wjpmr, 2025, 11(7), 413-426

WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.wjpmr.com

SJIF Impact Factor: 6.842

Research Article

ISSN (O): 2455-3301

ISSN (P): 3051-2557

FORMULATION AND EVALUATION OF OINTMENT OF GREWIA TENAX EXTRACT FOR NATURCEUTICAL DELIVERY SYSTEMS OF ANTIMICROBIAL AGENTS

Mahmoud Mahyoob Alburyhi[1]*, Salwa M. Raweh[2], Abdul Basit Ahmed Al Ghoury[3], Mohammed A. Al Khawlani[4], Maged Alwan Noman[1] and Abdalwali Ahmed Saif[1]

[1]Professor Dr. of Pharmaceutics and Industrial Pharmacy, Department of Pharmaceutics and Industrial Pharmacy, Faculty of Pharmacy, Sana'a University, Sana'a, Yemen.

[2]Associate Professor Dr. of Pharmacognosy, Department of Pharmacognosy, Faculty of Pharmacy, Sana'a University, Sana'a, Yemen.

[3]Associate Professor Dr. of Medical Parasitology and Microbiology, Faculty of Medicine and Health Sciences, Amran University, Yemen.

[4]Assistant Professor Dr. of Pharmacology and Toxicology, Faculty of Pharmacy, Sana'a University, Sana'a, Yemen.

***Corresponding Author: Prof. Dr. Mahmoud Mahyoob Alburyhi**

Professor Dr. of Pharmaceutics and Industrial Pharmacy, Department of Pharmaceutics and Industrial Pharmacy, Faculty of Pharmacy, Sana'a University, Sana'a, Yemen.

Article Received on 13/05/2025 **Article Revised on 02/06/2025** **Article Accepted on 23/06/2025**

ABSTRACT

The objective of this present study was to produce an ointment formulation containing an *Grewia tenax* extract and evaluate its antimicrobial activity. *Grewia tenax* (Family:Tiliacea) represent as one of the selected plants used as treatment. The alcoholic extract of different part of plant (leaves, stems and fruits) were have antimicrobial effects against different tested microorganisms at different concentrations. The results indicated that the alcoholic leaves extract was more efficacy against tested microorganisms (S. aureus, S. epidermidis, E. coli and P. aeruginosa) with inhibition zones equal (18,19,17and14mm) respectively than other parts extract followed by stem extract then by fruits extract with the inhibition zones (17,18,17, and 13mm) and (17,16,15 and 14mm) against (S. aureus, S. epidermidis, E. coli and P. aeruginosa) respectively. Generally, the antibacterial activity of *Grewia tenax* extract appears to be inhibitory to Gram-positive bacteria more than Gram-negative bacteria. The ointment formulations were prepared which are concentrations (12.5, 6.25, 3.125 and 1.5% w/w) and made compare between base and ethanol extract were evaluated. The formulation ointment containing F1(12.5w/w) extract showed better antimicrobial activity, physicochemical characteristics, and pharmacological parameters than the other ointment formulations. The zone of Gentamycin was similarity with a highly concentration ointment formulation F1(12.5w/w) were evaluated. Among the all-ointment formulations the ointment formulation F1(12.5w/w) containing *Grewia tenax* showed better antimicrobial activity. It was concluded that the extract of *Grewia tenax* F1(12.5w/w) was a better candidate for nutraceutical delivery systems of antimicrobial agents for eradicating common microbial infections.

KEYWORDS: *Grewia tenax*, Ointment, Antimicrobial Activity, Nutraceutical Delivery Systems.

INTRODUCTION

Background of *Grewia Tenax* (Family: Tiliaceae)[1-84]

The plant product or natural products show an important role in diseases prevention and treatment through the enhancement of antioxidant activity, inhibition of bacterial growth, and modulation of genetic pathways. The therapeutics role of number of plants in diseases management is still being enthusiastically researched due to their less side effect and affordable properties. It has been accepted that drugs based on allopathy are expensive and also exhibit toxic effect on normal tissues and on various biological activities. It is a largely accepted fact that numerous pharmacologically active drugs are derived from natural resources including medicinal plants.

Plants spices have been utilized to cure many diseases for a long time. In today's time, despite the fact that synthetic drugs are promptly accessible and exceedingly powerful in curing different diseases, there are persons who still incline toward utilizing traditional pharmaceuticals on account of their less harmful impacts. There is a wide diversity of compounds, particularly auxiliary metabolites, which are confined from plants having antibacterial, anticancer, anti-inflammatory, analgesic, antiviral antitumor, and many other activities to a major or minor extent. Well-known

examples of these phytochemical compounds incorporate phenols, glycosides, flavonoids, phenolic, saponins and stilbenes, cyanogenic glycosides, nitrogen compounds (betalains, amines, alkaloids), tannins, terpenoids, and few different endogenous metabolites.

Grewia tenax (Family: Tiliaceae), commonly known as Gangeti and or guddaim is a valuable plant species in Kachchh region. *G. tenax* is presumed to cure distress of stomach, skin and intestinal infections, fever, diarrhea, cough, dysentery, hepatic disorders, jaundice, rheumatism and have calm antibiotic properties. Leaves branches of *G. tenax* are significant element of traditional medicine for the curing of tonsillitis, trachoma and are used as a poultice to treat swelling. The plant species have free radical scavenging activities which might be in charge of the remedial action against tissue damages. As shown in Figure 1.

Grewia tenax (Forssk.) Fiori is a small-leaved white cross berry that belongs to the Tiliacea family. This fruit-producing deciduous shrub or small tree is prevalent in African and Southeast Asian countries. The tree has a wide distribution in the savannah plantation area in the north and middle of Sudan. *Grewia tenax* has been used in folk medicine in several ways in different countries. The roots have been used to treat jaundice. There is commercial potential in using the fruits in beverages, yogurt, ice cream, and baby food. *Grewia tenax* is used as medicine to treat various diseases including jaundice and hepatic disorders, a decoction prepared from the bark is used as antihelmintic and an alcoholic extract ointment was reported to help in faster wound healing. The fruits, roots and leaves of *G. tenax* were used as food while its juice and fruit decoctions have been used in Africa as thirst quenching drinks in hot weather. *Grewia tenax* is cultivated and distributed in Yemen.

In addition to the fruit, bark infusions are also used in wound healing. There is a paucity of scientific evidence regarding its use for jaundice and other liver disorders. Moreover, the fruits are eaten to treat anemia and chest diseases. The genus *Grewia* is represented in Egypt by three species, *Grewia villosa* Willd, *Grewia tembensis Fresen*, and *Grewia tenax Forssk*. The species is known for its edible fruits, which are nutritionally balanced and rich in iron and calcium. The drupes also contain amino acids, mineral elements (K, Ca, Mn, Fe, Cu and Zn), tannin and pectic substances.

The methanolic extract of *Grewia tenax Forssk*. showed good activity against Pseudomonas aeruginosa. In certain study, the carbohydrate and lipids content were investigated for the first time, in addition to the hepatoprotection activity of the prepared extracts from *Grewia tenax Forssk*. Fruits. The plant has high medicinal values and is widely used for the treatment of various common diseases. *G. tenax* Fiori is reputed to cure upset of stomachs, some skin and intestinal infections, cough, fever, diarrhea, dysentery, jaundice, rheumatism and have mild antibiotic properties. The plant preparations are used for the treatment of bone fracture and for bone strengthening. Its root and fruits are well known household remedy for the treatment of osteoporosis, tissue and wound healing. Leaves and twigs of *G. tenax* are an important component of folk medicine for the treatment of trachoma, tonsillitis, infections and are used as a poultice to treat swelling.

The stem bark and leaves of G. populifolia are reported to constitute some phytochemicals like triacontan-1-ol, α- amyrin, β-amyrin, β-sitosterol, lupenne, erythrodiol botulin and tetratriacont-21-ol-12-one. The plant has been found to contain grewinol, tetratricontane-22-ol-13-one. The seeds contain 5% of bright-yellow oil containing palmitic acid, stearic acid, oleic acid, linoleic acid and unsaponifiable. In preliminary phytochemical studies, plant extracts in different solvents were found to contain diterpenes, glycosides.

Product of Food Importance

Food: The fruits consumed by man and animals contain a large amount of iron and can be made into a refreshing drink. Fruit storage can be extended by drying. The dead leaves are eaten, but only while they remain on the plant. Its fruits are thirst quencher in summer season. A drink is prepared by soaking the fruit overnight, hand-pressing, sieving, and sweetening.

Fig. 1: *Grewia Tenax* Plant (Family: Tiliaceae).

Medicinal Importance

Leaves and twigs of *G. tenax* are important components of folk medicine for the treatment of trachoma, tonsillitis, infections and are used as a poultice to treat swelling. *G. tenax* plant is used for the treatment and prevention of iron deficiency anemia. Porridge, called Nesha, is prepared by boiling fruit pulp of *G. tenax* and millet flour given to lactating mothers. Ointment of whole plant extract applied locally for hard tissue repair and bark paste of G. tenax can be applied as plaster. A preparation of *G. tenax* fruit powder mixed with milk is given for the treatment of bone fracture and swelling.

