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Antibacterial and Antioxidant Activities of *Syzygium Aromaticum Capparis Spinosa*, and Some Novel Acylselenourea and Acylthourea Derivatives

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ABSTRACT

This study aims to tested the antibacterial and antioxidant activities of two different plant extracts which were *Syzygium aromaticum* and *Capparis spinosa*, and five novel derivatives, i.e. [4-Nitro-N-((4-(N-(pyrimidin-2-yl) sulfamoyl) phenyl) carbamoselenoyl) Benz amide (1), 4-Methyl-N-((4-(N-(pyrimidin-2-yl) sulfamoyl) phenyl) carbamoselenoyl) Benz amide (2), 4-Methyl-N-((4-(N-(pyrimidin-2-yl) sulfamoyl phenyl) carbamothioyl) Benz amide (3), 4-Nitro-N-((4-nitrophenyl) carbamo selenoyl) Benz amide (4), N-(2,6-dioxo-1,2,3,6-tetrahydropyrimidine-1-carbonoselenoyl)-nitrobenzamide (5)| in six concentrations:1,5, 10,25, 50, and 100 ug/ml of plant extracts and in three concentrations. 500,750 ,1000ug/ml of novel synthesis compounds on gram-positive bacteria (*Staphylococcus aureus)* and gram-negative bacteria (*Escherichia coli).* The antibacterial activity was evaluated with antibiotics susceptible and resistant to microorganisms. The 2, 2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging technique was used to assess antioxidant activity. The findings showed that *Syzygium aromaticum* extract and synthesis compound 3 were more effective against *Escherichia coli* bacteria and less effective against *Staphylococcus aureus* bacteria, whereas *Capparis spinosa* extract and synthesis compounds (1, 2, 4, and 5) were more effective against *Staphylococcus aureus* bacteria and less effective against *Escherichia coli* bacteria. The oxidation of the synthesis compounds (1, 2, and 3) is effective at concentrations of 500, 750, and 1000 and ineffective at concentrations of 50, 100, and 250, while compound 4 is effective at concentrations of 100, 250, 500, 750, and 1000 and ineffective at concentrations of 50 only. Compound 5 was effective at all concentrations.

1. Introduction

Ancient civilizations employed chemical compounds derived from plants to treat a variety of ailments (e.g., for food and fodder conservation). 30% of worldwide drug sales are comprised of natural products (Grabley & Thiericke, 1999). Due to their wide range of chemicals, natural goods, whether pure chemicals or standardized plant extracts, can be used to make any number of unique and effective additives and pharmaceutical treatments (Cos et al., 2006; O'Bryan et al., 2008).

The *Capparis spinosa* shrub lives for a long time and is a member of the Capparis family of plants (family Capparidaceae) (Benseghir & Seridi, 2007). Several biological effects, including antioxidant, antifungal, antihepatotoxic, anti-inflammatory, antiallergic and antihistamine, chondroprotective, hypolipidemic, and photoprotective, have been attributed to the vegetative components of *C. Spinosa* (Bonina et al., 2002). Glycosides, flavonodes, alkaloids, terpenes, essential oils, fatty acids, steroids, glucosinolates, carotenoids, and tocopherols are all

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found in *C. spinosa* (Tlili et al., 2009), along with other vitamins like vitamin C, proteins, and biogenic salts like potassium, magnesium, calcium, sodium, zinc, copper, and phosphorus (Rodrigo et al., 2006).

Clove is a medium-sized tree, also known as *Syzygium aromaticum* (*S. aromaticum*) or Eugenia cariophylata. For hundreds of years, the trade of cloves and the search for this valuable spice helped the Asian region's economy and agriculture grow. Cloves are used in many areas of daily life, so they play an important role in the lives of people in many different countries (Kamatou et al., 2012). This plant has been used for generations as a food preservation and medical herb, primarily as an antioxidant agent with antibacterial properties. Many recent studies have proven this plant's antibacterial, antifungal, antiviral, and anticarcinogenic effects. Clove, in particular, has drawn attention due to its high antioxidant and antibacterial properties that distinguish it from other spices (Shan et al., 2005).

