(Zingiber Antibacterial Activities of Yansoon (*Pimpinella anisum* L.), Ginger officinale L.) and Cinnamon (Cinnamomum zeylanicum L.) Extracts

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ABSTRACT

There is a*n* increasing demand for the biologically active substances from plant origin which is of current interest and focus for new research approach. The synthetic pharmaceuticals compounds showed various side effects on functions of different parts of the human body, both internally and externally. Therefore, the present study was investigating the antimicrobial activity of three important herbs, Ginger (*Zingiber officinale* L.), Yansoon (*Pimpinella anisum* L.) and Cinnamon (*Cinnamomum zeylanicum* L.). The cup- plate agar (inhibition zone) method was used for studying the effects of the extracts against *Streptococcus* sp, *Staphylococcus aureus* and *Enterococcus faecalis.* The results showed that, the ethanol extracts of cinnamon and the combination of ginger and cinnamon were highly effective on *Streptococcus* sp (24mm and 21mm, respectively), compared to the water extracts (15mm and16mm, respectively). However, the water and the ethanol extracts of ginger and yansoon were less effective (11mm, 9mm, 8.5mm and 8mm, respectively). The ethanol extracts of cinnamon and the combination of ginger and cinnamon were highly effective on *Staphylococcus aureus* giving (24mm and 21.5 mm, respectively) followed by water extract (20mm and 21 mm, respectively). While, the ethanol and water extracts of ginger and yansoon were less effective (11mm, 10.5mm, 9mm and 9.5mm, respectively). The ethanol and water extracts of cinnamon were highly effective on *E. faecalis* giving (21mm and 20.5 mm, respectively). The ethanol extracts of the combination of ginger and cinnamon were effective (20 mm) followed by water extract (18mm). The water and ethanol extracts of ginger and yansoon were less effective giving (15 mm, 12 mm, 8 mm and 9 mm, respectively). From the results it could be concluded that, the extracts of (Cinnamon, Yansoon and Ginger) can be used as antimicrobial agents. It could be suggested that the active antimicrobial components need to be verified in any further study and more microorganism are to be tested .

Key-words: Antimicrobial , Ginger, Yansoon , Cinnamon, *Staphylococcus aureus*, *Enterococcus faecalis*. .

INTRODUCTION

A herb is a plant or a plant part used for its scent, flavor or therapeutic properties. Herbal products are dietary supplements that people take to improve their health. Many herbs have been used for a long time or claimed as health benefits. They are sold as tablets, capsules, powders, teas, extracts and fresh or dried plants. However, some can cause health problems, some are not effective and may interact with other drugs taken by the patient [1]. Throughout history, natural products from plants have played major sustaining roles in life of humans, especially for food sources and for medicinal products. Nature has provided mankind with folk medicines for centuries to be the richest source of bioactive chemicals for development of modern drugs. Terrestrial plants in particular were used as the basis of sophisticated traditional pharmacopoeias. From as early as 260 BC and some of the earliest documentations come from prescriptions from Mesopotamia. Records from the ancient Egyptians and Chinese showed that plants were used for preparation of hundred drugs covering almost impressive array of health problems and disease [2]. About 25 percent of the drug prescriptions dispend in the United States contain at least one active ingredient derived from plant material. Some are from plants extracts, others are synthesized to mimic a natural plant compound and many drugs commonly used today are of herbal [3]. The World health Organization (WHO) estimates that 4 billion people (80% of the world population) presently use herbal medicine for some aspects of primary health care. Herbal medicine is a major component in all indigenous people's traditional medicine [4]. WHO also stated that out of the 119 plant-derived pharmaceutical medicines, about 74 percent was used in modern medicine in ways that correlated directly with their traditional uses as plant medicine by native culture [3]. Substances derived from the plants, remain the basis for a large proportion of commercial medication used today for treatment of heart diseases, high pressure, pain, asthma and other health problems, such as the use of clove plant in modern medicine. The herb has been used since 1775. At present, the powder leaves of the plant are known as the cardiac stimulant to the millions of heart patients, it keeps them alive worldwide [3]. The plant has formed the basis for traditional medicine system in most societies in the Sudan and has been used for thousands of years. Hundreds of years ago there were few or no synthetic drugs in Sudan and up to 300,000 species of higher plants were the main sources of drugs. During this period, when the developed world shifted largely from natural to synthetics, life expenses and population doubled, citizens began to recognize that substances occurring naturally are inherently safe and more healthful than synthetic compounds [5]. The use of herbs and spices cuisine developed, in part, as a borne pathogens. Studies showed that in tropical climate, -response to the treatment of food where pathogens are most abundant, recipe are the most highly spiced. Further, the spices with the most potent antimicrobial activity and very low toxicity tend to be selected [6]. Ginger or ginger root is the rhizome of the plant *Zingiber officinale*, consumed as a delicacy, medicine, or spice. Ginger is one of the most commonly consumed dietary condiments in the world [7]. Ginger has been valued for its antibacterial properties for thousands of years in Asian cultures [8]. *Zingiber officinalis*, commonly known as ginger belongs to the family Zingiberaceaeis cultivated