Effective treatment strategies have been developed for eradicating common microbial infections. Despite the concerning approaches, the ever-increasing incidences of

microbial infections commonly caused by parasites, fungi, viruses, and bacteria are alarming. Several common bacterial infections are caused by bacteria such as Escherichia coli, Streptococcus pneumonia, Klebsiella pneumonia, and Staphylococcus aureus. Bacterial infections further cause several chronic infections and are the reason for the high number of mortalities, globally. Therefore, the discovery of antibiotics is directed as a remarkable achievement in the medical field, from surgery to organ transplant and for various microbial infections and diseases. But bacteria have developed immunity against antibiotics which led to the occurrence of multidrug resistant bacteria. For decades, antimicrobial resistance (AMR) has been growing as a threat to the treatment efficacy of antiparasitic, antifungal, antiviral, and antibacterial drugs. Hence, antibiotic resistance, especially antibacterial resistance (ABR), has turned out as a dilemma in the medical field and public health, for treating patients. *Grewia tenax* extract for their antimicrobial applications to use as alternatives to antibiotics for the benefit of patients.

In this study, ointment formulations containing extract of *Grewia tenax* were prepared for nutraceutical delivery systems of antimicrobial agents for eradicating common microbial infections.

MATERIALS AND METHODS

Plant Materials and Preparation of Extract

The extract of *Grewia tenax* was prepared and gift from (Dr. Salwa M. Raweh, Associate Professor Dr. of Pharmacognosy, Department of Pharmacognosy, Faculty of Pharmacy, Sana'a University, Sana'a, Yemen). Oleaginous base (white soft paraffin), Emollient (liquid paraffin), Emulsifying (cetostearyl alcohol), Ethanol 95% (v/v) (Umco®, Yemen) and Distilled water as a gift from (Modern and Global Pharmaceutical Industry Company-Yemen).

Formulation and Evaluation of *Grewia Tenax* Extract[85-182]

Phytochemical Screening of Extract

The phytochemical screening was conducted on the *Grewia tenax* extract by using many tests of phytochemical such as (Molisch's test, Benedict's test, Xanthoprotein, Ninhydrin, Fecl3, Cupper acetate, Mayer's test, Wagner's test, Dandruff's test, Hager's test, Alkaline reagent and Lead acetate).

Antimicrobial Activity of Extract

Four bacteria were used for the study, Gram positive bacteria include of staphylococcus epidermidis, Staphylococcus aureus and Gram-negative bacteria include Escherichia coli, Pseudomonas aeruginosa. All the tested strains were local isolates and were obtained from AL-Aulaqi laboratory. These bacteria served as test pathogens for antibacterial activity assay. Four different concentrations of each extract of selected plants (12.5, 6.25, 3. 25 and 1.5 mg/ml) were dissolved in purified water (PW) to be used in antimicrobial activity test. Extract solutions were prepared just before carrying out the test. Antibacterial activity of the extracts was determined by agar well diffusion method.

The bacterial suspensions containing 106 CFU/ml of bacteria were spread on petri dishes plates with a sterile swab moistened with the bacterial suspension. In each of these plates, five wells were cut out using a standard corn borer (7mm). About 60µl of each extract was added into different wells (duplicate each concentration), PW was used as a negative control. Positive control antibiotic wells were placed in the plate. All the plates were incubated for 24hrs, at 37°C. After incubation bioactivity was evaluated by measuring the zone of inhibition. The experiment was performed in one of antibiotic standard Gentamycin (10mcg) were used as reference to determine the sensitivity of each bacterial species tested and used as control positive.

Preparation of Ointment Formulations

Ointments were prepared by the fusion method. The white soft paraffin was melted at 70 -75ºC then liquid paraffin was added at 70ºC. After melting, the ingredients were stirred gently. Cetostearyl powder (0.25% W/W) then the mixture was added to previous ingredients.

In water bath with a temperature not exceeding 50°C, the *Grewia tenax* extracts in a concentration of 12.5, 6.25, 3.25 and 1.5% were added to prepare four formulations, F1 (12.5% w/w), F2 (6.25% w/w), F3 (3.25% w/w), and F4(1.5% w/w), respectively. The remaining quantity of purified water was added, and the pH was drop wise adjusted with buffer. The final weight was adjusted with water *quantum statis* (*q.s.*) to 100g as shown in Table 1.

Table 1: Composition of Ointment Formulations.

Ingredients Percentage	F1	F2	F3	F4
***Grewia Tenax* Extract (w/w)**	12.5	6.25	3.25	1.5
Oleaginous Base (White Soft Paraffin) WSP	1.5	3	4	5
Emollient (Liquid Paraffin) LP	2.5	5	3	4
Emulsifying (Cetostearyl Alcohol) CSA	1.5	2	3	4
Distilled Water	q.s.p.	q.s.p.	q.s.p.	q.s.p.

q.s.n. = quantity sufficient to neutralize ointment base, q.s.p = quantity sufficient to prepare 100 grams of ointment

Formulation Ointment Base

The three ingredients for ointment base formulation, which are white soft paraffin liquid paraffin, and cetostearyl alcohol.

Evaluation of Ointment Formulations

Physical Appearance

The ointment formulations were evaluated for their physical parameters.

pH Determination of Ointment Formulations

The pH of the ointments was detected with a digital pH meter. An amount of 0.5g of ointment was dissolved in 50ml of distilled water and stored for two hours. Each formulation's pH was measured in triplicate and the average values were taken.

Viscosity Evaluation of Ointment Formulations

The rheological behavior of different formulations was done by measuring the viscosity. This viscosity expressed in centipoise (cP) was determined by Brookfield viscometer by a modified method. The test sample was taken in a clean and dry 250ml beaker, and the viscosity of the test sample was determined by the standard operating procedure of viscometer using spindle No. 5. This spindle was used for finding the viscosity of the sample at speeds of 25, 50, and 80rpm. Samples were measured at 25 ± 1°C.

Evaluation of Ointment Base

The different formulation bases aimed at choosing the best proportion of ingredients as oleaginous base (white soft paraffin), emollient (liquid paraffin) and emulsifying (cetostearyl alcohol) dependent and independent. These results as shown in Table 2.

Table 2: Results of the Selection Variables.

Independent (Ingredient)	Dependent (Response)
Oleaginous Base (White Soft Paraffin)	Ointment base
Emollient (Liquid Paraffin)	Viscosity
Emulsifying (Cetostearyl Alcohol)	Emulsifying agent

Effect of Formulation Ingredients on Viscosity

Significantly shows that the oleaginous base (white soft paraffin) has the maximum effects on the viscosity of ointment base while the binary effects of emollient (liquid paraffin) and emulsifying (cetostearyl alcohol) have the minimum effect on the viscosity. The results as shown in Table 3.

Table 3: Optimization of Formulations.

Independent (Ingredient)	Abbreviation	Lower Limit %	Upper Limit %
Oleaginous Base (White Soft Paraffin)	WSP	1.25	5
Emollient (Liquid Paraffin)	LP	2.5	5
Emulsifying (Cetostearyl Alcohol)	CSA	1.5	5

Antibacterial Activity of Ointment Formulations

Each formulation was assessed for its antimicrobial effects against the microorganisms on a nutrient agar using a suitable diffusion method. About 0.2 ml of the bacterial test strain was inoculated over a nutrient agar plate with a sterile cotton swab and was allowed to dry. With the help of a cork borer, 6 mm diameter wells were created. Half a milliliter of the *Grewia tenax* extract was introduced into the wells. The plates were placed at room temperature for about one hour. Then the plates were placed in an incubator at 37 °C for 24 hours. Then, the zone of inhibition was checked and recorded Gentamycin was used as standard.

RESULTS AND DISCUSSION

This study evaluated the antibacterial activity of herbal ointments. Four different concentrations of an *Grewia tenax* extract were used to prepare ointment formulations. The formulations were evaluated for the physical parameters.

Phytochemical Screening of Extract

The Molisch's test was negative with all parts of extracts for *Grewia tenax*. While, it showed positive for benedict's test. In the other test of detection proteins and amines the results of the current study showed positive for xanthoprotein test in leaves and fruits but was negative in M. at the same of test for protein in Ninhydrin test it was positive in M and fruits but negative in leaves. The detection of phenol and diterpenes it was positive in leaves and M respectively while was negative for other parts. In alkaloids, it was only positive with Wagner's test in all parts of plant so this extract contains of alkaloids. Detection of Flavonoids it was only positive in Lead acetate in two parts of plant leaves and fruits but negative in Alkaline test at the all parts of plant. As shown in Table 4.

Table 4: The Results of Phytochemical Tests for *Grewia Tenax* Extract.