The chemistry of organoselenium compounds progressed and developed more than 100 years later. Many organic selenium compounds are highly toxic and unstable many synthesized methods were developed to prepare more stable, less toxic, easy to prepare, and safe to handle organic selenium derivatives which used as antioxidant and anticancer (Block et al.,1998; Wu et al.,1999), antiviral (Parnham et al., 1991), antihypertensive (May et al., 1997), antibacterial (Nadhirah et al., 2020), and other medicinal applications (May, 2002 and Neamah & Al-Jadaan, 2020).

The current investigation aims to determine the antibacterial of plant extracts (*Syzygium aromaticum* and *Capparis spinosa*) and newly synthesized chemical compounds and antioxidant properties of newly synthesized chemical compounds.

2. Materials and Methods

Preparation of Plant Extraction

Under this study *Capparis spinosa* and *Syzygium aromaticum*, two types of plants were extracted, initially, both plants were gathered from a natural plant nursery in the province of Basrah, washed, dried, and then ground by mortal in accordance with the procedure by (Siracusa, et al., 2011).

Extraction of *Capparis spinosa*

One hundred grammes of plant material were put into a beaker with 200 ml of ethanol. The mixture was stirred with a magnetic stirrer for 30 minutes. After that, the precipitator was separated from the plant material using a centrifuge at 3000rpm for 15 minutes. The plant material was then spread out on glass plates and dried in an oven at 60°C (Siracusa, et al., 2011).

Extraction of *Syzygium aromaticum*

Using a grinder, the dried clove bud was roughly crushed before being separated into 200g of ground samples for the extraction process. In a typical Soxhlet apparatus, plant material is inserted in a thimble-holder and a distillation flask is filled with condensed, fresh solvent. Soxhlet is a traditional technique that is used to assess the efficacy of various solid-liquid extraction procedures. When the thimble-holder solution overflows, a syphon aspirates it and empties it back into the distillation flask, delivering the extracted solutes into the bulk liquid. In the solvent flask, distillation is employed to separate the solute from the solvent. Fresh solvent is returned to the plant solid bed, while the material that has been dissolved remains in the flask. The procedure is repeated until the extraction is complete. Matrix characteristics, particle size, and internal diffusion all play crucial roles in Soxhlet extraction and may even be the limiting step. A Soxhlet extractor was used to put the sample in. Dichloromethane and the boiling chip granules were put in a round flask. The extraction process took 6-7 hours at a temperature of 70-80C^0. After filtering, a rotating vacuum evaporator evaporated the solvent from the crude extract. Then, the crude extract was measured out, and it was placed in a vial for future examination.

Preparation of Synthesis Compounds

The chemicals and solvents (HPLC grade) uses in this study obtained from commercial sources and used as received, Solvents were dried according to method by (Vogel, 1974). All reactions were conducted under dry circumstances, quantified using thin-layer chromatography (TLC), and the spots were seen under ultraviolet light. KSeCN was prepared from the reaction of elemental Se with KCN according to Swank and Willett (1965). Column chromatography was used to purify the reaction products using silica gel 60 A° and benzene/ethanol (9:1) as the elution solvent.

Bacterial Isolates

Staphylococcus aureus and *Escheria coli* were obtained from microbiology laboratory /College of Veterinary Medicine / University of Basrah.

Antibacterial Activity

Antibacterial activity of plant extracts and synthesized compounds were evaluated for their antibacterial activity by agar well diffusion method. Petri- dishes with 20 ml of Mueller – Hinton agar were prepared, inoculated with 1 x 10^6 cell/ml (0.1 optical density on 540 nm wavelength). 100 µl of a 24 h broth culture of test bacteria, wells of 6 mm diameter each were made and filled with 100 µl of plant extracts and synthesis compounds. The inoculated plates were incubated for 24 h at 37ÛC and after incubation , the diameters of inhibition zone were measured in mm according to the method by (Shareef, 2011).

