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Study of the Antioxidant Activity of Gum Arabic and Its Effect on Bacteria

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Abstract

Gum Arabic (GA) is the main product of acacia trees, also known as Acacia seyal gum (ASG), and is a dried exudate from trees of Acacia. It provides a rich source of non-viscous soluble fiber that is used traditionally in folk medicine. It is rich in antioxidant. The aim of this research was to extract phenolic compounds present in gum Arabic (GA) using absolute methanol. The antioxidant activity was studied using two methods: Folin-Ciocalteu indexes (FCI), which indicate total phenolic compounds (TPC), where gallic acid was used as a reference, and 2,2-diphenyl-1-picrylhydrazyl (DPPH), where ascorbic acid was used as a reference. The results reveal that the FCI shows that the phenolic compounds extracted from GA range from 1079 to 4944 mg GAE/g of extract, where GAE is gallic acid equivalent. It was observed that the phenolic compounds have a great ability to displace the stable free radical DPPH to diphenylpicrylhydrazine of the yellow color, and the best value for IC_{50} was 4461.05 μg/ml. The antioxidant equivalent to ascorbic acid was 4163.30 μg/ml, which was the highest efficacy for a concentration of 5000 mg/ml of the extract and the lowest at a concentration of 1000 mg/ml. The extract was tested against the following antibacterial types: *Staphylococcus aureus*, *Streptococcus spp*, *Escherichia coli*, *Klebsiella spp*, *Pseudomonas spp*, and *Proteus spp*. According to the findings, different extract concentrations effectively inhibited the growth of the chosen pathogenic microorganisms. The study revealed that the Gum Arabic (GA) contains large amounts of phenolic compounds which were found to be the main contributor to its antioxidant activities, and the extract was found to exert low to moderate antibacterial activity. Hence, it can be concluded that the Gum Arabic (GA) can lead to the creation of compounds that can be used to develop new and more effective products.

Keywords

Gum Arabic, Antioxidant, Solvent Extraction, TPC, DPPH, Antibacterial

Activity

1. Introduction

Gum Arabic (GA), scientifically referred to as Acacia gum, is a consumable biopolymer derived from the exudates of mature specimens of Acacia Senegal and Acacia Seyal, predominantly found in the Sahelian region of Sudan within Africa. This exudate manifests as a non-viscous liquid, characterized by a high concentration of soluble fibers, and typically emanates from the stems and branches of the trees under conditions of environmental stress, including drought, suboptimal soil fertility, and physical injury [1]. The freshly excreted gum exhibits a pale golden yellow hue, possesses a semi-liquid consistency, is devoid of any discernible odor, and is generally characterized by a lack of taste. Upon solidification, it undergoes a transformation in coloration, ultimately achieving a reddish yellow shade accompanied by a substantial consistency, rendering it challenging to pulverize. Gum Arabic, which is derived from the bark of the Acacia Senegal, has been a significant commodity in trade for over four millennia, underscoring its crucial role as a primary source of revenue for the African populace. This substance is produced commercially across the Sahel region, extending from Senegal to Sudan and Somaliland [2]. The majority of edible gums derived from arboreal sources, in fact, and exudates are composed of sugar polymers. Natural gums, commonly referred to as Gond, Goond, Dinka, Gaund, or Gondh, are polysaccharides of botanical origin that are advocated for their advantageous effects during gestation and postpartum, particularly in fortifying the spinal structure. These substances are hydrophilic and yield gelatinous viscous solutions; due to this property, they are employed within the alimentary sector as thickeners, gelling agents, emulsifiers, and stabilizers [3]. In addition to their functionality as adhesives, binding agents, crystal inhibitors, clarifying agents, encapsulating agents, and flocculating agents, natural gums find extensive applications across diverse industries, including viticulture, where they serve as refining agents [4].

Chemically, GA constitutes a heterogeneous assemblage of macromolecules exhibiting varied dimensions and compositions, predominantly consisting of carbohydrates and proteins. It is characterized by a high concentration of non-viscous soluble fibers that possess significant dietary benefits, in addition to containing essential minerals such as potassium, magnesium, and calcium [5]. Recent investigations have underscored the antioxidant properties of GA, its nephroprotective effects, as well as other physiological impacts [6]. Moreover, its involvement in lipid metabolism [7], along with its beneficial implications in the management of various degenerative conditions such as renal failure [8], cardiovascular disorders [9], and gastrointestinal ailments [10], Gum acacia has been historically employed for the treatment of diarrhoea, dysentery, and diabetes [11]. Its applications extend to the management of diarrhoea, dysentery, and diabetes, as well as address-