commercially in India, China, South East Asia, West Indies, Mexico and other parts of the world. It is consumed worldwide as a spice and flavoring agent and is attributed to have many medicinal properties. The British Herbal Compendium reported its action as carminative, anti-emetic c, peripheral circulatory stimulant and anti-inflammatory [9]. As an aromatic plant, yansoon (*Pimpinella anisum* L.) is an annual herb indigenous to Iran, India, Turkey and many other warm regions in the world and have been used traditionally in therapy of some disease worldwide for long time; *P. anisum* has been used as a stimulating effect of digestion and anti-parasite, ant-ifungal [10] and for treat catarrh of respiratory tract and therapeutic effect on several condition such as a gynecological and neurological disorder [11]; [12], and can be used as ant-ipyretic [13]. Cinnamon *(Cinnamomum zeylanicum)* is one of the oldest herbal medicine known, having been mentioned in Chinese texts since 4000 years ago [14]. It is an evergreen tropical tree, belonging to the Lauraceae family. Cinnamon barks and leaves are widely used as spice and flavoring agents in foods and for various applications in medicine [15]. Cinnamon is often used for medicinal purposes due to its unique properties. The essential oil from its bark is rich in trans-cinnamaldehyde with antimicrobial effects against animal and plant pathogens, food poisoning and spoilage bacteria and fungi [16]. The bark and leaves of *Cinnamomum sp* are commonly used as spices in home kitchens and their distilled essential oils are used as flavoring agents in the food and beverage industries [14].

MATERIALS and METHODS

Materials:

Materials of different herbs including; Ginger (*Z. officinale*) roots,Yansoon (*P. anisum)* seeds and Cinnamon (*C. zeylanicum*) bark, were obtained from the local market of Wad Medani City, Sudan and were collected in June 2015. The samples were freed from foreign materials like stones, sand and dust, before being kept in the lab., for further investigation. The samples were then dried, and milled using laboratory mill into fine powder. The Three bacteria isolates *(Staphylococcus aureus, Streptococcus* sp *and Enterococcus* sp) were obtained from the Medical laboratory of University of Gezira, Wad Medani, Sudan. The nutrient agar medium was used for growing and for the antibacterial tests. The medium was dispensed into flasks (250 per ml), and in^2) for15 minutes, then poured into sterile Petri dishes, which were /autoclaved at 121° C (151b allowed to solidity and kept in a refrigerator before being used.

Methods:

The Cup-Plate Agar (Inhibition Zone) Method:

ml) of the different parts of the herbs /Aqueous and alcoholic extracts of the powder (50 – 500g were added to the nutrient agar medium, to give different concentrations (0.00, 35.0, 40.0, 45.0 ml). In this method two ml of a standardized bacterial cell suspension (10×10^7) of /and 50.0 mg *Streptococcus aureus , Staphyllococcus sp* or *Enterococcus sp* were thoroughly mixed with 200 ml of the sterile molten medium. The medium was then distributed in to sterile Petri- dishes and left to solidify at room temperature for 24 hours. Sterile Whatman glass fiber discs (No.5) were saturated with the extract of *Zingiber officinale, Pimpinella anisum , C. zeylanicum* or the combination of ginger and cinnamon then allowed to dry and transferred centrally on the surface of the solidified medium in each plate. The plates were then incubated at room temperature for 24 hours and the inhibition zones were measured as described by [17] and [18]. Three replicates were made for each treatment. The statistical analysis was carried out using the analysis of variance (ANOVA) and Duncan's Multiple Range Test was also used to separate between means.