Antioxidant (DPPH)

The DPPH solution was prepared according to the procedure described by Chen et al. (2016) with slight modifications. The stock solution, prepared daily, was used at a 0.1 mM final concentration: 2 mg of DPPH reagent (Sigma–Aldrich, USA) were weighed (Analytical Balance Gibertini Elettronica E505, sensitivity 0.01 mg) and suspended in 50 mL of ethanol (EtOH) 96%. The mixture was vigorously shaken for 30 min under magnetic stirrer agitation (ARE Heating Magnetic Stirrer; Velp Scientifica, Usmate, Italy) and kept at room temperature in the dark. Experimental data were acquired on a spectrophotometer (Varian Cary 50 Bio UV-Vis; Varian Inc., Palo Alto, CA, USA), set at 517 nm under dim light, by measuring the sample absorbance decrease against the control (blank solution). The DPPH radical scavenging effect results in decolorization and is calculated in terms of percentage

reduction of DPPH according to the following equation (Molyneux, 2004):

$$\% \text{ DPPH Reduction} = \frac{(A0-As)}{A0} X\ 100$$

Where A_0 represents the absorbance of the control and A_S is the absorbance of the samples.

The % DPPH reduction values were normalized per sampled air volume (m^3; %DPPH v) or per PM mas amount (mg; %DPPH m).

3. Results and Discussion

Antibacterial activity of plant extracts

The results showed that antibacterial activity of *Syzygium aromaticum* extract has a high activity against *Escherichia coli* as compared with *Staphylococcus aureus*. However, in contrast the *Capparis spinosa* showed a high activity on *Staphylococcus aureus* as compared with *Escherichia coli* as in (Table, 1 and 2).

Table 1
Antibacterial activity of Syzygium aromaticum extract against bacterial isolates (*Escherichia coli* and *Staphylococcus aureus*)

		Inhibition zone (mm)					
	Bacterial strains	**1ug/ml**	**5 ug/ml**	**10ug/ml**	**25 ug/ml**	**50 ug/ml**	**100 ug/ml**
Syzygium aromaticum	*Staphylococcus aureus*	2.4	2.4	2.6	3	2.4	0
	Escherichia coli	2.3	2.5	2.7	2.7	2.9	3.1

Table 2
Antibacterial activity of *Capparis spinosa* extract against bacterial isolates (*Escherichia coli* and *Staphylococcus aureus*)

		Inhibition zone (mm)					
	Bacterial strains	**1ug/ml**	**5 ug/ml**	**10ug/ml**	**25 ug/ml**	**50 ug/ml**	**100 ug/ml**
Capparis spinosa	*Staphylococcus aureus*	0	1.4	1.4	1.3	1.3	1.2
	Escherichia coli	0	1.2	1.2	1.3	1.3	1.3

In Table (3) the compounds (1,2, 4 and 5) the high activity with *Staphylococcus aureus* as compared with *Escherichia coli*, while, in compounds (3) the high activity showed in *Escherichia coli* as compared with *Staphylococcus aureus* in all concentrations.

Table 3
Antibacterial activity of Synthesis compounds against bacterial isolates (*Escherichia coli* and *Staphylococcus aureus*)

Synthesis compounds	**Bacterial strains**	**Diameter of inhibition zone in mm**		
		500 ug/ml	**750 ug/ml**	**1000 ug/ml**
Compound 1	*Staphylococcus aureus*	2.7	2.8	3
	Escherichia coli	1.1	1.2	1.2
Compound 2	*Staphylococcus aureus*	2.5	2.7	3.3
	Escherichia coli	1.2	1.2	1.3
Compound 3	*Staphylococcus aureus*	1	1	1
	Escherichia coli	1.2	1.2	1.3
Compound 4	*Staphylococcus aureus*	1.8	1.8	1.8
	Escherichia coli	0.1	1.2	1.3
Compound 5	*Staphylococcus aureus*	1.6	1.7	2.7
	Escherichia coli	1.1	1.2	1.3

Antioxidant (DPPH)

The antioxidant against novel synthesis compounds showed different results for each one. In compound **1**, it was effective at a concentration of 500, 750, 1000 (close proportions) but not at 50, 100, or 250 concentrations. While compound **2** is effective at a concentration of 500, 750, 1000 (corresponding ratios) and inactive at 50, 100, 250 concentrations. Compound **3** was effective at a concentration of 500, 750, 1000 (above 1000) and inactive at 50,100,250 concentrations. Compound **4** was effective at 100, 250, 500, 750, 1000 (The highest is 1000 and the lowest is 100) and inactive at 50 concentrations. Finally, compound **5**'s effectiveness at all concentrations(highest is 500 and lowest is 50) (Tables, 4, 5, 6, 7, 8 and 9).