Test	Ethanolic Extract		
	Leaves	Mix	Fruits
Detection of (CHO)			
Molisch's Test	-ve	-ve	-ve
Benedict's Test	-ve	+ve	+ve
Detection of Proteins and Amines			
Xanthoprotein	+ve	-ve	+ve
Ninhydrin	-ve	+ve	+ve
Detection of Phenols			
Fecl3	+ve	-ve	+ve
Detection of Diterpenes			
Cupper Acetate	-ve	+ve	-ve
Detection of Alkaloids			
Mayer's Test	-ve	-ve	-ve
Wagner's Test	+ve	+ve	+ve
Dandruff's Test	-ve	+ve	+ve
Hager's Test	-ve	-ve	+ve
Detection of Flavonoids			
Alkaline Reagent	-ve	-ve	-ve
Lead Acetate	+ve	-ve	+ve

Antibacterial Activity of *Grewia Tenax* Extract

The results of antibacterial activity of *Grewia tenax* obtained as one solvent extract against four different human pathogenic bacteria and different concentrations. The results of this study showed the alcoholic extract of different part of plant (leaves fruits and mix) were have antimicrobial effects against different tested microorganisms at different concentrations. these results indicated that the alcoholic leaves extract was more efficacy against tested microorganisms (S. aureus, S. epidermidis, E. coli and P. aeruginosa) with inhibition zones equal (18,19,17,14mm) respectively than other parts extract followed by mix extract then by fruits extract with the inhibition zones (17,18,17 and 13mm) and (17,16,15 and 14mm) against (S. aureus, S. epidermidis, E. coli and P. aeruginosa) respectively. All these results were comparing with the zones of reference antibiotic standard (17mm, 16 mm, 15mm and 14mm) against (S. aureus, S epidermidis, E. coli and P. aeruginosa) respectively. Through these results may possible to using instead of antibiotics. These results showed that the ethanolic extract of different parts might be equal or more in the characteristics of antibiotics.

Generally, the antibacterial activity of *Grewia tenax* extract appears to be more inhibitory to Gram-positive bacteria than Gram-negative bacteria. The zones of growth inhibition on the Gram-positive, Gram negative, that used in this research showed the growth inhibition as shown in Table 5 and Figure 2(a,b,c,d). The concentration of *Grewia tenax* extracts was determined by incubating four concentrations (12.5, 6.25, 3.25 and1.5 %) of extracts with a standard inoculum of microbial cultures; however, 12.5% was the highest concentration showed the effects, while placebo showed no growth inhibitory on all microorganisms. Gentamycin was the only antibiotics used as standard for gram positive and gram-negative bacteria. This standard revealed antimicrobial activity with all organisms in ethanolic solvents.

Table 5: The Antimicrobial Activity of *Grewia Tenax* Extract Against Some Pathogenic Bacteria.

Bacteria	Conc												RSTD	Plac
	Leaves				Mix				Fruits					
	12.5	6.25	3.25	1.5	12.5	6.25	3.25	1.5	12.5	6.25	3.25	1.5		
S. Aureus	18	15	11	10	17	14	11	9	17	15	10	8	14	0
S. Epidermidis	19	16	11	10	18	14	12	9	16	13	12	9	15	0
E. Coli	17	15	13	12	17	14	12	11	15	12	11	10	14	0
P. Aeruginosa	14	12	10	8	13	12	10	9	14	12	10	9	14	0

RSTD = Reference Standard (Gentamycin). Plac = Placebo, Conc = Concentration.

Fig. 2a: Staphylococcus Epidermidis Test.

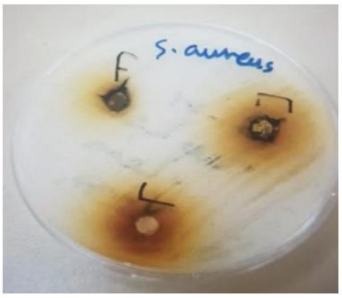

Fig. 2b: Staphylococcus Aureus Test.

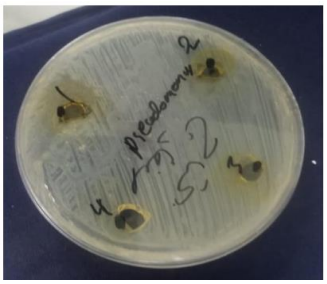

Fig. 2c: Pseudomonas Aeruginosa Test.

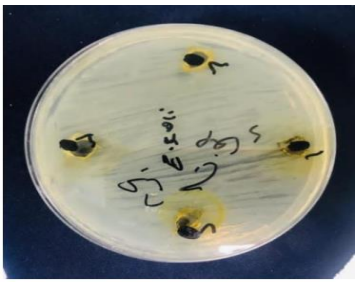

Fig. 2d: E. Coli Test.

Fig. 2: The High Sensitivity Results of *Grewia Tenax* Extract Against Some Pathogenic Bacteria.

During this study, the ointment formulation was tested on the mice. Many concentrations were prepared which are (12.5, 6.25, 3. 25 and 1.5%) and make compare between base and ethanol extract. The results of this study showed a high effective at 12.5%.

DISCUSSION

This study has been focused in particular on the famous medicinal plant used in Yemen. This present study used ethanolic solvents to extract this plant against gram positive and gram-negative bacterium and evaluated obtained extract for antimicrobial activity using well diffusion assay, phytochemical test and formulation. This results showed that the highest antimicrobial activity was with ethanolic solvent with gram-positive bacteria with all concentrations. The *Grewia tenax* indigenous to be used as an excellent dressing for wounds. The results of diameter of the zone of inhibition are shown in Table 5. Plant extracts resulting in 15mm or more growth inhibition zones were considered active and those resulting in less than 15mm were inactive. This current study of ethanolic fraction found a high antimicrobial effective against several gram positive and gram-negative bacteria including S. aureus, S. epidermidis and E. coli but it showed no effective against P. aeruginosa because the inhibition zone was 14mm. In this study, Ethanolic fraction showed better antimicrobial activity against S. aureus, S. epidermidis, E- Coli, and Pseudomonas aeruginosa, (18, 19, 17, and 14mm) in leaves and (17, 16, 15 and 14mm) in fruit respectively, these results showed a high sensitivity against S. aureus.

As shown in Table 5, the results showed that the high antimicrobial activity with all organisms using Gentamycin as standard. The zone of Gentamycin was similarity with a highly concentration (12.5%). In phytochemical screening the extract of this plant has alkaloids, Diterpenes, phenol and Flavonoids it was only positive with Wagner's test in all parts of plant so this extract contain of alkaloids. Detection of Flavonoids it was positive in Lead acetate in two parts of plant leaves and fruits but negative in Alkaline test at the all parts of plant. The effectiveness of medicinal plants in healing diseases is due to the presence of different phytochemical compounds (Alamgeer and Asif, 2018). The different phytochemical compounds present in *G. tenax* could be responsible for the antibacterial activity detected in this study against S. aureus. The lowest minimum inhibitory activity of *G. tenax* crude extract observed against P. aeruginosa. The ointments were creating an optimal process of wound healing. The ointment showed that the oleaginous base (white soft paraffin) has the maximum effects on the oleaginous of ointment base while the binary effects of emollient (liquid paraffin) and emulsifying (cetostearyl alcohol) have the minimum effect.

CONCLUSION

According to the present study, the antimicrobial activity improves with the increasing concentration of the *Grewia tenax* extract. The extract of this medicinal plant has antimicrobial activity with S. epidermidis, S. aureus and E. coli. The different phytochemical compounds present in *G. tenax* could be responsible for the antibacterial activity detected in this study against S. aureus. The results of *Grewia tenax* extract showed a high antimicrobial activity with all organisms using Gentamycin as standard. The zone of Gentamycin was similarity with a highly concentration ointment formulation F1(12.5w/w). Among the all-ointment

formulations the ointment formulation F1(12.5w/w) containing *Grewia tenax* showed better antimicrobial activity. It was concluded that the extract of *Grewia tenax* F1(12.5w/w) was a better candidate for nutraceutical delivery systems of antimicrobial agents for eradicating common microbial infections.

ACKNOWLEDGEMENT

The authors are thankful to Modern and Global Pharmaceutical Industry Company-Yemen, for support and facilities.

