchers(120) dosed mice with Moringa oleifera bark extract (250 and 500 mg/kg, respectively) once daily for 7 days. Treatment with MO extract as well as standard hepatoprotective agent silymarin ameliorated the increased plasma levels of these hepatic enzymes and indicated the hepatoprotective potential of the extract.

and treated orally with Moringa oleifera (400 mg / kg) leaves extract daily for 8 weeks. The results showed that CCl poisoning of mice leads to a significant decrease in total body weight and an increase in the ratio of liver to body weight. Also, taking Moringa oleifera alone showed a non-significant increase in total body weight compared to the control group. Liver function tests showed that CCl poisoning of mice leads to significant elevations in serum ALT, AST and ALP accompanied by significant decreases in serum albumin and total protein levels. that received CCI alone.(121)

4-2- Discussion

It was also revealed in this study that Liver enzyme biomarkers were not significantly altered by the extract. Despite this, histopathological results showed unremarkable sinus congestion in the hepatocytes of the treated animals. Sperm quality examination revealed no toxic effect on sperm count, motility and morphology as shown in this study. The results of lipid peroxidation and antioxidant level of treated mice as shown in this study showed a non-significant increase in MDA level and decrease in SOD and catalase levels at doses above 500 mg/kg. This may indicate that Moringa oleifera has the ability to stimulate the generation of free radicals and this may be the rationale for the slight increase in urea and creatinine values in treated animals.(118). The study showed that Moringa oleifera extract significantly reduced SGPT, SGOT level significantly at 500 mg/kg dose and also ALP level significantly reduced at 250 mg/kg and 500 mg/kg dose. The enhanced level reduction of serum SGPT( Serum Glutamic-pyruvic Transaminase ) , SGOT(glutamic-oxaloaetic transaminase), ALP(Alkaline phosphatase) and total bilirubin by Moringa oleifera extract appears to provide protection and maintain the functional integrity of hepatocytes. An abnormal increase in plasma bilirubin levels indicates severe cholestatic liver disease in hepatocyte function. Previous oral administration of Moringa oleifera extract showed significant protection against Acetaminophen AAP-induced hepatotoxicity. It reduced bilirubin levels although it was minimal at both doses and is an indication of protection against AAP-induced hepatic damage. Acetaminophen (AAP) is a frequently used analgesic that causes the formation of NAPQI and hepatic damage by GSH depletion.(120).
The results showed that *Moringa oleifera* leaf extract reduced the level of Malondialdehyde and the activity of liver enzymes and increased the activity of antioxidant factors. At the same time, the histological deteriorating effects of CCI and toxicity were improved after treatment with this extract. In conclusions, *Moringa oleifera* leaf extract enhanced innate antioxidant activity and attenuated CC-induced liver injury, and thus could be used as a liver preventative drug in the future.(121)

### 5.2 Effect of *Moringa* plant on Osteoporosis

This study was conducted to study the effect of *Moringa oleifera* leaves and seeds and their mixtures on osteoporosis in mice. Thirty-five adult female rats were divided into five groups, the first group, the negative control group (five) and fed only the basic diet, and the other four groups were fed (7 rats each). On a basic diet containing 100 mg of prednisone acetate as a source of glucocorticoids/kg of the diet to induce osteoporosis for two weeks. One group of them was presented as a positive control, while the other three groups were fed a prednisone acetate diet containing dried *moringa* leaves (2.5%), *moringa* seeds (2.5%) and 2.5% of their mixture at (1:1), respectively. Blood and femur samples were collected to estimate both blood and bone markers of osteoporosis. The results showed that supplementation with *Moringa oleifera* leaves and seeds and their combinations resulted in a significant (p < 0.05) increase in serum calcium and phosphorous in osteoporotic rats. There was a significant (P < 0.05) increase in parathyroid hormone (T4) and a significant (P < 0.05) decrease in parathyroid hormone (PTH) in osteoporotic rats. The mineral density of the femur bones was also significantly increased.(122)

### 6.2 Discussion

The real bone malady is osteoporosis, a fundamental skeletal illness, with an ensuing increment in bone delicacy and defenselessness to break. Menopause or estrogen inadequacy is the fundamental driver of osteoporosis. *Moringa* powder contains a sufficient amount of vitamins, minerals, proteins, phenols and various phytonutrients. This makes the tree a solution to various diseases. *Moringa* is one of the plants’ most abundant sources of vitamins and minerals, for example, calcium, copper, iron, potassium, magnesium, manganese and zinc. These results were in concert with the current study. The results of the current study showed that maintaining the rats on leaves, seeds or *moringa* mixture caused a significant increase in the level of calcium and phosphorous in the blood. Calcium, Phosphate and Vitamin D are essential for healthy bone structure and function. The mineral density of the femur bones has also been significantly increased.(122)