Table 4

The Antioxidant Against Five Different Novel Synthesis Compounds ([4-Nitro-N-((4-(N-(pyrimidin-2-yl) sulfamoyl) phenyl) carbamoselenoyl) Benz amide**(1)**, 4-Methyl-N-((4-(N-(pyrimidin-2-yl) sulfamoyl) phenyl) carbamoselenoyl) Benz amide**(2)**, 4-Methyl-N-((4-(N-(pyrimidin-2-yl) sulfamoyl phenyl) carbamothioyl) Benz amide**(3)**,4-Nitro-N-((4-nitrophenyl) carbamo selenoyl) Benz amide**(4)**,N-(2,6-dioxo-1,2,3,6-tetrahydropyrimidine-1-carbonoselenoyl)-nitrobenzamide**(5)**]

		1			2			3			4			5	
	50	100	250	50	100	250	50	100	250	50	100	250	50	100	250
A	0.503	0.492	0.432	0.473	0.483	0.46	0.489	0.49	0.469	0.412	0.399	0.571	0.364	0.461	0.86
B	0.53	0.51	0.402	0.475	0.481	0.466	0.498	0.49	0.477	0.42	0.386	0.599	0.361	0.469	0.87
C	0.057	0.066	0.085	0.047	0.049	0.069	0.048	0.048	0.044	0.133	0.201	0.456	0.153	0.364	0.707
D	0.057	0.066	0.085	0.047	0.049	0.069	0.048	0.048	0.044	0.133	0.201	0.456	0.153	0.364	0.707
E															
F															
G							0.445	0.436			0.043	0.043			
H							0.421	0.43			0.044	0.043			
							0.428	0.449							
							0.435	0.473							
							0.439625								
							0.396625								
	0.446	0.426	0.347	0.426	0.434	0.391	0.441	0.442	0.425	0.279	0.198	0.115	0.211	0.097	0.153
	0.473	0.444	0.317	0.428	0.432	0.397	0.45	0.442	0.433	0.287	0.185	0.143	0.208	0.105	0.163
control	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625
control	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625	0.396625
scavenger		1			2			3			4			5	
	50	100	250	50	100	250	50	100	250	50	100	250	50	100	250
	-12.4488	-7.40624	12.51182	-7.40624	-9.42326	1.418216	-11.1882	-11.4403	-7.15411	29.65648	50.07879	71.00536	46.80113	75.54365	61.42452
	-19.2562	-11.9445	20.07564	-7.91049	-8.919	-0.09455	-13.4573	-11.4403	-9.17113	27.63946	53.35645	63.94579	47.55752	73.52663	58.90325

Table 5
The Antioxidant of First Novel Synthesis Compound (4-Nitro-N-((4-(N-(pyrimidin-2-yl) sulfamoyl) phenyl) carbamoselenoyl) Benz amide)

1 compound						
	50ug/ml	**100ug/ml**	**250ug/ml**	**500ug/ml**	**750ug/ml**	**1000ug/ml**
Mean	-15.8525	-9.67537	16.29373	93.9302	94.84067	97.57208
scavenger%	-12.4488	-7.40624	12.51182	93.9302	96.66161	96.66161
DPPH%	-19.2562	-11.9445	20.07564	93.9302	93.01973	98.48255