EXPERIMENTAL RESULTS

Effect of the Herb Aqueous Extracts on the Inhibition Zone:

The present study investigated the antimicrobial activities of the different herbs Anise (Yansoon), Ginger and Cinnamon against the three bacteria (*Staphylococcus aureus, Streptococcus* sp and *Enterococcus* sp). Different concentrations of water extracted (aqueous extract) was used. The cup plate inhibition zone method was used for comparison between the different herbs. The results of the effects of the different concentration of extracts of (yansoon), ginger, cinnamon and the combination of ginger and cinnamon on *Streptococcus* sp inhibition zone are shown in Table (.1). It was found that all concentrations of the water extracts 0f the herbs were significantly effective in inhibiting growth of *Streptococcus* sp compared to the control, although, there were no significant differences between the concentrations or the different herbs. However, there was increasing effect with the increasing concentrations of the water extracts reaching its maximum at the highest concentration (50%). However, the inhibition zones at that concentration were (16, 15, 11, and 9mm) for cinnamon, the combination of cinnamon and ginger, ginger and yansoon extracts, respectively. Table (.2) showed the effect of different concentration of aqueous extracts of yansoon, ginger, cinnamon and combination of ginger and cinnamon on *S. aureus*. The results showed that there was a significant effect with the increasing concentrations of the extract reaching its maximum at the highest concentration (50%), the inhibition zones (20, 21, 9, and10.5mm) for cinnamon, cinnamon and ginger combination, ginger and yansoon extracts, respectively. However, the cinnamon is more effective followed by cinnamon and ginger combination. The results also indicated that the extracts were effective on this bacterium than on *Streptococcus* sp., although, there were significant differences between the concentrations or the different herbs. Table (.3) showed the effects of different concentrations of aqueous extracts of yansoon, ginger, cinnamon and combination of ginger and cinnamon on *E. faecalis*. From the results it was found that there was an increasing effect with the increasing concentrations of the extracts reaching its maximum at the highest concentration (50%). The inhibition zones at that concentrations were (21, 18, 15, and 12mm) for cinnamon, cinnamon and ginger combination, ginger and yansoon extracts,

respectively. However, the cinnamon is more effective followed by cinnamon and ginger combination, ginger and yansoon. Although, there were no significant differences between the concentrations or the different herbs.

Effect of the Herb Ethanolic Extracts on the Inhibition Zone:

Different concentrations of the herbs ethanolic extracts were used against the inhibition zone of the three bacteria using the cup plate inhibition zone method. The results of the effects of the different concentrations of the ethanolic extracts of yansoon, ginger, cinnamon and the combination of ginger and cinnamon on *Streptococcus sp* inhibition zone are shown in Table (.4). From the results it was found that there was an increasing effect given by increasing concentrations of the herbs extracts. However, at the highest concentration (50%), the inhibition zones at the different concentrations were (24, 21, 8.5 and 8mm) for cinnamon, cinnamon and ginger combination, ginger and yansoon extracts, respectively. However, all concentrations of the herbs extracts were effective in inhibiting growth of *streptococcus spp* .However, there were no significant differences between the

Table (1): Effect of different concentrations of herbs extracted by water on inhibition zone (mm) of *Streptococcus* sp

	Herbs				
Concentration %	Anise	Ginger	Cinnamon	Ginger+ Cinnamon	MEAN
0	6.0	6.0	6.0	6.0	6
35	7.2	7.0	14.0	10.0	9.65
40	7.7	7.5	14.5	10.0	9.93
45	7.7	8.0	14.5	10.5	10.25
50	9.0	11.0	15.0	16.0	12.75
MEAN	7.5	8.0	12.8	10.5	

f 59.783 -25.2652 and 3.1346

P –value=0.00001, 0.00001 and 0.0117

Table (2): Effect of different concentrations of herbs extracted by water on inhibition zone (mm) on Staphylococcus sp

	Herbs				MEAN
Concentration %	Anise	Ginger	Cinnamon	Ginger+ Cinnamon	
0	6.0	6.0	6.0	6.0	6
35	7.7	7.2	. 15.0	12.0	10.48
40	8.5	7.5	16.0	15.0	11.87
45	10.0	8.5	19.0	20.0	14.37
50	10.5	9.0	20.0	21.0	15.12
Mean	8.5	7.6	15.3	14.8	

f= 208.8778, 135.3303 and 17.5155

P –value=0.00001, 0.00001 and 0.00001

Table (.3): Effect of different concentrations of herbs extracted by water on inhibition zone (mm) Enterococus sp