### 7.2 Effect of *Moringa* plant on level of male reproductive hormones

The study showed the effect of aqueous extract group of *Moringa* seeds at a concentration of 200-300-400 mg/kg and aqueous extract group treated with cadmium chloride on the level of testosterone LH and FSH for male albino rats for a period of one month. Where the results were observed that there was a significant increase in the level of testicular fat hormone T and follicle stimulating hormone (FSH) for the two groups of rats that were dosed with aqueous extract of *Moringa* seeds only (300,400) mg / kg, while the results showed no significant differences in the level of these two hormones in the group that The extract was dosed 200 mg / kg for 30 days, and there were no significant differences in the level of LH hormone in the groups that were dosed with aqueous extract of *Moringa* seeds only (200, 300, 400) mg / kg compared to the negative control group. While the results showed a significant increase (in the levels of testicular fat hormone T, LH and FSH) in groups of rats that were dosed with aqueous extract of *Moringa* seeds at concentrations (200,300,400) mg/kg with cadmium chloride for 30 days compared to the group that was dosed Cadmium chloride only the positive control group, in addition, there were no significant differences between these groups in the level of testicular fat hormone T when compared with each other or when compared with the negative control group.(123)
8.2 - Discussion

The primary examination of the plant components of *Moringa* seed extract proved that it contains many plant components such as steroids, flavonoids, phenols pl, tannins, and saponines, as saponins and steroids possess fertility-boosting properties and are useful for treating erectile dysfunction. The high concentration of hormones may be due to the *Moringa* plant containing Rutin and Quercetin, which stimulate the Luteinizing Hormone (LH) in the testicles to produce greater levels of testosterone. (123)

9.2 - Toxic effects of *Moringa Oleifera* plant

Daily doses of 100, 200, 400 and 1000 mg/kg body weight of crude methanol extracts of *M. oleifera* leaves and seeds were administered orally to 8 groups of 5 mice per group for 28 days. A control group of 5 mice was also included in the experiment. There was a significant decrease in hemoglobin in animals treated with 1000 mg/kg body weight of the seed extract while there was no significant change in Hb at the other doses. Also, the leaf extract did not result in any significant decrease in hemoglobin in all tested doses. The decrease in PCV and Hb indicates that the seed extract in some certain doses can precipitate a certain degree of anemia especially if it is used for a long period of time. The observed increase in neutrophils and white blood cells (WBC) although insignificant, in animals treated with 200 and 1000 mg/kg of seed extract may be due to the plant's ability to induce a certain degree of improvement in immunity. (123)

Aminotransferases (ALT and AST) are good markers of liver cell damage though not necessarily indicative of the severity of damage. There was a significant decrease of AST levels in the group of rats treated with 100 and 200 mg/kg, in rats treated with 400 mg/kg and 1000 mg/kg seed extract respectively while only the group treated with 1000 mg/kg leaf extract revealed a significant decrease in AST levels p<0.01. Other doses of the leaf extract tested revealed no significant change in the levels of AST. A decrease of AST observed is an indication that the extracts possess some potential to protect the liver cells. The seed extract at all doses tested can thus be regarded as safe doses at which the extract may be administered. (123)

An increased ALT is known to indicate liver disease and has become a tool for measuring hepatic necrosis." In this study, the decrease in alanine amino transferase (ALT) levels was significant in the group treated with 200 mg/kg of the seed extract, emphasizing the 200 mg/kg body weight as an effective and safe dose while other doses of both seed and leaf extracts, revealed no significant changes. (123)

A significant decrease in the alkaline phosphatase (ALP) levels p<0.001 was observed in rats treated with the seed extract at all doses tested, indicating that the seed extract is safe at all doses tested and effective in lowering the liver enzyme ALP. The occurrence of cholestasis nor- mally associated withincrease in serum ALP and which mostly precedes other indicators such as hyperbilirubinemia is thus ruled out. Hence, the seed can be said to be more effective in reducing the liver enzyme ALP when compared with the significant decrease in ALP levels at 100 mg/kg and 1000 mg/kg body weight respectively which was observed in rats treated with the leaf extract while at other doses of the leaf extract (200 and 400 mg/kg) revealed no significant change. (123)

Urea is one of a number of non-protein nitrogenous substances that accumulate in the plasma when renal excretion is reduced. Causes of increased blood urea levels include high protein diet, intestinal hemorrhage, dehydration and shock. Urea level could be decreased as a result of liver failure, low protein diet and presence of anabolic steroids. In this study, there was a significant decrease in blood urea nitrogen levels in animals treated with 100 mg/kg of the seed extract. (123)
Conclusion

Moringa is considered one of the plants rich in nutrients, especially in its leaves. Its nutritional, healing, social and economic potential include. Several studies have described its ability to regulate

Recommendations

1- People’s awareness of the beneficial effect of this miracle tree (Moringa Oleifera) must be increased.

2- Consumption of Moringa oleifera daily as an herb or even as a spice should be encouraged.

Moringa oleifera cultivation should be increased in Iraq. The area of

3- It should be taken into account for future nutrition research focusing on the use of Moringa as a mineral supplement.

4- It is too early to recommend Moringa oleifera leaves as a drug for the prevention or treatment of diabetes, cardiovascular disease, dyslipidemia, cancer and infectious diseases.

5- A histological study of body organs such as the ovaries, testes, liver, spleen, and kidneys, and studying the effect of moringa on them is possible.
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