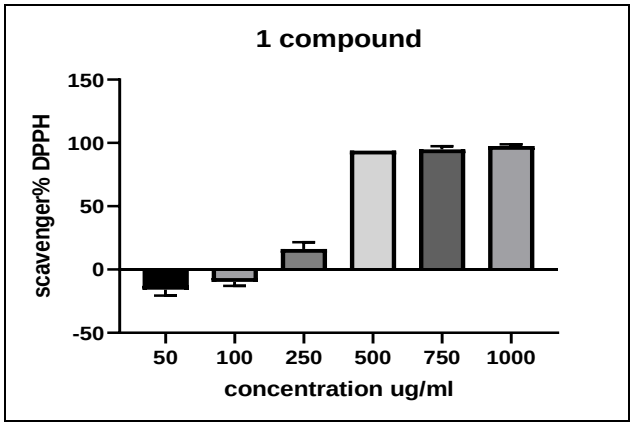

Fig. 1. The Antioxidant of First Novel Synthesis Compound

Table 6
The Antioxidant of Second Novel Synthesis Compound (4-Methyl-N-((4-(N-(pyrimidin-2-yl) sulfamoyl) phenyl) carbamoselenoyl) Benz amide)

	2 compound					
	50ug/ml	**100ug/ml**	**250ug/ml**	**500ug/ml**	**750ug/ml**	**1000ug/ml**
Mean	-7.65837	-9.17113	0.661834	81.63885	79.66616	81.03187
scavenger%	-7.40624	-9.42326	1.418216	80.88012	78.4522	80.88012
DPPH%	-7.91049	-8.919	-0.09455	82.39757	80.88012	81.18361

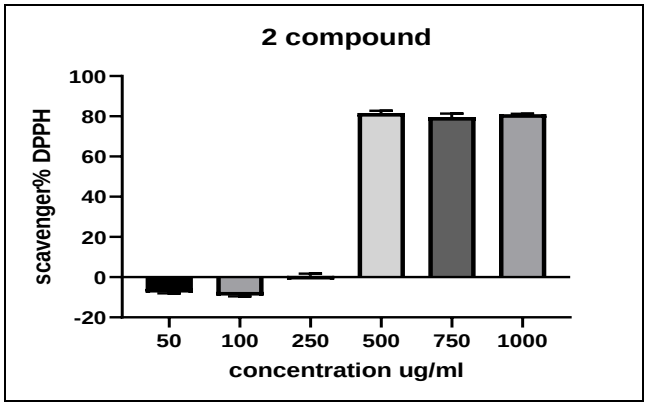

Fig. 2. The Antioxidant of Second Novel Synthesis Compound

Table 7
The Antioxidant of Third Novel Synthesis Compound (4-Methyl-N-((4-(N-(pyrimidin-2-yl) sulfamoyl phenyl) carbamothioyl) Benz amide)

	3 compound					
	50ug/ml	**100ug/ml**	**250ug/ml**	**500ug/ml**	**750ug/ml**	**1000ug/ml**
Mean	-13.4573	-11.4403	-9.17113	73.29287	79.36267	86.64643
scavenger%	-11.1882	-11.4403	-7.15411	67.83005	66.91958	81.4871
DPPH%	-13.4573	-11.4403	-9.17113	73.29287	79.36267	86.64643

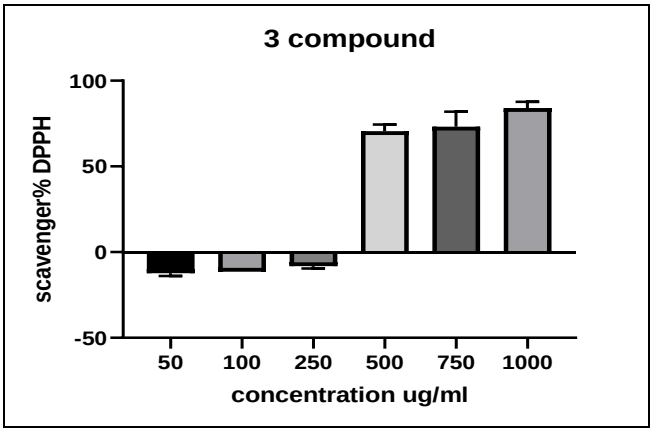

Fig. 3. The Antioxidant of Third Novel Synthesis Compound

Table 8
The Antioxidant of Fourth Novel Synthesis Compound (4-Nitro-N-((4-nitrophenyl) carbamo selenoyl) Benz amide)