	Herbs				MEAN
Concentration %	Anise	Ginger	Cinnamon	Ginger Cinnamon	
0	6.0	6.0	6.0	6.0	6
35	8.5	9.2	16.0	8.0	10.4

40	8.7	9.8	16.0	11.0	11.4
45	11.2	11.0	19.5	15.5	14.3
50	12.0	15.0	21.0	18.0	16.7
Mean	9.35	10.3	15.7	11.7	

F=21.2587, 35.8557 and 2.0779

P –value=0.0001,0.00001 and 0.0322

concentrations or the different herbs. Table (.5) show the effect of different concentration of ethanolic extracts of yansoon, cinnamon and combination of ginger and cinnamon on *Staph. aureus*. The results showed that there were higher effects by the higher concentrations of the extracts of cinnamon, cinnamon and ginger combination, (24 and 21.5, respectively). However, less effect were found for ginger and yansoon ethanolic extracts (11and 9, respectively). On the other hand, there were no significant differences between the concentrations or the different herbs.Table (.6) show the effect of different concentration of ethanolic extracts of of Anise (yansoon), ginger, cinnamon and combination of ginger and cinnamon on *E. faecalis*. The result showed that there was increasing effect with the increasing concentrations of the extract reaching its maximum at the highest concentration (50%), the inhibition zones at the concentration were (20.5, 20, 8, and 10.5) for cinnamon, cinnamon and ginger combination, ginger and anise (yansoon) extracts respectively. However, the cinnamon is more effective followed by cinnamon and ginger combination compare to ginger and yansoon extracts Although, there were no significant differences between the concentrations or the herbs.

Table (. 4): Effect of different concentrations of herbs extracted by ethanol on inhibition zone (mm) of Streptococcus sp

	Herbs				MEAN
Concentration %	Anise	Ginger	Cinnamon	cinnamon+ ginger	
0	6.0	6.0	6.0	6.0	6.0
35	7.5	7.0	15.0	20.0	12.5
40	7.5	7.5	24.0	20.0	14.8
45	7.5	7.5	24.0	20.0	15.0
50	8.0	8.5	24.0	21.0	15.6
Mean	7.3	7.3	19.0	17.6	

df 3,4 ,12 P-value= 0.00001, 0.00001, 0.00001

Table (. 5): Effect of different concentrations of herbs extracted by ethanol on inhibition zone (mm) of Staphylococcus sp

	Herbs				MEAN
Concentration %	Anise	Ginger	Cinnamon	Ginger+ Cinnamon	
0	6.0	6.0	6.0	6.0	6.0

35	7.0	10.5	11.0	16.0	11.1
40	8.0	10.5	20.0	19.0	14.3
45	8.0	11.0	21.5	21.0	15.3
50	9.0	11.0	24.0	21.5	16.5
Mean	7.6	9.8	16.6	18.1	

df 3,4,12 P-value=0.00001, 0.00001 and 0.00002

Table (.6): Effect of different concentrations of herbs extracted by ethanol on inhibition zone (mm) of Ennterococcus sp

	Herbs				MEAN
Concentration %	Anise (Yansoon)	Ginger	Cinnamon	Ginger+ Cinnamon	
0	6.0	6.0	6.0	6.0	6.0
35	7.0	7.0	18.0	15.0	11.7
40	8.0	7.0	19.5	19.0	13.3
45	9.5	9.0	20.5	19.5	14.4
50	10.7	8.0	20.5	20.0	15.0
Mean	8.0	7.4	16.9	15.9	

df 3,4,12 P-value=0.00001, 0.00001 and 0.00001 Effect of

Different Extracting Solvents:

Two extracting solvents were used including; ethanol and water (aqueous extracts) .The cup plates inhibition Zone method was used for comparison between the two solvent. Results on Fig (1) are showing the effect of extracts obtained by the two solvents on the inhibition zones of the bacterium *Streptococcus* sp. The results showed that water extract and ethanol extract of anise (yansoon) gave least effect (9, 8 mm), respectively. However, the water extracts of ginger was

better than the ethanol extracts (11 and 8.5 mm) respectively. The larger inhibition zone of growth was obtained by the ethanol extract of cinnamon (24mm) followed by water extract (15mm).The result also indicated that the ethanolic extract of ginger and cinnamon combination was more effective (21mm) compared to the water extracts (16mm). On the other hand, results on Fig (2) are showing the effects of the extracts of the two solvents on the inhibition zones of the bacterium *Staph. aureus* .The results showed that the different herbs were showing different antimicrobial effects when extracted with different solvents. The results indicated that generally, water extract of yansoon was effective than its ethanol extract giving 10.5 and 9.5, respectively. However, the ethanol extracts of ginger was effective (11mm), followed by the water extracts (9mm). The higher inhibition zone of growth was obtained by ethanol extract of cinnamon (24mm), followed by water extract (20mm).The result indicated that the ethanol extracts and water extracts of ginger and cinnamon combination was more effective (21.5 , 21), respectively. Cinnamon were highly effective, followed with water and ethanol extract of ginger and cinnamon combination. However the water extract of yansoon and ginger gave better effect, while the ethanol extracts of both were less effective. Table (7) are comparing the effects of the water extracts on the inhibition zones of the three bacteria *(Staphylococcus aureus, Streptococcus* sp *and Enterococcus feacalis*).The results showed that the Cinnamon water extracts were highly effective on *Enterococcus Streptococcus. sp feacalis* followed by *Staphylococcus aureus* and *Streptococcus spp* .On the other hand, cinnamon and Ginger combination water extracts were also effective on *Staphylococcus aureus* follow*ed* by *Enterococcus feacalis* and *Streptococcus spp*. Anise water extracts gave high effects on *Enterococcus feacalis* and less effects on *S. aures* and *Streptococcus* sp. However ,Ginger water extracts also gave high effects on *Enterococcus feacalis* and less effect on and *S. aureus* . Results in Table (8) are comparing the effects of the ethanolic extracts on the inhibition zones of the three bacteria *(Staphylococcus aureus, Streptococcus sp and Enterococcus feacalis*).The results showed that the Cinnamon ethanolic extracts gave highly effects on *Streptococcus* sp and *S. aures*, compared to *E. feacalis*. However, the cinnamon and the ,Ginger combination water extracts were highly effective on the three bacteria and yansoon ethanolic extracts gave high effects on *E. feacalis* and less effects on *S.aureus* and *Streptococcus* sp. However, Ginger ethanolic extracts also showed similar less effect on the three bacteria.

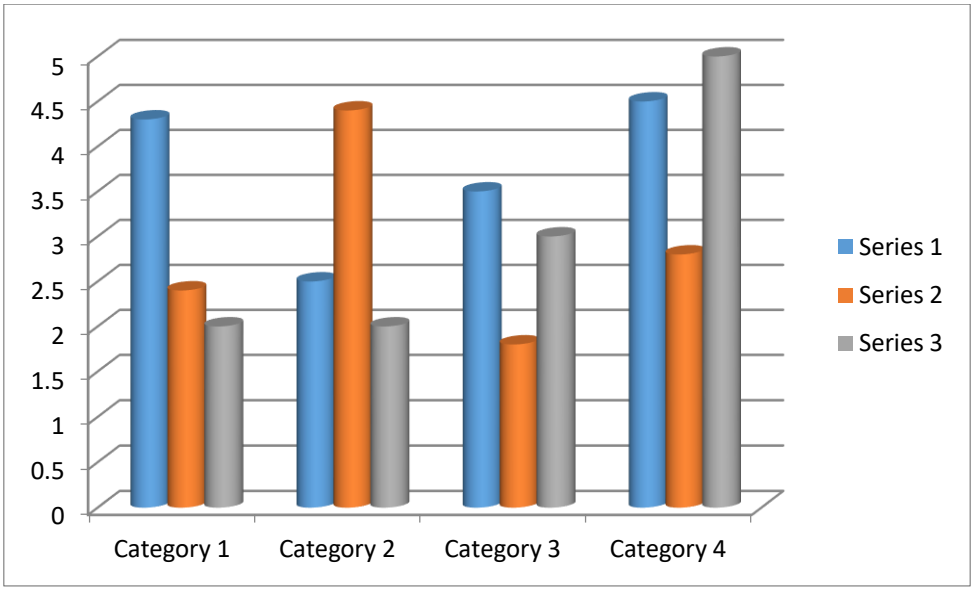

Table (.7): Effect of Herbs aqueous extracts on inhibition zones (mm) of some bacteria