REFERENCES

1. FAO. Traditional Food Plants: A Resource Book for Promoting the Exploitation Consumption of Food Plant in Arid, Semi-arid and Sub-humid Lands of Eastern Africa. Rome: FAO Food and Nutrition., 1988; 42.
2. Abdualrahman MAY, Ali AO, Suliman AM. Nutritional Evaluation of Guddaim Fruits (Grewia tenax) and its Utilization in Ice Cream Production. J Sc Tech., 2011; 12: 03.
3. Khemiss, F, Ghoul-Mazgar S, Moshtaghie A, Saidane D. Study of the effect of aqueous extract of Grewia tenax fruit on iron absorption by everted gut sac. Journal Ethno pharmacology., 2006; 103: 90-98.
4. El-Kamali H, El-Khalifa K. Folk medicinal plants of riverside forests of the Southern Blue Nile district, Sudan. Fitoterapia., 1999; 70: 493-497.
5. Shrivastava, P, Chandrapuria, V, Bhargava M, Kushwah A. Biochemical alterations in healing tissues with herbal preparations in cow calves. Ind J Veterin Surg., 2000; 21: 79-81.
6. Kumar S, Parveen F, Goyal S, Chauhan A. Indigenous herbal coolants for combating heat stress in the hot Indian arid zone. Ind. Journal Tradit. Knowl., 2008; 7: 679-682.
7. Al-Numair KS, Ahmed SEB, Al-Assaf AH, Alamri MS. Hydrochloric acid extractable minerals and phytate and polyphenols contents of sprouted faba and white bean cultivars. Food Chem., 2009; 113(4): 1002.
8. Boulos L. Flora of Egypt printed by Al-Hadara Publishing, Cairo. Egypt., 2000; 2: 140.
9. Nidhi Sharma, Vidya Patni. Grewia tenax (Frosk.) Fiori.-A traditional medicinal plant with enormous economic prospective. Asian Journal Pharmcy Clinic Research., 2012; 5: 28-32.
10. Stef DS, Gergen I, Harmanescu M, Stef L, Druga M, Biron R. Determination of the microelement contents of some medicinal herbs. J Agroaliment Processes Technol., 2009; 15(1): 163-167.
11. Mabry–Hernandez IR. Screening for iron deficiency anemia–including iron supplementation for children and pregnant women. Am Fam Physician., 2009; 79(10): 897-8.
12. Praveen KG. Phytochemical and pharmacological properties of the Genus Grewia: a review. International Journal Pharmacy Pharmacology Science., 2012; 4(4): 72.
13. Prakash L, Sharma, NN, Goyal G. Chemical investigation of the stem barks of Grewia tenax (Forsk) Aschers and Grewia flavescens Juss. Indian J Chem Sect B: Org Chem Incl Med Chem., 1979; (5): 537-538.
14. Khemiss F, Ghoul-Mazgar S, Moshtaghie AA, Saidane D. Study of the effect of aqueous extract of Grewia tenax fruit on iron absorption by averted gut sac. J Ethnopharmacol., 2006; 103: 90-98.
15. Zaidi MA, Crow SA. Biologically active traditional medicinal herbs from Baluchistan, Pakistan. Journal Ethnopharmacology., 2005; 96: 331–334.
16. Martins E, Christiana I, Olobayo K. Effect of Grewia gum on the mechanical properties of paracetamol tablet formulations. African Journal of Pharmacy and Pharmacology., 2008; 2: 1-6.
17. Ogaji I, Okafor IS. Potential of Grewia Gum as Film Coating Agent: Some physicochemical properties of coated Praziquantel tablets. International J of Pharmaceutical Research., 2011; 3: 16-19.
18. Prasad CV, Rao KC, Reddy GV, Rani TS, Yerriswamy B, Subha MCS. Characteristic studies of Ligno-Cellulosic fabric Grewia tenax. Journal of Natural Fibers., 2010; 3: 194 – 215.
19. Akanksha DG, Vikas KJ, Neetesh S, Shalendra B, Neelam KJ. Dinesh: Formulation and Evaluation of Neomycin Sulphate Ointment containing Natural Wound Healing Agent Curcuma longa, International Journal of Pharmaceutical Sciences and Drug Research., 2009; 1: 105–118.
20. Elrofaei NA, Elsharif KH, Elshikh AA, Bashir ME, Ahmed IF, Garbi MI, Kabbashi AS, Saleh MS. Studies on Antibacterial Activity of Some Medicinal Plants against Selected Bacterial Strain. J Antimicrob Agents., 2018; 4: 2.
21. Alamgeer YW, Asif H. Traditional medicinal plants used for respiratory disorders in Pakistan: a review of the ethno-medicinal and pharmacological evidence. Chinese Medicine., 2018; 13: 48.
22. Elmuez Alsir, Aboagarib A, Ruijin Yang, Xia Hua, Azhari Siddeeg. Chemical Compositions, Nutritional Properties and Volatile Compounds of Guddaim (Grewia Tenax. Forssk) Fiori Fruits. Journal of Food and Nutrition Research., (2014); 2(4): 187-192.
23. Mikhail Yu, Chernyak Valery E, Tarabanko Andrey, Morosova A, Alexander A Kondrasenkoa. Preparative Synthesis of Furfural Diethyl Acetal through the Direct Interaction of the Alcohol and Aldehyde. Journal of Siberian Federal University Chemistry., 2016; 2: 146-151.
24. Yang HS, Fu DZ, Kong XF, Wang WC,Yang XJ, Nyachoti CM, Yinf YL. Dietary supplementation with N-carbamylglutamate increases the expression of intestinal amino acid transporters in weaned Huanjiang mini-pig piglets. J. Anim. Sci., 2013; 91: 2740–2748.
25. Choi JH, Maeda K, Nagai K, Harada E, Kawade M, Hirai H, Kawagishi H. Termitomycamides A to E, Fatty Acid Amides Isolated from the Mushroom Termitomyces titanicus, Suppress Endoplasmic

Reticulum Stress. Organic letters., 2010; 12: 5012-5015.
26. Sharma V, Singh M. Isolation and Characterization of Stigma-5,22dien-3-O- β -D-Glucopyranoside from the ethanolic root extract of Operculina turpethum; International Journal of Advanced Research., 2013; 1(8): 303-312.
27. Zhao Q, Xue Y, Liu ZD, Li H, Wang JF, Li ZJ, Wang YM, Dong P, Xue CH. Differential effects of sulfated triterpene glycosides, holothurin A1, and 24-dehydroechinoside A, on antimetastasic activity via regulation of the MMP-9 signal pathway. J Food Sci., 2010; 75, H280–H288.
28. Aydin S, Canpinar HU, ndeger U, Guc, D, Colakoglu M, Kars A, Basaran N. Assessment of immunotoxicity and genotoxicity in workers exposed to low concentrations of formaldehyde. J Arch Toxicol., 2013; 87(1): 145- 153.
29. Barber I, Sharma R, Mogra S, Panwar K, Garu U. Lead induced alterations in blood cell counts and hemoglobin during gestation and lactation in Swiss albino mice. Journal of Cell and Molecular Biology., 2011; 9(1): 69- 74.
30. El-Seweidy M, Asker M, Ali S, Atteia H. Effect of prolonged intake of iron enriched diet on testicular functions of experimental rats. Natural Science., 2010; 2(6): 551- 556.
31. Khadeer A, Krishna V, Dandin CJ. In vitro antioxidant and in vivo prophylactic effects of two gamma-lactones isolated from Grewia tiliaefolia against hepatotoxicity in carbon tetrachloride intoxicated rats. Eur J Pharmacol., 2010; 631(1-3): 42-52.
32. Kumar D, Kumar A, Prakash O. Potential antifertility agents from plants: A comprehensive review. J Ethnopharmacol., 2012; 140: 1-32.
33. Lebda M A. Acute iron overload and potential chemotherapeutic effect of turmeric in rats Int. J Pure App Biosci., 2014; 2 (2): 86-94.
34. Mahmoud EA, Elbessoumy AA. Effect of Curcumin on hematological, biochemical and antioxidants parameters in Schistosoma Mansoni infected mice. International Journal of Sciences., 2013; 2: 1-14.
35. Mansour SA, Mossa AH. Adverse effects of lactational exposure to chlorpyrifos in suckling rats. Hum Exper Toxicol., 2010; 29: 77-92.
36. Mohammed Elhassan GO, Yagi SM. Nutritional Composition of Grewia Species (Grewia tenax (Forsk.) Fiori, G. flavescens Juss and G. Villosa Willd) Fruits. Adv J Food Sci Technol., 2010; 2(3): 159-162.
37. Monfared AL. Histological, ultrastructural and biochemical studies on the kidney of mice treated with Carthamus tinctorius L. extract. Avicenna Journal of Phytomedicine AJP., 2013; 3(3): 272 – 278.
38. Obidah W, Godwin JL, Fate JZ, Madusolumuo MA. Toxic Effects of Grewia mollis Stem Bark in Experimental Rats. Journal of American Science., 2010; 6(12): 1544-1548.
39. Patil P, Patel MM, Bhavsar CJ. Preliminary Phytochemical and Hypoglycemic Activity of Leaves of Grewia Asiatica L. Research Journal of Pharmaceutical, Biological and Chemical Sciences., 2011; 2(1): 516-520.
40. Rasyidah TI, Suhana S, Nur-Hidayah H, Kaswandi MA, Noah RM. Evaluation of Antioxidant Activity of Zingiber Officinale (Ginger) on Formalin-Induced Testicular Toxicity in Rats. Journal of Medical and Bioengineering., 2014; 3(3): 149-153.
41. Saafi EB, Louedi M, Elfeki A, Zakhama A, Najjar MF. Protective effect of date palm fruit extract (Phoenix dactylifera L.) on dimethoate inducedoxidative stress in rat liver. Exp Toxicol Pathol., 2011; 63: 433–441.
42. Sharma N, Patni V. Grewia tenax (Frosk) Fiori-A traditional medicinal plant with enormous economic prospective. Asian J Pharm Clin Res., 2012; 5(3): 28-32.
43. Siddiqi R, Naz S, Ahmad S, Sayeed, SA. Antimicrobial activity of the polyphenolic fractions derived from Grewia asiatica, Eugenia jambolana and Carissa caranda. International Journal of Food Science & Technology., 2011; 46(2): 250-256.
44. Sini KR, Sinha BN, Rajasekaran A. Acute toxicity studies of aqueous leaf extract of Capparis grandiflora. J. Chem. Pharm. Res., 2010; 2(6): 112-117.
45. Soni A, Widyarti S, Soewondo A. Study of Necrosis in the Liver of Formaldehyde and Benzo (α) Pyrene Exposured- Mice. JTLS., 2013; 3 (1): 58 – 62.
46. Zia-Ul-Haq M, Stanković MS, Rizwan K, Feo VD. Grewia asiatica L., a food plant with multiple uses. Molecules., 2013; 18(3): 2663- 82.
47. Shree Devi M. et al. GC-MS, FT-IR Analysis and Antibacterial Study of Bioactive Compounds of Chundaivattral Chooranam - A Siddha Poly Herbal Formulation. International Journal of Pharm Tech Research., 2015; 8(10); 204-209.
48. Aboagarib EA, Yang R, Hua X. Physicochemical, nutritional and functional characteristics of seeds, peel and pulp of Grewia tenax (Forssk) Fiori fruits. Trop J Pharmaceut Res., 2016; 14(12): 2247-2254.
49. AadesariyaM K, RamVR, DaveP N. Evaluation of Antioxidant Activities by use of Various Extracts from Abutilon Pannosum and Grewia Tenax in the Kachchh Region. MOJ Food Process. Technol., 2017; 5(1): 13.
50. Yogeswari S, Ramalakshmi S, Neelavathy R, Muthumary J. Identification and Comparative Studies of Different Volatile Fractions from Monochaetiakansensis by GCMS. Global J Pharm., 2012; 6(2): 65-71.
51. Mihailovi V. et al. Studies on the antimicrobial activity and chemical composition of the essential oils and alcoholicextracts of Gentianaasclepiadea L. J Med Plant Res., 2011; 5(7): 1164-1174.
52. Mancini A. et al. Biological and nutritional properties of palm oil and palmitic acid: Effects on health. Molecules., 2015; 20(9): 17339–17361.