ing dry cough associated with amoebic dysentery, serving as a tonic, antiasthmatic, analgesic, and in the treatment of lesions within the oral cavity. Moreover, additional benefits have been documented. Consequently, GA holds significant promise for a multitude of advantages within the medical, food, and pharmaceutical sectors. Despite the challenges associated with data extraction concerning antioxidant activities through specialized extraction methodologies of GA and its derivatives, GA has the potential to serve as a valuable source of components for functional foods and related applications [12]. Should GA be recognized as a competitive source of phytonutrients, such knowledge or data would be of paramount importance.

It has also been documented in the literature. The predominant bioactive constituents of GA encompass phenolic acids, flavonoids, terpenoids, lignans, tannins, quinones, coumarins, and alkaloids [13]. Despite the examination of the anti-proliferative properties of GA compounds across various biological activities, there remains an absence of reports concerning their effects on any cancer cell lines, including those associated with breast cancer (MCF-7).

The antimicrobial efficacy of the ethanolic extracts derived from gum acacia, gum tragacanth, and guar gum has been observed against various pathogens, including *St. pneumoniae*, *S. aureus*, *E. coli*, *K. pneumoniae*, *P. aeruginosa*, and *C. albicans*. The extract of tragacanth gum demonstrated a markedly superior antimicrobial activity in comparison to the other examined gum extracts [14]. The findings from the investigations suggested that the methanolic extract of the stem bark of GA possesses bioactive compounds exhibiting antifasciola properties [15].

Gum tragacanth, akin to Karaya and Ghatti gums, is not predominantly acknowledged for its substantial antimicrobial properties; nonetheless, it has been employed as a quintessential material for the environmentally friendly synthesis of nanoparticles and nano-fiber scaffolds, which exhibit applications in infection management due to their extensive antimicrobial efficacy [16]. Owing to attributes such as biodegradability, non-toxicity, non-mutagenicity, natural abundance, enhanced resistance to microbial assaults, and extended shelf life, natural gums serve as optimal materials for the nanosynthesis of microcapsules encapsulating herbal extracts [17]. Moreover, the administration of tragacanth gum at a concentration of 3% in conjunction with 3% cholesterol in the diet of cockerels has been shown to suppress the onset of hypercholesterolemia [18]. In contrast to being inhibited, certain pathogenic strains, including those from the genera Klebsiella, Serratia, and Yersinia, are capable of fermenting tragacanth gum, signifying its swift biodegradability within the intestinal environment [19].

Multitudes of methodologies are available for the extraction of antioxidants from botanical sources and various alimentary substances. The methodologies frequently employed encompass shaking, high-speed homogenization, maceration, and stirring. Nonetheless, a thorough empirical evaluation of these methodologies has yet to be documented; however, certain investigations have delineated the limitations associated with these methods, which include suboptimal product

quality, safety risks, and extended durations for extraction [20]. Recent advancements have led to the development of innovative extraction methodologies, including microwave-assisted extraction, ultrasonic-assisted extraction, and enzyme-assisted supercritical fluid extraction techniques, specifically aimed at the isolation of antioxidants from botanical sources [21] [22]. The assessment of antioxidant capacities of natural food constituents or biological systems is executed through the implementation of diverse methodologies, which yield varying outcomes. In the context of evaluating antioxidant activity in vitro, the utilization of free radicals is prevalent, particularly 2, 2-diphenyl-1-picrylhydrazyl (DPPH). In comparison to a standard of Trolox (a water-soluble analogue of vitamin E), the free radical is generated within the aqueous medium. The quantification of the diminution of yellow-blue DPPH radical through the action of hydrogen-donating antioxidants is achieved by the attenuation of the long-wave absorption spectrum associated with the radical [23]. This methodology is conventionally referred to as the Trolox equivalent antioxidant capacity assay. It is characterized by its rapid execution and applicability within both aqueous and organic solvent matrices across a broad spectrum of pH values ranging from 5 to 7 [24].

In this study, we focused on calculating the total content of the phenolic compounds in the methanol extract of the Arabic Gum (AG), as well as identifying antioxidant by way 2, 2-diphenyl-1-picrylhydrazyl (DPPH). The antibacterial Concentrations were tested on the six species of bacteria. Extracts for their possible use as source of antioxidants and as antibacterial agents that can be used to prevent food spoilage.

