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In Vitro Antimicrobial Activity of Gum Arabic (Al Manna and Tayebat) Prebiotics against Infectious Pathogens

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ABSTRACT

The antimicrobial activity of two products of Acacia Senegal, Acacia seyal as prebiotics (Al Manna and Tayebat) extracts were assayed against the twelve gram positive and gram negative bacteria namely *S. aureus*, *S epidermidis*, *St. pneumoniae*, *Ps. aeroginosa*, *Proteus merabilis*, *Acinetobacter*, *Enterobacter*, *Klebsiella pneumoniae*, *Serratia spp.*, *E. coli*, *Salmonella typhi*, and *C. albicans* using agar well diffusion method. Aqueous extract were able to exhibit antimicrobial activity. The highest antimicrobial activity of Tayebat with zone of inhibition of 20 mm and Al Manna present with zone of inhibition 10 and 20 of different microorganisms. Prebiotic (Al Manna and Tayebat) could be used as a source of antimicrobial agents to treat different medical cases.

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INTRODUCTION

Infectious diseases show an important health problem and represent one of the main causes of morbidity and mortality worldwide, due to the indiscriminate use of antibiotics and incidence of multiple antibiotic resistances in human pathogens. Due to report of increasing developments of drug resistance in human pathogen, it is necessary to search for new agents which are better and without side effect for treating diseases especially in developing countries (1 and 2).

A wide variety of plant/natural products are used in the treatment of different ailments. In traditional medicine diverse infectious diseases have been treated with herbal products. Approximately the 80% of the world population have used herbal products to satisfy their primary health care (3).

It has been scientifically demonstrated that plants contain secondary metabolites (alkaloids, resins, oleosins, steroids, tannis and terpenes etc.) to which biological properties are attributed, and from these properties, drugs have been developed to care diseases. Due to this, there is a constant need to find and develop new compounds with antimicrobial potential, and to continue the search of medicinal plants with new mechanisms of action to treat infectious diseases (4).

Gum Arabic (GA) or Acacia gum is a dibble biopolymer obtained as exudates of mature trees of Acacia Senegal and Acacia seyal which grow principally in the African region of Sahel in Sudan. The exudate is a non-viscous liquid, rich in soluble fibers, and its emanation from the stems and branches usually occurs under stressful conditions such as draught, poor soil fertility, and injury (5).

Acacia Senegal and Acacia seyal also known gum Arabic, acacia gum, taken from two species of acacia tree; the gum is harvested commercially from wild trees throughout the Sahel from Senegal to Somalia, although it has been historically cultivated in Arabia and West Asia (6).

The tree is of great economic for the gum Arabic, it produces to be used as a food additive, in crafts and as a cosmetic. The gum is drained from cuts in the bark, and an individual tree will yield 200 to 300 grams. Seventy percent of the world gum Arabic is produced in Sudan, it is reportedly used as for its astringent properties, to treat bleeding, bronchitis, diarrhea, gonorrhea, leprosy, lymphoid fever and upper respiratory tract infections (7).

Gum Arabic also considered in folk medicine to treat diabetes mellitus. The plant has been shown to exhibit antibacterial, anti-inflammatory, vasoconstrictor actions, antihypertensive, antispasmodic activities, inhibitory effect against hepatitis virus, cytotoxic activities and antioxidant activity (8 and 9).

Various parts of this plant are known to be important source of secondary metabolites as alkaloids, cynogenic glycosides, fluoroacetate, gums, terpenes (including essential oils, diterepenes, phytosterol and triterpene genins and saponin) (10).

Aim of the present study was designed to evaluate the antibacterial potential of two gum Arabic products (probiotic) activity (AL Manna and Tayebat) against different types of bacteria isolated from different medical cases.