53. Venkata RamanB. et al. Antibacterial, antioxidant activity and GC-MS analysis of Eupatorium odoratum. Asian J Pharm Clin. Res., 2012; 5(2): 99–106.
54. MeenakshiS A, Kalavathy S. Analysis of Bioactive Compounds in Antiinfertility Formulation Using Gc Ms and Ftir Techniques. Int. J. Res. Biochem. Biophys., 2015; 5(2): 20–24.
55. Aimen I, Hatem K, Mohamed K. Supercritical fluid extraction of triterpenes and aliphatic hydrocarbons from olive tree derivatives. Arabian Journal of Chemistry., 2017; 10: S3967–S3973.
56. Nithya TG, Jayanthi J, Raghunathan MG. Phytochemical, Antibacterial and GC MS analysis of a floating fern Salviniamolesta D. S. Mitchell. International Journal of Pharm Tech Research, 2015; 8(9): 85-90.
57. Elango V. et al. Identification of bioactive components and its biological activities of Evolvulusalsinoideslinn.-A GC-MS study. 2015; 3(1): 41–44.
58. SalahA I, AliH AM, ImadH H. Spectral analysis and anti-bacterial activity of methanolic fruit extract of Citrulluscolocynthis using gas chromatography-mass spectrometry. African J. Biotechnol., 2015; 14(46): 3131–3158.
59. Journal A. Phytochemical analysis of ruelliapatula using gas chromatography - mass spectrometry. Asian Journal of Pharmaceutical and Clinical Research., 2016; 25–28.
60. SivakumarR, Dhivya A. GC-MS Analysis of Bioactive Compounds on Ethyl Acetate Extract of Cordia Monoica Roxb. Leaves. Int J Res Dev Pharm Life Sci., 2015; 4 (1): 1328–1333.
61. Konovalova O, Gergel E, Herhel V. GC-MS analysis of bioactive components of Shepherdiaargentea (Pursh.) Nutt. from Ukrainian flora. Sect. Title Pharm Anal., 2013; 2(6): 7–12.
62. PierreL L, MosesM N. Isolation and Characterisation of Stigmasterol and B - Sitosterol from OdontonemaStrictum (Acanthaceae). J Innov Pharm. Biol Sci., 2015; 2: 88–95.
63. Kumari TK, Muthukumarasamy S, Mohan VR. GC-MS analysis of ethanol extract of Sarcostemmasecamone L. Bennet (Asclepiadaceae). Sci Res Rep., 2012; 2: 187-91.
64. Singh A, Gautam PK, Verma A. et al. Green synthesis of metallic nanoparticles as effective alternatives to treat antibiotics resistant bacterial infections: a review. Biotechnology Reports., 2020; 25: Article ID e00427.
65. Wang L, Hu C, Shao L. Te antimicrobial activity of nanoparticles: present situation and prospects for the future. International Journal of Nanomedicine., 2017; 12: 1227–1249.
66. Crisan CM, Mocan T, Manolea M, Lasca LI, T˘ab˘aran FA, Mocan L. Review on silver nanoparticles as a novel class of antibacterial solutions. Applied Sciences., 2021; 11(3): 1120.
67. Huh AJ, Kwon YJ. Nanoantibiotics: a new paradigm for treating infectious diseases using nanomaterials in the antibiotics resistant era. Journal of Controlled Release., 2011; 156(2): 128–145.
68. Li H, Zhou X, Huang Y, Liao B, Cheng L, Ren B. Reactive oxygen species in pathogen clearance: the killing mechanisms, the adaption response, and the side effects. Frontiers in Microbiology., 2020; 11: Article ID 622534.
69. Gupta A, Mumtaz S, Li CH, Hussain I, Rotello VM. Combatting antibiotic-resistant bacteria using nanomaterials. Chemical Society Reviews., 2019; 48(2): 415–427.
70. Valodkar M, Modi S, Pal A, Takore S. Synthesis and anti-bacterial activity of Cu, Ag and Cu–Ag alloy nanoparticles: a green approach. Materials Research Bulletin., 2011; 46(3): 384–389.
71. Duan H, Wang D, Li Y. Green chemistry for nanoparticle synthesis. Chemical Society Reviews., 2015; 44(16): 5778–5792.
72. Tau O, Lovergine N, Prete P. Adsorption and decomposition steps on Cu(111) of liquid aromatic hydrocarbon precursors for low-temperature CVD of graphene: a DFT study. Carbon. 2023; 206: 142–149.
73. Pulit-Prociak J, Banach M. Silver nanoparticles – a material of the future. Open Chemistry., 2016; 14(1): 76–91.
74. Rama P, Baldelli A, Vignesh A. et al. Antimicrobial, antioxidant, and angiogenic bioactive silver nanoparticles produced using Murraya paniculata (L.) jack leaves. Nanomaterials and Nanotechnology., 2022; 12: Article ID 184798042110561.
75. Mandal D, Kumar Dash, Das B. et al. Bio-fabricated silver nanoparticles preferentially targets Gram positive depending on cell surface charge. Biomedicine and Pharmacotherapy., 2016; 83: 548–558.
76. Singhal M, Chatterjee S, Kumar A. et al. Exploring the antibacterial and antibioflm efficacy of silver nanoparticles biosynthesized using punica granatum leaves. Molecules., 2021; 26(19): 5762.
77. Chandra H, Kumari P, Bontempi E, Yadav S. Medicinal plants: treasure trove for green synthesis of metallic nanoparticles and their biomedical applications. Biocatalysis and Agricultural Biotechnology., 2020; 24: Article ID 101518.
78. Fruits F. Chemical compositions, nutritional properties and volatile compounds of Guddaim (Grewia Tenax. Forssk). J Food Nutr Res., 2014; 2(4): 187-192.
79. Aboagarib EA, Yang R, Hua X. Physicochemical, nutritional and functional characteristics of seeds, peel and pulp of Grewia tenax (Forssk) Fiori fruits. Trop J Pharm Res., 2015; 14(12): 2247-2254.
80. Suliman ZE, Zidan NS, Foudah SH. Chemical compositions, antioxidant and nutritional properties of the food products of Guddaim (Grewia tenax). Int J Pharm Res Allied Sci., 2018; 7(3): 172-182.
81. Al-Samawi HM, El-Shaibany A, Alburyhi MM.