	4 compound					
	50ug/ml	**100ug/ml**	**250ug/ml**	**500ug/ml**	**750ug/ml**	**1000ug/ml**
Mean	28.64797	51.71762	67.47558	98.02731	93.77845	105.3111
Scavenger%	29.65648	50.07879	71.00536	99.69651	94.23369	100.9105
DPPH%	27.63946	53.35645	63.94579	96.35812	93.32322	109.7117

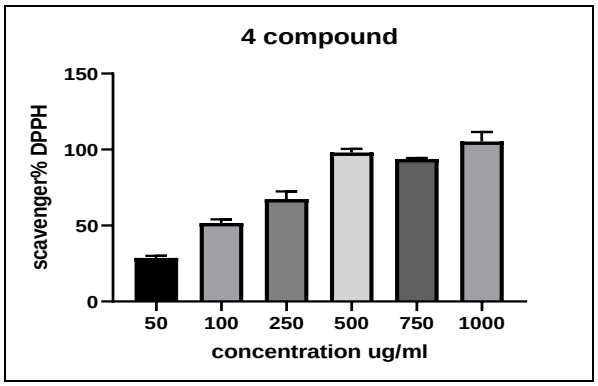

Fig. 4. The Antioxidant of Fourth Novel Synthesis Compound

Table 9
The Antioxidant of Fifth Novel Synthesis Compound) (N-(2,6-dioxo-1,2,3,6-tetrahydropyrimidine-1-carbonoselenoyl)-nitrobenzamide)

5 compound						
	50ug/ml	**100ug/ml**	**250ug/ml**	**500ug/ml**	**750ug/ml**	**1000ug/ml**
Mean	47.17933	74.53514	60.16388	109.4082	96.35812	97.26859
Scavenger%	46.80113	75.54365	61.42452	107.2838	96.05463	104.2489
DPPH%	47.55752	73.52663	58.90325	111.5326	96.66161	90.28832

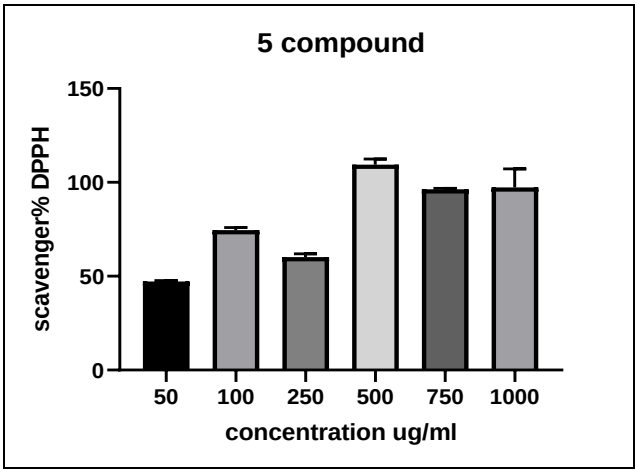

Fig. 5. The Antioxidant of Fifth Novel Synthesis Compound

The emergence of microbes that are resistant to antibiotics has increased the urgency of the hunt for new antibacterial substances. Numerous compounds with plant origins, including alkaloids, flavonoids, glycosides, terpenes, tannins, and polyphenols, have been found to have antibacterial action. Many have also been shown to have synergistic effects with already available antibacterial medicines (Ncube et al., 2008). One of the primary methods by which antioxidants operate in food systems is the radical scavenging of the DPPH radical. To fully grasp the following information, it is necessary first to understand the foundation of the assays employed for in vitro antioxidant determination. It should be noted that in vitro chemical tests have little resemblance to biological systems (Bjelakovic et al., 2007).

Used in this study *Syzygium aromaticum* and *Capparis spinosa* plant extracts, as well as novel synthetic chemicals developed following (Farhan et al., 2022). Four of these acylselenourea compounds were made using a one-pot technique by reacting KSeCN with the properly substituted acid chloride, adding the correct ammine, and then adding dry THF. While one acylthiourea compound was made from KSCN using a one-pot method in dry THF and 4-Methylbenzoyl chloride. To standardise plant extract antibacterial activity testing, we employed diffusion and dilution techniques to test their mixtures against gram-positive and gram-negative bacteria.