MATERIALS AND METHODS

Preparation of aquatic extracts

The ready Tayebat and AL Manna powder used, Manufactured by (Nature Gums)/Sudan packed by sidratul corporation SdnBhd/Malaysia. Aqueous extract was soaked (50) gram of each product by (100) ml distillated water, and allowed to stand for 72 hrs, and sterilized by filtration (using Millipore 0.45) filter paper). This was considered as the 50% concentration of the extract. The extract stored in sterile bottles and kept in freezer at 4^{o}C until further use for screening of antimicrobial activity (11).

Bacterial isolates

Different eleven clinical microbial isolates (gram positive, gram negative and one isolate of *C. albicuns*) (listed at Table 1) were isolated and identified by using conventional biochemical tests and Api system (Biomeraux, France) (12), and cultivated in pure culture, at microbiological laboratory/college of Medicine/Babylon University.

Table 1: Bacterial isolates in the study

Gram negative bacteria	Gram positive bacteria
Salmonella typhi	*Staphylococcus aureus*
Ps. aeroginosa	*Staphylococcus epidermidis*
Proteus merabilis	*Streptococcus pneumoniae*
Klebsiella pneumonia	Yeast microorganism
Enterobacter spp.	*Candida albicans*
Acinetobacter	
E. coli	
Serratia spp.	

Screening of antimicrobial activity

Aqueous Al Manna and Tayebat were used for evaluation of antimicrobial activity by the agar well diffusion method (13). In this method, a pure isolate of each microbe was grown on agar plates at 37^{o}C for 24 hours. One plate of each microorganism was taken and a minimum of four colonies were transferred into normal saline (0.85%) under aseptic conditions. Density of each microbial suspension was adjusted to be equal to that of 10^{6} CFU/ml (standardized by 0.5 McFarland standard) and used as the inoculum for performing an agar well diffusion assay. One hundred microliter (100 µlL) of the inoculum of each test organism was spread onto the agar plates were allowed to dry and 8mm wells were made with a sterile borer in the inoculated agar plated. A 100 µlL volume of each extract was propelled directly in to the plates for each test organism. The plates were allowed to stand for 1 hr at room temperature for diffusion of the extract into agar and incubated at 37^{o}C for 24 hrs, the antimicrobial activity, indicated by an inhibition zone surrounding the well containing the extract, was recorded, if the zone was greater than 8mm. The experiments were performed in triplicate and the mean values of the diameter of inhibition zone (14).

Antibacterial activity assay

The antibacterial activity was determined by agar disc diffusion (12). Agar plates were inoculated with 0.1 ml broth culture of tested organisms and was spread with sterile an L-shaped rod glass spreader. The antibiotics disks of ciprofloxacin were added in the center of agar plate (the plates were performed in triplicates). All plate of the tested organisms was then allowed to incubate at 37^{o}C for overnight. After 24 hrs of incubation, each extract was noted for zone of incubation for all isolates. The diameter of the zone of inhibitions were measured in triplicate and the mean values of the diameter of inhibition zone were calculated.

Test microorganisms

Eleven gram positive and gram negative bacteria were used in this study and one isolate of *Candida albicans* to determine the antimicrobial activity of Al Manna and Tayebat extracts. All bacterial strains were maintained on freshly prepared blood agar. Isolated bacterial strains were identified to the species level based on the standard biochemical and microbial methods (12), and on the basis of staining, morphological and cultural characteristics for yeast (15 and 16). The bacterial isolates were sub-cultured on nutrient agar and *C. albicans* on malt yeast agar and incubated aerobically at 37^{o}C.

RESULTS AND DISCUSSION

Antimicrobial activity (assessed in terms of inhibition zone) of Al Manna and Tyabat extracts, tested against selected microorganisms were recorded (Figure 1, 2, 3). The results of the antimicrobial activity assays indicated that Gum Arabic (Acacia) as prebiotic extract had inhibiting activity on *Staphylococcus aureus, Staphylococcus epidermidis, Streptococcus pneumoniae, Salmonella typhi, Ps. aeroginosa, Proteus merabilis, Klebsiella pneumoniae, Enterobacter spp., Acinetobacter, E. coli, Serratia spp.* and *Candida albicans*.