	Herbs			
Organism	Anise (Yansoon)	Ginger	Cinnamon	Ginger+ Cinnamon
Streptococcus sp	9.0	11.0	15.0	16.0
Staphylococcus aureus	10.5	9.0	20.0	21.0
Enterococus faecalis	12.0	15.0	21.0	18.0

df 1 and 1 p-value =0.344042 and 0.79516

Table (8): Effect of Herbs ethanol extracts on inhibition zones (mm) of some bacteria

	Herbs			
Organism	Anise (Yansoon)	Cinnamon	Ginger	Ginger+ Cinnamon
Streptococcus sp	9.0	8.5	24.0	21.0
Staphylococcus aureus	9.5	11.0	24.0	21.5
Enterococus faecalis	10.7	8.0	20.5	20.0

df 1 and 2 P-value=0.357611 and 0.031182

DISCUSSION

The present study was investigated the biological activities of the aqueous and ethanol extracts from different herbs, Anise (Yansoon), Cinnamon, Ginger and Cinnamon and Ginger combination against three bacteria (*Staphylococcus aureus, Streptococcus* sp and *E. feacalis*). The cup- plate agar diffusion (inhibition zone) method was used. The results of the study indicated that the extracts of Anise (Yansoon), Cinnamon, Ginger and Cinnamon and Ginger combination using the inhibition zone method were effective against the three bacteria compared to the control treatment.The results also indicated that the Cinnamon water extracts were highly effective on *E. feacalis* followed by *S. aureus* and *Streptococcus* sp. On the other hand, Cinnamon and Ginger combination water extracts were also effective on *S. aureus* followed by *E. feacalis* and *Streptococcus* sp. Yansoon water extracts gave high effects on *E. feacalis* and less effects on *S. aureus* and *Streptococcus* sp. However, Ginger water extracts also gave high effects on *E. feacalis* and less effect on *Streptococcus* sp and *S. aureus*. The result showed that the Cinnamon ethanolic extracts gave similar highly effects on on *Streptococcus* sp and *S. aureus* followed by *E. feacalis* and cinnamon and ginger combination water extracts were highly effective on the three bacteria. However, yansoon ethanolic extracts gave high effects on *E. feacalis* and less effects on *S. aureus* and *Streptococcus* sp. Ginger ethanolic extracts also showed similar less effect on the three bacteria. [19] found that methanolic extract of *P. anisum* showed antibacterial activity against *S. aureus*, *Streptococcus pyogenes*, *E. coli* and *Klebsiella pneumonia* whereas, acetone and petrolenum ether extracts were not inhibit the growth of any of the test bacteria; while, [20] reported that the antibacterial activity of yansoon was effective against the gram positive bacteria (*S. aureus, S. epidermidis, S. pneumonia, Micrococcus luteus)* and against gram negative bacteria *(Proteus mirabilis, Citrobacter koseri, Enterobacter*