2. Materials and Methods

2.1. Gum Arabic (GA) Samples

Gum Arabic (GA) of the Alkhashab variety was obtained from a local market in Sudan. Following the removal of impurities and sand, the samples were subjected to a random selection process to ensure homogeneity among the nodules of GA. Subsequently, the material was ground into a fine mechanical powder using a testing sieve from Fisher Company, adhering to USA standards, with a mesh size of 1.40 mm. The resultant powder was then securely stored in airtight polyethylene bags within a desiccator.

2.2. Chemicals and Equipment Used

In this study, methanol solvent of analytical grade was used at a ratio of 95% from the company (PSPARK chemical). DPPH free radical scavenging assay: 2, 2- diphenyl-1- picrylhydrazyl and Ascorbic acid from the company (BHD chemical). Total phenolic content: sodium carbonate, Folin-Ciocalteu reagent (Chem King). A spectrophotometer was used: (Italy 40 40 Spectrophotometer) and (Eliza reader, Biotek, Germany).

2.3. Extraction Method

The authentication of Gum Arabic (GA) was conducted by Professor A.M. Am-

letan, who serves as the Head of the Botany Department at Misurata University, Libya, ensuring its unequivocal identification. The cold extraction technique, specifically soaking, was employed, wherein the sample was immersed in a beaker containing a minimal volume of solvent adequate to submerge it [25]. A quantity of 5 grams of the extract was measured utilizing (Glossaries DHAUS) and subsequently immersed in 100 milliliters of cold methanol; the selection of methanol was predicated on its efficacy as a polar solvent for the dissolution of phenolic compounds present in G. It was observed that polar extracts exhibited superior free radical scavenging capabilities in comparison to their less polar counterparts. The container was subsequently positioned on a magnetic stirrer (Model: RT 15P; Serial: 2 930 700). Following this, the samples were allowed to rotate for a duration of 24 hours. Additionally, a filtration procedure was conducted on the clarified suspension employing a Sartorius PTEF 0.45 μm filter, while the beaker was encased in aluminum foil to prevent spillage of the mixture and to mitigate exposure to light. The filtrate was maintained at ambient temperature until the complete evaporation of the solvent was achieved. The extract was dried under vacuum, the extraction yield was then calculated as a percent of the used powder. The precipitate was kept in the refrigerator until the analysis was conducted.

2.4. Antioxidant Assays

2.4.1. Determination of Folin-Ciocalteu Index for Total Phenolic Contents (TPC)

For the quantification of Total Phenolic Content (TPC), the Folin-Ciocalteu Index (FCI) assay was utilized with slight modifications; the employed methodology is in accordance with the protocol specified by [26]. An amount of 1 mg of Gum Arabic (GA) extract was accurately measured and subsequently dissolved in 1 ml of high-purity methanol. The resultant samples were then diluted with methanol to achieve five distinct concentrations (5000, 4000, 3000, 2000, 1000 μg/ml). Approximately, 1.5 ml of diluted Folin-Ciocalteu reagent (10%) was introduced to 0.1 ml (1 mg/ml) of the sample extract for each respective concentration, which was subsequently mixed thoroughly and allowed to equilibrate for a period of 5 minutes. Following this, 1.2 ml (7.5%) of sodium carbonate (Na_2CO_3) (w/v) was incorporated, and the resulting mixture was permitted to rest for 30 minutes in a controlled dark environment. The absorbance was then quantified at a wavelength of 765 nm using a UVD-3500 spectrophotometer after an elapsed time of 2 hours. The findings were subsequently recorded in terms of milligrams of gallic acid equivalent. A standard curve was plotted using different concentrations of Gallic acid. The absorbance obtained was converted to gallic acid equivalent (GAE) in mg per gm of dry material (mg GAE/g of extract) using Gallic acid standard curve.

2.4.2. DPPH Radical-Scavenging Activity

The efficacy of the extract in scavenging the stable DPPH free radical was quantitatively assessed [27]. DPPH was employed to evaluate the proton radical scavenging capability of Gum Arabic (GA) extracts, due to its possession of a proton

free radical and its distinctive absorbance characteristics at 517 nm. The DPPH compound is characterized as a purple-black solid material. This radical demonstrates stability, and its antioxidant potential is quantified by measuring the IC50 value, which is defined as the concentration of the extract necessary to inhibit 50% of the DPPH radical.