Review Article: The Therapeutic Potential of Micromeria Biflora: A Comprehensive Review. World Journal of Pharmaceutical Research., 2024; 13(6): 7-11.
82. Al-Wajih AM, El-Shaibany A, Alburyhi MM, Abdelkhalek AS, Elaasser MM, Raslan AE. Comparative Study of Phytochemical Composition, Oral Toxicity, Antioxidant, and Anticancer Activities of Both Aloe Vera and Aloe Vacillans (Asphodelaceae Family) Flowers Extract: In Vitro, In Vivo, and in Silico Studies. Trends in Phytochemical Research., 2025; 9(1): 1-22.
83. Al-Samawi HM, El-Shaibany A, Alburyhi MM. Review Article: The Pharmacological Potential of The Genus Micromeria. World Journal of Pharmaceutical Research., 2024; 13(6): 1-6.
84. Al-Samawi HM, El-Shaibany A, Abdelkhalek AS, Alburyhi MM, Elaasser MM, Raslan AE. Metabolite Profiling and Toxicity, Antioxidant, and Antitumor Evaluation of Micromeria Biflora Aerial Parts Extract Combined with ADMET Prediction and Molecular Docking Analysis. Chemistry & Biodiversity., 2025; 0: e202403258: 1-19.
85. Bary AA, El-Gazayerly ON, Alburyhi MM. A Pharmaceutical Study on Lamotrigine. Ph.D. Thesis, Faculty of Pharmacy, Cairo University., 2009.
86. Alburyhi MM, Salim YA, Saif AA, Noman MA. Furosemide-Excipient Compatibility Studies for Advanced Drug Delivery Systems Development. World Journal of Pharmaceutical Research., 2024; 13(22): 1178-1219.
87. Alburyhi MM, Saif AA, Noman MA. Lornoxicam-Excipient Compatibility Studies for Microsponge-Based Drug Delivery Systems Development. World Journal of Pharmaceutical and Medical Research., 2025; 11(4): 70-81.
88. Hamidaddin MA, Alburyhi MM, Noman MA, Saif AA. Formulation and Evaluation of Rosuvastatin Fast Dissolving Tablets. World Journal of Pharmacy and Pharmaceutical Sciences., 2023; 12(9): 2293-2303.
89. Alburyhi MM, Hamidaddin MA, Noman MA, Saif AA, Yahya TA, Al-Ghorafi MA. Rivaroxaban-Excipient Compatibility Studies for Advanced Drug Delivery Systems Development. European Journal of Pharmaceutical and Medical Research., 2024; 11(9): 370-404.
90. Bary AA, El-Gazayerly ON, Alburyhi MM. Formulation of Immediate Release Lamotrigine Tablets and Bioequivalence Study. Journal of Chemical Pharm Research., 2013; 5(10): 266–271.
91. Saif AA, Alburyhi MM, Noman MA, Yahya TA, Al-Ghorafi MA. Famotidine-Excipient Compatibility Studies for Advanced Drug Delivery Systems Development. World Journal of Pharmaceutical Research., 2024; 13(18): 1346-1408.
92. Alburyhi MM, Noman MA, Saif AA, Al-Ghorafi MA, Al Khawlani MA, Yahya TAA. Formulation and Evaluation of Anti-acne Spironolactone Emulgel Novel Trend in Topical Drug Delivery System. World Journal of Pharmaceutical Research., 2023; 12(22): 96-119.
93. Alburyhi MM, Noman MA, Saif AA, Salim YA, Hamidaddin MA, Yahya TA, Al-Ghorafi MA, Abdullah JH. Lisinopril-Excipient Compatibility Studies for Advanced Drug Delivery Systems Development. World Journal of Pharmaceutical Research., 2024; 13(16): 59-111.
94. Al-Ghorafi MA, Alburyhi MM, Saif AA, Noman MA, Yahya TA. Drotaverine-Excipient Compatibility Studies for Advanced Drug Delivery Systems Development. World Journal of Pharmaceutical Research., 2024; 13(18): 1285-1340.
95. Alburyhi MM, Noman MA, Saif AA, Hamidaddin MA, Yahya TA, Al-Ghorafi MA. Rosuvastatin-Excipient Compatibility Studies for Advanced Drug Delivery Systems Development. World Journal of Pharmaceutical Research., 2024; 13(13): 1549-1582.
96. Alburyhi MM, Saif AA, Noman MA. Ticagrelor-Excipient Compatibility Studies for Advanced Drug Delivery Systems Development. World Journal of Pharmacy and Pharmaceutical Sciences., 2024; 13(10): 1081-1132.
97. Alburyhi MM, Noman MA, Saif AA, Al-Ghorafi MA, Yahya TA, Yassin SH, Al Khawlani MA. Diclofenac-Excipient Compatibility Studies for Advanced Drug Delivery Systems Development. World Journal of Pharmaceutical Research., 2024; 13(14): 1297-1333.
98. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Aloe Vera Extract Capsules Delivery System as an Advanced Phytotherapy Approach for Controlling Diabetes. World Journal of Pharmacy and Pharmaceutical Sciences., 2024; 13(4): 1408-1423.
99. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Curcuma Longa Extract Capsules Delivery System as an Advanced Phytotherapy Approach for Cancer. European Journal of Biomedical and Pharmaceutical Sciences., 2024; 11(6): 37-43.
100. Alburyhi MM, Saif AA, Noman MA, Salim YA, Hamidaddin MA. Formulation and Evaluation of Lisinopril Orally Disintegrating Tablets. World Journal of Pharmacy and Pharmaceutical Sciences., 2023; 12(9): 357-369.
101. Alburyhi MM, Saif AA, Noman MA. Stability Study of Six Brands of Amoxicillin Trihydrate and Clavulanic Acid Oral Suspension Present in Yemen Markets. Journal of Chemical Pharm Research., 2013; 5(5): 293-296.
102. Alburyhi MM, El-Shaibany A. Formulation and Evaluation of Antitumor Activity of Artemisia Arborescence Extract Capsules as Dietary Supplement Herbal Product Against Breast Cancer. World Journal of Pharmaceutical Research., 2024; 13(3): 95-114.
103. Alburyhi MM, Hamidaddin MA, Saif AA, Noman MA. Formulation and Evaluation of Rivaroxaban Orodispersible Tablets. World Journal of Pharmacy