In this study, the purpose was to examine the inhibitory effects of Gum Arabic as two products on some pathogenic bacteria and fungal causing different illness in humans with agar well diffusion method as *in vitro*. In this study, extracts of Al Manna and Tayebat displayed a variable degree of antibacterial activity on different microorganisms. All isolates were found to be more sensitive to Tayebat (20mm) than Al Manna extract (10mm) medicinal plant based

antimicrobials represent a vast untapped source of pharmaceuticals and further exploration of plant antimicrobials need to occur for treatment of infectious diseases. The aqueous extract of two products has been evaluated against different bacterial and fungal human pathogens and variable activities for two products.

In this study, the aqueous extracts of Al Manna and Tayebat were found to be active in inhibiting the growth of all twelve tested bacterial and fungal pathogens, our work is supported by earlier studies on an aqueous extract that exhibited activity against bacteria (17 and 18).

Among the tested bacterial pathogens, Gram positive bacterial strains have been found to be same susceptible to gram negative bacterial strains.

A majority of the described antimicrobial effect of Gum Arabic have been attributed to their secondary metabolites or due to presence of saponin, saponin glycosides, volatile oil, hydrolysable tannin, triterpenoid, flavonoids, phenol and alkaloids (19 and 20).

The antibacterial and antifungal potential of two extracts of Gum Arabic is due to it is high terpene contents. Terpenes are biologically active molecules and are considered to be part of plants defense systems and as such have been included in the large group of protective molecules found in plants named as phytoprotectants (21).

Such effects of Gum Arabic are attributed to the high salt content of Ca^{+2}, Mg^{+2} and K^{+2} of polysaccharides in GA, and the effect of gum in the metabolism of Ca and possibly phosphate. It is also known that cyanogenic glycosides and GA contains many types of enzymes such as oxidases, peroxidases, and pectinases, some of which have antimicrobial properties (22 and 23). The results of present study support the valuable use of GA in traditional medicines for treatment of different infections.

CONCLUSION

From the present screening, it could be concluded that Gum Arabic is potent antimicrobial agent. These extracts have an activity against *S. typhi*, gram positive and gram negative bacteria. Tayebat aqueous extract is more effective than Al Manna aqueous extract.