A volume of 0.1 ml from each designated concentration was meticulously combined with 2.9 ml of a pre-prepared 0.1 mM DPPH solution. The control group was constituted by the incorporation of 0.1 ml of the extract alongside 2.9 ml of the DPPH solution. The negative control was established by the amalgamation of 0.1 ml of methanol with 2.9 ml of the DPPH solution, which was subsequently subjected to a 30-minute incubation period in a dark environment. Absorbance measurements were obtained at a wavelength of 517 nm through the use of a spectrophotometer following a duration of 2 hours. The results were recorded in terms of milligrams of ascorbic acid equivalent. Methanol served as the baseline solution, and the absorbance of the DPPH solution was also assessed in the absence of the extract, with the I% inhibition rate for the free radical DPPH calculated according to the following relationship [28]:

Radical scavenging activity (RSA %) = (Control absorbance − Sample absorbance/control absorbance) × 100

2.5. Determination of Antibacterial Activity of Gum Arabic (GA) Extracts

2.5.1. Antibacterial Screening

Different concentrations of the extract were tested for antibacterial activities and were assayed against some of the bacteria, the cup-plate method [29] was used to assay antibacterial activity against types *Staphylococcus-aureus*, *Streptococcus spp.*, *Escherichia coli*, *Klebsiella spp.*, *Psuedomones spp.* and *Protues spp.*).The solvent used was dimethyl formamide (DMF), and the sample concentration was 25 - 500 μg/ml.

2.5.2. Testing for Antibacterial Activity

The organisms to be tested were inoculated into nutrient agar. The incubation period was 24 h at 37˚C and colonies isolated from these media were inoculated for 2 h at 37˚C [30].

The method was adopted in this study by using cup–plate agar diffusion method with some minor modifications, to assess the antibacterial activity. 20 ml aliquots of incubated agar were distributed into sterile Petri dishes, the agar was left to set in each of these plates Which were divided into two groups, each group has six cups in (10 mm in diameter) were cut using a sterile cork- borer (No 4). Each of the halves was designed for one of the test compounds. Separate Petri-dishes were created for the standard antibacterial chemotherapeutic agent. The agar discs were removed, Alternated cups were filled with 0.1 ml sample of each of the extracts and pure complexes using adjustable volume micro titer pipette, and allowed to diffuse at room temperature for two hours. The plates were then

incubated. In the upright position at 37˚C for 24 hours.

This procedure was repeated under variable concentrations of the extract and the standard antibacterial chemotherapeutic. The resultant growth inhibition zones in diameter were measured and averaged after incubation result.

2.6. Statistical Analysis

Statistical analyses were computed by using Microsoft Excel 2013.

3. Results and Discussion

3.1. Extraction Yields

The yield of extraction is contingent upon the solvents utilized, the duration and thermal conditions of the extraction process, as well as the intrinsic chemical characteristics of the sample being analyzed. Given equivalent temporal and thermal parameters, the choice of solvent in conjunction with the chemical properties of the sample emerges as the two preeminent factors influencing extraction efficacy. The solvents that have been empirically recommended for effective extraction comprise aqueous blends of methanol, ethanol, and acetone [31]. In the current investigation, the extraction yield achieved utilizing methanol as the solvent was quantified at a percentage of 5.62%.

3.2. Total Phenolic Contents (TPC)

The assessment of antioxidant activities was conducted utilizing methanol extraction and quantified as total phenolic content (TPC). The Folin-Ciocalteu reagent methodology was employed, with gallic acid serving as a positive control, indicating a total phenolic content ranging from approximately 1079 to 4944 mg GAE/g of extract. The findings presented in **Table 1** elucidated that the gum extraction contained a substantial concentration of phenolic compounds, which serve to inhibit the advancement of chain oxidation reactions either through the donation of hydrogen atoms or by chelating metal ions. Consequently, these entities act as reductants and antioxidants [32]; the assays were performed utilizing the complete extract, as this methodology may present superior benefits in comparison to isolated components, owing to the observation that a bioactive singular constituent can demonstrate modifications in its characteristics when engaging with other compounds that are present within the extract [33].

Initially, a calibration curve was established utilizing diverse concentrations of gallic acid (**Figure 1**). Subsequently, extract samples were formulated at varying concentrations (5000, 4000, 3000, 2000, 1000 μM). At the concentration of 5000 μM, the samples exhibited significantly elevated values of the total phenolic content (TPC), yielding a value of 4944 mg GAE/g of extract. Conversely, the TPC value at the concentration of 1000 μM for the samples revealed a minimal value of 1079 mg GAE/g of extract. The findings suggested that the values of the crude extract displayed a descending trend, with 5000 μM preceding 1000 μM, respectively. The results of the investigation provide compelling evidence that phenolic

compounds constitute critical constituents of this particular type of gum, and specific pharmacological effects may be attributed to the presence of this pivotal element. Through the course of our research, we observed that an increase in the concentration of the extract correlates positively with the quantity of phenolic compounds it encompasses.