and Pharmaceutical Sciences., 2024; 13(2): 2066-2092.
104. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Aloe Vera Extract Capsules Delivery System as an Advanced Phytotherapy Approach for Cancer. World Journal of Pharmaceutical Research., 2024; 13(8): 1052-1072.
105. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Aloe Rubroviolaceae Extract Capsules Delivery System as an Advanced Phytotherapy Approach for Hepatoprotective. European Journal of Biomedical and Pharmaceutical Sciences., 2024; 11(4): 53-61.
106. Alburyhi MM, Saif AA, Noman MA, Yahya TA. Formulation, Development and Evaluation of Famotidine Orodispersible Tablets. European Journal of Pharmaceutical and Medical Research., 2023; 10(10): 56-62.
107. Alburyhi MM, Saif AA, Noman MA, Saif RM. Recent Innovations of Delivery Systems for Antimicrobial Susceptibility Study of Ciprofloxacin Biodegradable Formulations for Post-Operative Infection Prophylaxis. European Journal of Pharmaceutical and Medical Research., 2023; 10(9): 32-36.
108. Aboghanem A, Alburyhi MM, Noman MA. Effect of Different Excipients on Formulation of Immediate Release Artemether/Lumefantrine Tablets. Journal of Chemical Pharm Research., 2013; 5(11): 617-625.
109. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Dictyota Dichotoma Extract Medicinal Seaweed Capsules Delivery System as an Advanced Phytotherapy Approach for Cancer. European Journal of Biomedical and Pharmaceutical Sciences., 2024; 11(4): 63-70.
110. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Celery Extract Capsules Delivery System as an Advanced Phytotherapy Approach for Gout. World Journal of Pharmaceutical Research., 2024; 13(11): 2383-2404.
111. Raweh SM, Noman MA, Alburyhi MM, Saif AA. Formulation and Evaluation of Anti-acne Gel of Azadirachta Indica Extract Herbal Product. European Journal of Pharmaceutical and Medical Research, 2024; 11(2): 427-433.
112. Alburyhi MM, Saif AA, Noman MA. Formulation and Evaluation of Ticagrelor Orodispersible Tablets. World Journal of Pharmaceutical Research., 2024; 13(5): 26-55.
113. Alburyhi MM, Saif AA, Noman MA, Yahya TA, Al-Ghorafi MA. Formulation and Evaluation of Drotaverine Orally Disintegrating Tablets. World Journal of Pharmaceutical Research., 2023; 12(18): 66-79.
114. Alburyhi MM, El-Shaibany A. Formulation and Evaluation of Effervescent Granules of Artemisia Arborescence Herbal Product for Foodborne Illness. World Journal of Pharmacy and Pharmaceutical Sciences., 2023; 12(12): 1429-1444.
115. Alburyhi MM, Saif AA, Saif RM. Preformulation Study of Ceftriaxone and Ciprofloxacin for Lipid Based Drug Delivery Systems. EJUA-BA, 2022; 3(4): 339-350.
116. Alburyhi MM, Noman MA, Saif AA. Formulation and Evaluation of Natural Herbal Anti-acne as Gel Delivery Systems. World Journal of Pharmaceutical Research., 2024; 13(21): 1447-1467.
117. Noman MA, Alburyhi MM, Saif AA, Yahya TAA. Evaluation and Drug Stability Studies Some Atorvastatin Tablets Brands Available in Sana'a Market Yemen. World Journal of Pharmaceutical and Medical Research., 2024; 10(12): 231-236.
118. Alburyhi MM, Noman MA, Alemad AF. Preformulation Studies of Cefixime for Dispersible Tablets Delivery System Development. World Journal of Pharmacy and Pharmaceutical Sciences., 2024; 13(12): 75-99.
119. Al-Ghorafi MA, Alburyhi MM, Muthanna MS. Chemical Incompatibilities of IV Admixture Combinations in ICU, Orthopedic and Emergency Units of Various Hospitals and Medical Centers in Sana'a, Yemen. European Journal of Pharmaceutical and Medical Research., 2023; 10(10): 416-425.
120. Noman MA, Alburyhi MM, Saif AA, Yahya TAA. Formulation and Evaluation of Polyherbal Extract for Skin Hyperpigmentation as Gel Advanced Delivery Systems. World Journal of Pharmaceutical Research., 2024; 13(22): 1260-1280.
121. Saif AA, Noman MA, Alburyhi MM, Yahya TAA. Evaluation and Drug Stability Studies Some Levocetirizine Tablets Brands Available in Sana'a Market Yemen. World Journal of Pharmaceutical Research., 2024; 13(24): 1009-1022.
122. Alburyhi MM, Noman MA, AA Saif. Formulation and Evaluation of Meloxicam Emulgel Delivery System for Topical Applications. World Journal of Pharmaceutical Research., 2025; 14(4): 1324-1337.
123. Othman AM, Alburyhi MM, Al-Hadad GH. Formulation and Evaluation of Captopril Mouth Dissolving Tablets. European Journal of Pharmaceutical and Medical Research, 2024; 11(1): 18-28.
124. Alburyhi MM, El-Shaibany A, Al-Wajih AM, Alqadhi AA, Almlhani AN. Advancements in Nano-Formulation Systems for Enhancing the Delivery of Herbal Ingredients. European Journal of Pharmaceutical and Medical Research., 2025; 12(1): 212-231.
125. Al-Ghorafi MA, Alburyhi MM, Muthanna MS. Effect of Rosemary and Myrtus Extracts Combination on Androgenetic Alopecia: A Comparative Study with Minoxidil. European Journal of Pharmaceutical and Medical Research., 2023; 10(10): 35-39.
126. Alburyhi MM, Noman MA, Saif AA, Alemad AF. Dispersible and Orodispersible Tablets Delivery Systems for Antibacterials Development. World Journal of Pharmaceutical Research., 2025; 14(1):

1229-1257.
127. Alburyhi MM, El-Shaibany A, Al-Wajih AM, Almlhani AN, Alqadhi AA. Innovative Approaches in Herbal Drug Delivery Systems Enhancing Efficacy and Reducing Side Effects. World Journal of Pharmacy and Pharmaceutical Sciences., 2025; 14(1): 919-929.
128. Alburyhi MM, Saif AA, Noman MA, Saif RM. Recent Innovations of Delivery Systems for Antimicrobial Susceptibility Study of Ceftriaxone Biodegradable Formulations for Post-Operative Infection Prophylaxis. European Journal of Pharmaceutical and Medical Research., 2023; 10(8): 95-99.
129. Al-Ghorafi MA, Alburyhi MM, Saif AA, Noman MA. Meloxicam-Excipient Compatibility Studies for Advanced Drug Delivery Systems Development. World Journal of Pharmaceutical and Medical Research., 2025; 11(1): 87-106.
130. Alburyhi MM, Saif AA, Noman MA. Domperidone-Excipient Compatibility Studies for Advanced Drug Delivery Systems Development. World Journal of Biomedical and Pharmaceutical Sciences., 2025; 12(3): 250-269.
131. Alburyhi MM, Saif AA, Noman MA. Spironolactone-Excipient Compatibility Studies for Advanced Drug Delivery Systems Development. World Journal of Pharmacy and Pharmaceutical Sciences., 2025; 14(3): 871-910.
132. Saif AA, Alburyhi MM, Noman MA. Ketoprofen-Excipient Compatibility Studies for Advanced Drug Delivery Systems Development. World Journal of Pharmacy and Pharmaceutical Sciences., 2025; 14(4): 92-123.
133. Alburyhi MM, Saif AA, Noman MA, Yassin SH. Formulation and Evaluation of Simvastatin Orodispersible Tablets. World Journal of Pharmaceutical Research., 2023; 12(16): 1033-1047.
134. Noman MA, Alburyhi MM, Alqubati MA. Preformulation and Characterization Studies of Clopidogrel Active Ingredient for Orodispersible Tablets Development. World Journal of Pharmacy and Pharmaceutical Sciences., 2024; 13(3): 996-1015.
135. Alburyhi MM, El-Shaibany A. Formulation and Evaluation of Anti-peptic Ulcer Capsules of Curcuma Longa Herbal Product. World Journal of Pharmaceutical Research., 2023; 12(22): 76-96.
136. Alburyhi MM, Saif AA, Noman MA, Al Ghoury AA. Formulation and Evaluation of Antimalarial Drugs Suppositories. World Journal of Pharmaceutical Research., 2023; 12(20): 89-108.
137. Alburyhi MM, Saif AA, Noman MA, Saeed SA, Al-Ghorafi MA. Formulation and Evaluation of Diclofenac Orodispersible Tablets. European Journal of Pharmaceutical and Medical Research., 2023; 10(9): 01-06.
138. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Chamomile Extract Capsules Delivery System as an Advanced Phytotherapy Approach for Gout. World Journal of Pharmaceutical and Life Sciences., 2025; 11(04): 215-228.
139. Alburyhi MM, Noman MA, Saif AA. Metronidazole-Excipient Compatibility Studies for Medicated Chewing Gum Delivery Systems Development. European Journal of Pharmaceutical and Medical Research., 2025; 12(4): 567-589.
140. Alburyhi MM, Saif AA, Noman MA, Al-Ghorafi MA. Comparative Study of Certain Commercially Available Brands of Paracetamol Tablets in Sana'a City, Yemen. European Journal of Pharmaceutical and Medical Research., 2018; 5(12): 36-42.
141. Alburyhi MM, Saif AA, Noman MA, Al khawlani MA. Formulation and Evaluation of Bisoprolol Fast Dissolving Tablets. World Journal of Pharmaceutical Research., 2023; 12(16): 01-10.
142. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Tribulus Terrestris Extract Capsules Delivery System as an Advanced Phytotherapy Approach for Controlling Diabetes. World Journal of Pharmaceutical Research., 2024; 13(7): 1264-1282.
143. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Pandanus Odoratissimus Extract Capsules Delivery System as an Advanced Phytotherapy Approach for Hepatoprotective. European Journal of Pharmaceutical and Medical Research., 2024; 11(4): 06-13.
144. Noman MA, Alburyhi MM, Saif AA. Knowledge and Perception about Pharmacovigilance Among 4Th and 5Th Levels Pharmacy Students in Some Public and Private Universities, Sana'a Yemen. World Journal of Pharmaceutical and Medical Research., 2023; 9(11): 14-19.
145. Alburyhi MM, Noman MA, Saif AA, Salim YA, Abdullah JH. Formulation and Evaluation of Domperidone Orodispersible Tablets. World Journal of Pharmacy and Pharmaceutical Sciences., 2024; 13(3): 49-68.
146. Alburyhi MM, Saif AA, Noman MA, Hamidaddin MA. Formulation and Evaluation of Clopidogrel Orodispersible Tablets. World Journal of Pharmaceutical Research., 2024; 13(6): 42-64.
147. Alburyhi MM, Saif AA, Noman MA, Al Khawlani MA. Bisoprolol-Excipient Compatibility Studies for Advanced Drug Delivery Systems Development. World Journal of Pharmaceutical and Medical Research., 2024; 10(10): 304-324.
148. Bary AA, El-Gazayerly ON, Alburyhi MM. A Pharmaceutical Study on Methocarbamol. MSc Thesis, Faculty of Pharmacy, Cairo University., 2006.
149. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Plicosepalus Acacia Extract Capsules Delivery System as an Advanced Phytotherapy Approach for Hepatoprotective. World Journal of Pharmaceutical Research., 2025; 14(8): 1309-1334.