This study concluded that *Capparis spinosa* extract and synthesis compounds (1, 2, 4, and 5) were more effective against *Staphylococcus aureus* and less effective against *Escherichia coli*. bacteria, while *Syzygium aromaticum* (clove) extract and synthesis compound 3 were more effective against *Escherichia coli* bacteria and less effective against *Staphylococcus aureus*. Also, this study proved in oxidation

test that the novel synthesis compounds (1, 2, and 3) are effective at concentrations 500, 750, and 1000 and ineffective at concentrations 50, 100, and 250, while compound 4 is effective at concentrations 100, 250, 500, 750, and 1000, and ineffective at concentration 50 only, Compound 5 was effective at all concentrations.

The efficacy of the aqueous extract of *Capparis spinosa* is because it contains significant amounts of chemical compounds like alkaloids, phenols, steroids, and glycosides, in addition to antioxidants. Mustafa (2011) found that *Capparis spinosa's* aerial portions were effective against helminths, lending credence to the plant's long-held traditional usage. On the other hand, Niamah and Alali, (2016) that recorded a high concentration of essential oil from coriander led to increased zone inhibition for all strains. Test G- bacteria was less affected than the G+ bacteria. In comparison to the gram-negative bacteria *Escherichia coli* and *Pseudomonas aeruginosa*, the ethanol and acetone extract showed the strongest antibacterial activity against the gram-positive bacteria *Staphylococcus aureus* (Al-Tememy, 2013). While Shareef, (2011) confirmed the bacterial species tested against the essential oil of cinnamon oil, *Staphylococcus* aureus was discovered to be highly sensitive to its action, followed by *Escherichia coli, Pseudomonas aeruginosa, Proteus sp., Klebsiella pneumoniae, and Brucella sp.,* while frankincense essential oil demonstrated moderate antibacterial activity against *Proteus sp., Staphylococcus aureus and Escherichia coli* Gram-positive and Gram-negative bacteria were shown to be susceptible to the strong essential oils of cinnamon and frankincense.

Another study revealed that piperine had more antibacterial action against *Escherichia coli and Proteus vulgaris* than erythromycin and streptomycin but less activity against *Staphylococcus aureus* and *Pseudomonas aeruginosa* than erythromycin and streptomycin (Aldaly, 2010). In addition, Al-hejjaj et al. (2010) demonstrated the extracted alkaloid's antibacterial activity on five clinical bacterial isolates as a preliminary screening. The highest antibacterial activity was measured at (27mm) on (Strep. sp) and the lowest at (12mm) on *Escherichia coli*, with the remaining effects on Bacterial strains falling between these results. Another study confirmed the concentration-dependent bactericidal activity of Hibiscus Rosasiensis aqueous and pure pigment extracts. Another research found antibacterial activity in *Hibiscus Rosasiensis* aqueous and pure pigment extracts at concentrations (of 20, 50, 100, 200, 250 mg). These extracts were evaluated against *Staphylococcus aureus* and *Escherichia coli* reference bacteria. With a minimum inhibitory dosage of 20 mg/ml, both extracts displayed clear efficacy against the tested strains.

Another investigation confirmed the bactericidal activity of *Hibiscus Rosasiensis* aqueous and pure pigment extracts in concentration (20, 50, 100, 200, 250 mg). With the least inhibitory dosage of 20 mg/ml, both extracts demonstrated clear efficacy against the tested strains (Saiwan & Weheed, 2010). While Khudaier et al. (2013) discovered that *Staphylococcus aureus* and *Pseudomonas aeruginosa* were the most susceptible bacteria to *Lawsonia inermis* extracts, *Escherichia coli* was more resistant to these extracts.

Antibacterial activity of clove essential oil has been reported against *Staphylococcus aureus* and *Listeria monocytogenes* in pasteurized milk (Cava et al., 2007). According to Matan (2012) reported that clove oil showed strong antimicrobial resistance against *Penicillium* sp., *Aspergillus flavus* and *Staphylococcus aureus* found on dried fish (*Decapterus maruadsi*). Zengin and Baysal (2014) reported the antimicrobial activity of clove oil against three gram-positive bacteria (*Listeria innocua, Carnobacterium divergens* and *Staphyloccous aureus*) and four gram-negative bacteria (*Salmonella typhimurium, Escherichia coli, Serratia liquefaciens* and *Shewanella putrefacians*) by broth microdilution method.