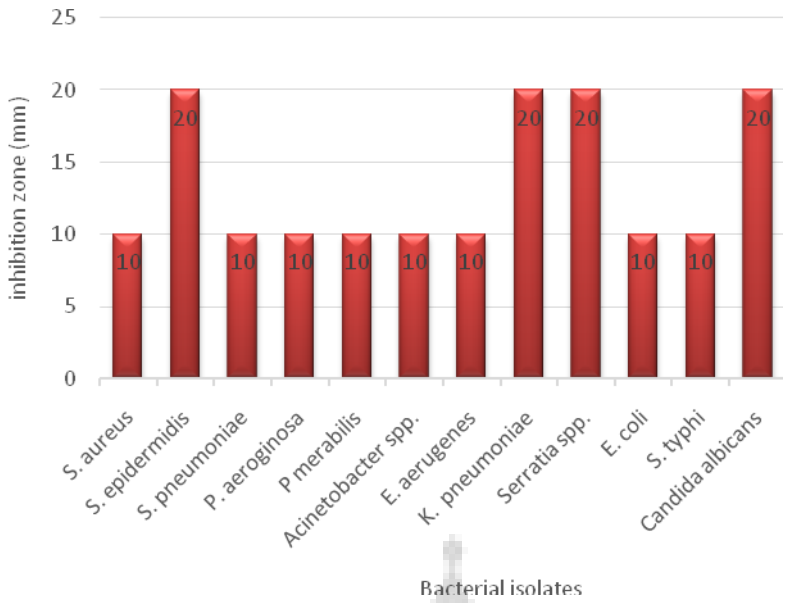

Figure 1. Antimicrobial activity of Al Manna against bacteria and yeast

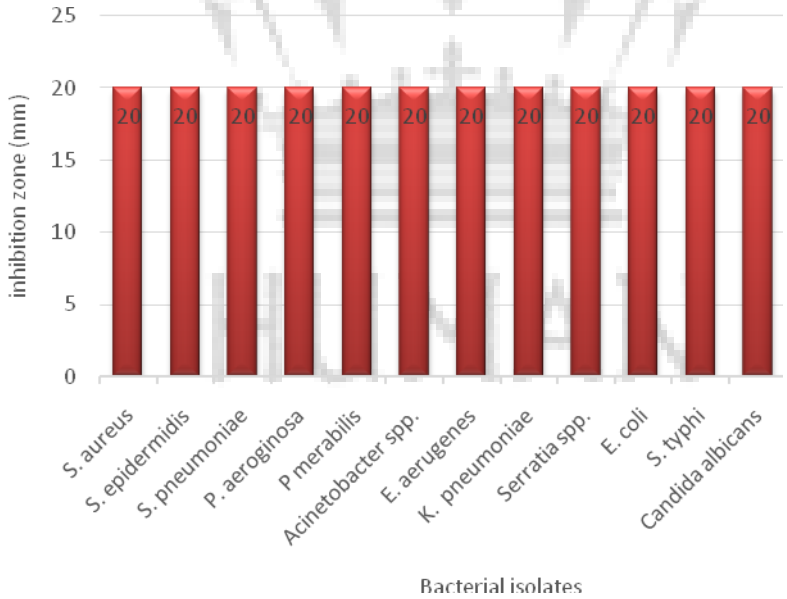

Figure 2. Antimicrobial activity of Tayebat prebiotic against bacteria and yeast

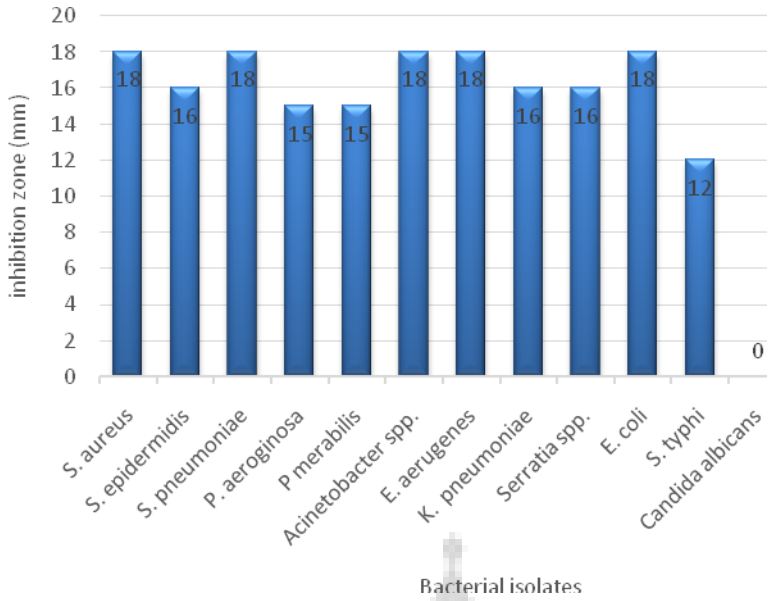

Figure 3. Antimicrobial activity of ciprofloxacin against bacteria and yeast

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REFERENCES

1. Marijori MC. Plant products as antimicrobial agents. Clinic microbial. Rev. 1999; 12: 564-582.
2. Kahkashan P, Najatm A, BokhariSoliman, DAW. Antibacterial activity of phoenix ductylifera L-leaf and pit extracts against selected gram negative and gram positive bacteria. J. Med. Plant. Res. 2012; 6(2): 296-300.
3. ShubhiMehrotri, A shwanim K., Srivastava, Shoma Paul Nandi. Comparative antibacterial activates of NeemAmla, Aloe, Assam Tea and clove extracts against Vibrio cholera, *Staphylococcus aureus* and *Pseudomonas aeroginosa*. J. Med. Plant Res. 2010; 4(22): 2393-2398.
4. Egwaikhide PA, Okeniyi SO, Gimba, CE. Screening for anti-microbial activity and phytochemical constituents of some Nigerian medicinal plants. J. Med. Plant. Res. 2009; 3(12): 1088-1091.
5. Wiliams PA, Philliphs GO. In handbook of hydrocolloids; Williams, P. A. Philliphs, G. O., CRC Press: Cambridge. 2000; 155-168.
6. Khan R, Islam B, Akram M, Shakil S. Antimicrobial activity of five Herbal Extracts against Multi drug resistance (MDR) strains of bacteria and fungus of clinical origin. Molecules. 2009; 14(2): 586-597.
7. Del WE. In vitro evaluation of peroxyl radical scavenging capacity of water extract of Acacia nilotica (L). Afr. J. Biotechnol. 2009; 8(7): 1270-1272.
8. Gilani AH, Shaheen F, Zamanm M. Studies on antihypertensive antispasmodic activites of methanol extract of Acacia nilotica pods. Phytother. Res. 1999; 13: 665-669.

9. Malviya S. Rawat R, Verma M, Kharia A. Preliminary phytochemical investigations of Acacia nilotica Linn plant. Curpharm, Res. 2011; 1(2): 91-100.
10. Seigler DS. Photochemistry of Acacia-sensulato. Bochem. Syst. Ecology. 2003; 31(8): 845-873.