150. Saif AA, Alburyhi MM, Noman MA. Formulation and Evaluation of Ketoprofen Fast Dissolving Tablets. International Journal of Sciences., 2018; 7(09): 27- 39.
151. Saif AA, Alburyhi MM, Noman MA, Almaktari AM. Formulation and Evaluation of Trimetazidine Hydrochloride and Clopidogrel Bisulphate Multi-unit Solid Dosage Forms. Journal of Chemical Pharm Research., 2014; 6(2): 421-426.
152. Noman MA, Alburyhi MM, El-Shaibany A, Alwesabi NA. Preformulation and Characterization Studies of Pandanus Odoratissimus L Extract Active Ingredient in Treatment of Nocturnal Enuresis. World Journal of Pharmacy and Pharmaceutical Sciences., 2024; 13(2): 1603-1620.
153. Alburyhi MM, El-Shaibany A. Formulation and Evaluation of Oral Pharmaceutical Solution of Pandanus Odoratissimus L Extract Herbal Product in Treatment of Nocturnal Enuresis. World Journal of Pharmacy and Pharmaceutical Sciences., 2024; 13(1): 1840-1851.
154. Alburyhi MM, El-Shaibany A. Formulation and Evaluation of Antibacterial Orodispersible Tablets of Artemisia Arborescence Extract Herbal Product. European Journal of Pharmaceutical and Medical Research., 2024; 11(2): 409-417.
155. Saif AA, Alburyhi MM, Noman MA. Evaluation of Vitamin and Mineral Tablets and Capsules in Yemen Market. Journal of Chemical Pharma Research., 2013; 5(9): 15-26.
156. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Acalypha Fruticosa Extract Tablets Delivery System as an Advanced Phytotherapy Approach for Controlling Diabetes. World Journal of Pharmaceutical Research., 2024; 13(8): 1073-1091.
157. Noman MA, Alburyhi MM, El-Shaibany A, Alwesabi NA. Formulation and Evaluation of Pandanus Odoratissimus L Extract for Treatment of Nocturnal Enuresis as Orodispersible Tablets Delivery System. World Journal of Pharmaceutical Research., 2024; 13(5): 56 -71.
158. Salim YA, Yahya TA, Hamidaddin MA, Alburyhi MM. An In-Vitro New Bioequivalence Study and Densitometric Method for Determination of Azithromycin Tablets of Different Brands. Asian Journal of Pharmaceutical Analysis and Medicinal Chemistry., 2020; 8(4): 147-152.
159. Alburyhi MM, Saif AA, Noman MA, Yassin SH. Simvastatin-Excipient Compatibility Studies for Advanced Drug delivery Systems Development. World Journal of Pharmaceutical Research., 2024; 13(19): 1463-1512.
160. Al-Ghorafi MA, Alburyhi MM. Formulation and Evaluation of Novel Antiaging Cream Containing Dragon's Blood Extract. European Journal of Pharmaceutical and Medical Research., 2024; 11(1): 239-244.
161. Al-Ghorafi MA, Alburyhi MM. Evaluation and Formulation of Antifungal Activity of Dragon Blood Extract and Inorganic Salts on Dermatophytosis and Candidiasis. European Journal of Pharmaceutical and Medical Research., 2024; 11(1): 09-17.
162. Othman AM, Alburyhi MM, Al-Hadad GH. Captopril-Excipient Preformulation Studies for Mouth Dissolving Tablets Development. World Journal of Pharmaceutical Research, 2025; 14(10): 1398-1420.
163. Alburyhi MM, Salim YA, Saif AA, Noman MA, Abdullah JH, Yahya TAA. Formulation, Development and Evaluation of Furosemide and Amlodipine Tablets Drug Delivery Systems. World Journal of Pharmaceutical and Medical Research, 2025; 11(5): 358-378.
164. Alburyhi MM, Yahya TAA, Saif AA, Noman MA. Formulation and Evaluation of Lornoxicam Microsponge-Based Gel as A Transdermal Drug Delivery Systems. World Journal of Pharmaceutical and Life Sciences, 2025; 11(5): 200-217.
165. Mohamed YAS, Alburyhi MM, Wadi ZA. Simultaneous Hydrophilic Interaction Thin Layer Chromatographic (Hitlc) Method for Determination of Amlodipine and Furosemide Binary Mixture. World Journal of Pharmacy and Pharmaceutical Sciences., 2025; 14(5): 1175-1183.
166. Alkhawlani MA, Al-Ghani AM, Alburyhi MM. Study the Potential Drug- Drug Interaction Through Prescriptions Analysis in Some Sana'a City Hospitals, Yemen. European Journal of Pharmaceutical and Medical Research., 2024; 11(5): 440-448.
167. Al Ghoury AA, Al-Ghorafi MA, Alburyhi MM, Noman MA. Antimicrobial Susceptibility Patterns of Staphylococcus Aureus to Different Antimicrobial Agents Isolated as Clinical Samples at Certain General Hospitals in Sana'a City, Yemen. World Journal of Pharmaceutical Research., 2024; 13(16): 35-47.
168. Noman MA, Alburyhi MM, Saif AA, Yahya TAA. Assessment of Knowledge, Attitude, and Practice of Pharmacovigilance Among Pharmacists and Health care Professionals in Four Government Hospitals at Sana'a City, Yemen. European Journal of Biomedical and Pharmaceutical Sciences., 2025; 12(5): 250-267.
169. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Ginger Extract Capsules Delivery System as an Advanced Phytotherapy Approach for Controlling Diabetes. World Journal of Pharmaceutical and Medical Research., 2025; 11(6): 400-415.
170. Alburyhi MM, Saif AA, Noman MA, Saif RM. The Importance of Stability Testing in Pharmaceutical Development of Ceftriaxone Implant Biodegradable Tablets. Matrix Science Pharma (MSP)., 2025; 9(2): 58-63.
171. Mohamed YAS, Alkhawlani MA, Faisal A, Alburyhi MM. Modern Analytical Techniques Used in Authentication of Yemeni Sider Honey. World Journal of Pharmacy and Pharmaceutical Sciences.,

2025; 14(6): 1414-1429.
172. Saif AA, Alburyhi MM, Noman MA, Abudunia A. Amoxicillin-Excipient Compatibility Studies for Advanced Drug delivery Systems Development. European Journal of Pharmaceutical and Medical Research., 2025; 12(6): 530-562.
173. Alburyhi MM, Hamidaddin MA, Noman MA, Saif AA. Formulation and Evaluation of Metronidazole Medicated Chewing Gum as a Drug Delivery System. European Journal of Biomedical and Pharmaceutical Sciences, 2025; 12(6): 353-370.
174. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Plicosepalus Acacia Extract Capsules Delivery System as an Advanced Phytotherapy Approach for Controlling Diabetes. World Journal of Pharmaceutical and Life Sciences., 2025; 11(6): 323-337.
175. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Pandanus Odoratissimus Extract Capsules Delivery System as an Advanced Phytotherapy Approach for Breast Cancer. World Journal of Pharmaceutical Research., 2024; 13(8): 1092-1112.
176. Alburyhi MM, El-Shaibany A. Formulation, Development and Evaluation of Tribulus Terrestris Extract Capsules Delivery System as an Advanced Phytotherapy Approach for Kidney Stones. World Journal of Pharmacy and Pharmaceutical Sciences., 2024; 13(5): 1425-1443.
177. Subramanian R, Gayathri S, Rathnavel C, Raj V. Analysis of mineral and heavy metals in some medicinal plants collected from local market. Asian Pac J Trop Biomed., 2012; 2(1): 74-78.
178. Feldsine P, Abeyta C, Andrews WH. AOAC International methods committee guidelines for validation of qualitative and quantitative food microbiological official methods of analysis. J AOAC Int., 2002; 85(5): 1187-1200.
179. Sulieman AM, Mariod AA. Grewia tenax (Guddaim): Phytochemical constituents, bioactive compounds, traditional and medicinal uses. Nutri Value Prod., 2019: 165-173.
180. Gomez S, Kuruvila B, Maneesha PK, Joseph M. Variation in physico-chemical, organoleptic and microbial qualities of intermediate moisture pineapple (Ananas comosus (L.) Merr.) slices during storage. Food Prod Process Nut., 2022; 4(1): 1-5.
181. Kumar S, Singh B, Bajpai V. Traditional uses, phytochemistry, quality control and biological activities of genus Grewia. Phytomed Plus., 2022; 2(3): 100290.
182. Lewu MN, Adebola PO, Afolayan AJ. Comparative assessment of the nutritional value of commercially available cocoyam and potato tubers in south Africa. J Food Qual., 2010; 33(4): 461-476.