Mytle et al., (2006) reported decreased growth rate of *Listeria monocytogenes* when treated with 1 and 2% clove oil. Fu et al., (2007), Yang et al., (2003) and Chaieb et al., (2007) reported that antimicrobial activity of clove oil was due to presence of eugenol, 2-heptanone, methyl salicylate, kaempferol, gallic acid, isoeugenol and oleanolic acid. These compounds generally denatured proteins that reacted with cell membrane and changed their permeability (Warnke et al., 2009).

Clove essential oil was more efficient against Gram-negative bacteria but showed smaller halos than those in our research for Gram positive bacteria (Silvestri et al., 2010). Another eugenol-rich clove essential oil presented inhibition zones of 28.3 and 28.1mm for *Staphyloccous aureus* and *Escherichia coli*, respectively, indicating the susceptibility of the bacteria to the essential oil (Radünz et al., 2019). Inhibition halo size (IHS) to classify antimicrobial activity as follows: IHS≥15mm strong inhibition; 10≤IHS <15 moderate inhibitions; and IHS <10 inactive. When the results of the present study are compared with literature, a pattern can be observed, with *Syzygium aromaticum* essential oil being considered as strong inhibitor for *Staphyloccous aureus* and *Escherichia coli* and a moderate inhibitor for *Pseudomonas aeruginosa*.

Furthermore, Al-hejjaj et al. (2010) discovered that the MICs for *Staphylococcus aureus* and *Escherichia coli* were in the range of (600mcg to 3000mcg). However, the results of the main screening of the traditional medicine varied widely with Ceph. Showing the best results (30mm) against (Strep. sp.), and Amo. Showing the lowest results (11mm) against *Escherichia coli*. High antioxidant activity shown by clove oil was due the presence of phenolic compounds like eugenol, thymol and eugenol acetate (Yadav & Bhatnagar, 2007; Dai et al., 2013; Nam & Kim, 2013). Eugenol present in clove oil possessed high antioxidant activity which was comparable with the activities of synthetic antioxidants pyrogallol and BHA (Dorman et al., 2000). Inhibition of (97.3%) lipid peroxidation of linoleic acid emulsion when treated with 15 µg/ml of clove oil.

Different parts of caper were investigated for their antioxidant effects, potentially useful against some degenerative diseases. An aqueous infusion from flower tops of capers growing in Croatia was analyzed for antioxidant activity before and after in vitro digestion (Siracusa et al., 2011).

Capparis spinosa aerial part and root extracts were extracted with solvents of varying polarity. Ethyl acetate extract of the aerial part contains the highest concentration of phenolic compounds and flavonoids followed by the chloroform extract of roots. The antioxidant activity of different extracts of *Capparis sspinosa* was evaluated by DPPH radical scavenging method. The antioxidant activity (IC50 µg/ml) of methanol and ethyl acetate extracts were 94.4±4.5 and57.75±2.3 respectively (Alsabri et al., 2012).

4. Conclusion

The present study confirms the determined antibacterial activities of plant extracts which were *Syzygium aromaticum* and *Capparis spinosa*, and novel acylselenourea and acylthourea derivatives, i.e. [4-Nitro-N-((4-(N-(pyrimidin-2-yl) sulfamoyl) phenyl) carbamoselenoyl) Benz amide(1), 4-Methyl-N-((4-(N-(pyrimidin-2-yl) sulfamoyl) phenyl) carbamoselenoyl) Benz amide(2), 4-Methyl-N-((4-(N-(pyrimidin-2-yl) sulfamoyl phenyl) carbamothioyl) Benz amide(3),4-Nitro-N-((4-nitrophenyl) carbamo selenoyl) Benz amide(4), N-(2,6-dioxo-1,2,3,6-tetrahydropyrimidine-1-carbonoselenoyl)-4-nitrobenzamide(5)]and antioxidant properties of newly synthesized chemical compounds. It found that both different materials had a high result on *Staphylococcus aureus* and *Escherichia coli* so that it could be used for treatment.

Competing Interests

The authors have declared that no competing interests exist.

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