11. Hindi NKK, Alsultany HAR, AlshibIy IKA, and Chabuck ZAG. The effect of some medicinal plants on bacterial skin infections. World J. PHARMACY and pharmaceuticals sciences. 2013; 2(5): 2355-3366.
12. Forbes BA, Sahm DF, and Weissfeld AS. Bailey and Scotts diagnostic micnobiology. 12th.ed.elsvier china; 2007.
13. NCCLS (National committee for clinical laboratory standards).Methods for dilution antimicrobial susceptibility test of bacteria grow aerobically approved standard M100 –S12.Wayne. PA ,NCCLS; 2002
14. Aneja KR, Sharma C. Antimicrobial potential of fruit extracts of ElettariacardamonumMaton (chhotielaichi) against the pathogens causing ear infection pharmacologyonl. 20103; :750-756.
15. Aneja KR. Experiments in microbiology. Plant pathology and biotechnology 4thed. New Delhi: New Age international publishers; 2003.
16. Cappuccino JG, Sherman N. Microbiology. Lab Manual 7th ed. San Francisco: Benjamin Cummings Publishing COMPANY. 2008.
17. Ahmed I, Mehmood Z, Mohmmod F. Screening of some Indian medicinal plants for their antimicrobial properties. J. Ethnopharmacol. 1998; 62: 183-193.
18. Sharma C, Anejam KR, Surain P, Dhiman R. In vitro, evaluation of anti-microbial spectrum of Acacia nilotica leaves and bark extracts against pathogens causing otitis infection. J. of Innovative Biology. 2014; 1(1):51-56.
19. Chaubal R, Tambe A. Isolation of new straight chain compound from Acacia nilotica. Ind. J. Chem. 2006; 45(B): 1231-1233.
20. Wisdom GOS, Shittu, GA. In vitro antimicrobial and phytochemical activites of Acacia nilotica leaf extract. J. Med. Plant. Res. 2010; 4(12): 1232-1234.
21. Morrissey JP. Osbourn AE. Fungal resistance to plant antibiotics as a mechanism of pathogenesis. Microbial Med. Biol. Rev. 1999; 63: 708-724.
22. Tyler V, Brady L, and Robbers J. 7th ed. Phuladelphia Lea and Febiger. 1977; 66-68.
23. Saini M, Saini R, Roy S, and Kumar A. Comparative pharmacognostical and antimicrobial studies of Acacia species (Mimosaceae). J. Med. Plant Res. 2008; 2(12):378-386.