aerogenes). The extract showed no bactericidal effect on *Pseudomonas aeruginosa* and *E. coli.* The result of the effect of ethanolic extract of anise fruit was recorded by [21]. Medicinal plants continue to be an important Therapeutic aid for alleviating the ailments of humankind. Today, there is a renewed interest in traditional medicine and an increasing demand for more drugs from plant sources. This revival of the interest in plant-derived drugs is mainly due to the current widespread belief that "green medicine" is safe and more dependable than the costly synthetic drugs, many of which have adverse side effects [22]. An attempt has been made to enrich the knowledge of antibacterial activity of 5%, 10%, and 50% crude extract of clove buds and ginger rhizomes on *S. mutans*. Through the extensive literature review it has been concluded the beneficial aspects of plant derived drugs are good source of antibiotics, antioxidants and anti-inflammatory agents [23]; [24] .They found that 10% ginger extract inhibited the growth of *Streptococcus mutans* which is also confirmed by the findings of the study conducted by [25] from its use in breads baked by ancient Greeks ginger (*Zingeber officinale*) is a popular flavoring agent. The active compounds contained in ginger are divided into two groups: volatile essential oils and fragrant or harsh phenol compounds [26].The ginger root ethanol extract showed the greatest effect on both *S. aureus* and *S. pyogene* compared to the leaf and root water extract and the leaf ethanol extract. This is an indication that ginger is effective against *S. aureus* and *S. pyogene* infections. In some parts of the African Continent, herbal medicines are sometimes administered concomitantly with antibiotics [27] and this can lead to either beneficial or deleterious effects. Ginger is a promising plant material with numerous biological activities. Various solvents were used for extraction of bioactive compounds from ginger. [28] showed that the ethanolic extract of stem bark of Cinnamon has exerted antibacterial activity against clinical isolates of Methicillin Resistant *S. aureus* (MRSA), from Kolkata, India. The antibacterial activity was expressed as both diameters of inhibition and minimum inhibitory concentration (MIC). The cinnamon extract, which showed a diameter of inhibition zone ranging from 22 to 27 mm. The authors concluded that Cinnamon could be considered a valuable support in the treatment of infection and may contribute to the development of potential antimicrobial agents against MRSA bacteria[28] . The aqueous, hydro-alcoholic and alcoholic dried inner bark extracts of cinnamon obtained by Soxhlet extraction were tested against two acne causing bacteria, i.e., Propioni bacterium and *S. epidermidis*, using the well diffusion method. The results showed that at a concentration of 5 mg/ml. The inhibition zones for aqueous and ethanolic dried inner bark extracts against Propioni bacterium were 18, 1.02 mm and 18 and 1.6 mm, respectively. The hydro-ethanolic dried inner bark extracts were found to be inactive. The *S. epidermidis* strains were more sensitive towards these extracts, with higher inhibition zones (22, 1.7 mm, 22, 1.2 mm and 15, 1.8 mm) for aqueous, hydro-alcoholic and ethanolic extracts, respectively). The authors ascribed the antibacterial activity to the presence of phenolic compounds such as cinnamaldehyde and eugenol, and concluded that these cinnamon extracts could be used to develop new formulations for acne treatment [29 The study indicated that Cinnamon, Anise (Yansoon) and Ginger aqueous extracts and ethanolic extracts have antimicrobial activity against the tested bacteria (*Staphylococcus aureus*, *Streptococcus* sp and *Enterococcus faecalis*) The inhibitory effect against the tested bacteria was more effective when using higher concentration of the extract. The study also indicated that the cinnamon ethanolic extracts was more effective compared to the ethanolic extracts of the two other herbs. The Combination of

Cinnamon and Ginger gave lesser effect than cinnamon alone and higher effect than Ginger alone.

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النشاط المضاد للبكتريا في مستخلصات الينسون والقرفة والزنجبيل

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الملخص

هنالك حاجة ماسة للمواد النشطة أحيائياً ذات المصدر النباتي حيث اصبح لها اهتمام في الأبحاث الحديثة. المواد الصيدلانية الاصطناعية اتضح أن له تأثيرات جانبية للمختلف أجزاء جسم الإنسان داخلياً وخارجياً . وعليه فقد جرى في هذه الدراسة البحث عن إيجاد مصادر مضادة للبكتيريا في مستخلصات الينسون والقرفة والزنجبيل. استخدمت في الدراسة طريقة المنطقة المثبطة لدراسة التأثير على أنواع البكتيريا المختلفة التالية (*Staphylococcus aureus* *Enterococcus faecalis*) *Streptococcus* sp, and)

أظهرت النتائج أن المستخلص الكحولي لكل من القرفة ومخلوط القرفة والزنجبيل له تأثير فعال على البكتيريا (*Enterococcus faecalis*) كما يلي:

(24مم, 21مم على التوالي). ومع ذلك فقد كانت المستخلصات المائية والكحولية للزنجبيل والينسون أقل فعالية (11مم و 9مم على التوالي). هذا وكانت مستخلصات القرفة ومخلوط الزنجبيل والقرفة أكثر فعالية على البكتيريا *Staphylococcus aureus* حيث اعطت (24مم و 21.5مم على التوالي), تبع ذلك المستخلص المائي لكليهما (20مم و 21مم على التوالي). في حين كانت المستخلصات الكحولية والمائية لزنجبيل والينسون أقل فعالية ومن ناحية أخرى لوحظ أن مستخلصات القرفة هي الأكثر فعالية مقارنة بمستخلصات الزنجبيل والينسون . يستنتج من النتائج أن مستخلصات تلك النباتات يمكن استخدامها كمواد مضادة للبكتيريا. لابد من إجراء دراسات لاحقة للتعرّف على المواد الكيميائية الفعالة في تلك المستخلصات كما ويجب اختبار أحياء دقيقة عديدة أخرى في الدراسات اللاحقة.