The results derived from this investigation demonstrate a significant alignment with a multitude of previously established empirical observations. This suggests that phenolic compounds generally exhibit enhanced solubility in polar organic solvents in comparison to aqueous environments. Moreover, the outcomes of this research are in agreement with those of other researchers, indicating that among the solvents assessed, a 50% methanol extract exhibited the highest concentration of total phenolics sourced from Gum Arabic [34]. The empirical evidence presented by the researchers suggests that both ethanol and methanol demonstrate superior efficacy in the extraction of total phenolics from Gum Arabic (GA) compared to water [35]. Moreover, in the evaluation of total phenolic content through the Folin assay, the methanolic crude extract of Acacia seyal gum (ASG) samples exhibited an exceptionally elevated phenolic content of approximately 285.08 ± 3.57 mg GAE/100 g DW, while the acetone extract yielded a phenolic content of 358.57 ± 1.58 mg GAE/100 g DW for Acacia seyal gum (ASG) [36]. Additionally, in another study, the total phenolic content of (ASG) was 11933 ± 38 mg GAE/100 g DW [37]. The total phenolic content in gum arabic (GA) this investigation corroborated the health-promoting attributes linked to the presence of phenolic compounds.

Table 1. Total Phenolic Contents (TPC) and Extract Yield of methanolic extract of Gum Arabic (GA).

Concentration (µg/ml)	Total phenolic Contents (TPC) mg GAE/g of extract	Extract yield (%)
5000	4944	
4000	4129	
3000	3119	5.62%
2000	2084	
1000	1079	

Table 1 illustrates the dose-dependent increase in Total phenolic Contents (TPC), with the highest value of Total phenolic Contents (TPC) observed at 5000 µg/ml and least value at 1000 µg/ml.

3.3. DPPH Radical-Scavenging Activity

There exist numerous methodologies for the evaluation of antioxidant activity related to both synthetic and natural compounds. The DPPH assay constitutes a rapid and economical strategy, frequently utilized for the assessment of the antioxidative potential of various natural sources. The DPPH scavenging assay is

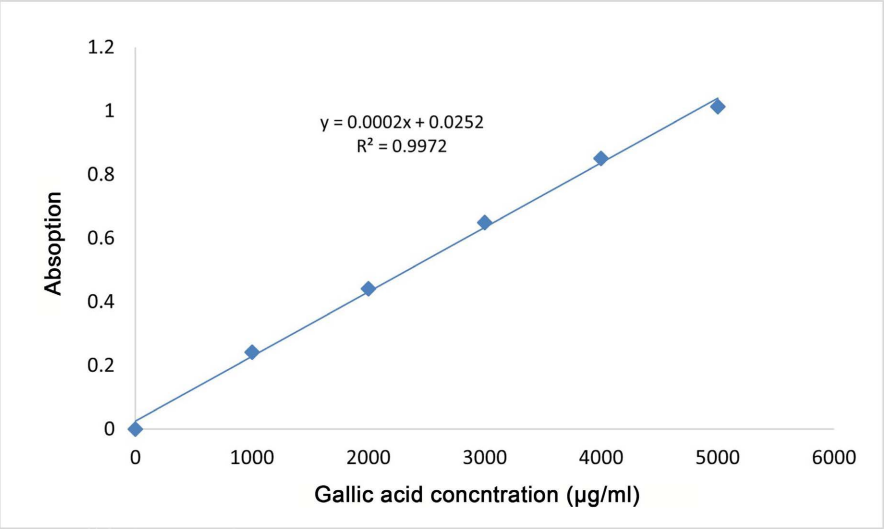

Figure 1. Standard gallic acid solution (µg/ml).

widely employed to investigate the free radical scavenging properties of plant extracts owing to its sensitivity, simplicity, expediency, and extensive availability in chemical laboratories. Antioxidants possess the capability to attenuate radical species through the mechanism of hydrogen donation, resulting in a decrease in DPPH absorbance quantified at 515 nm. The IC50 value denotes the concentration of the sample at which the percentage of inhibition reaches 50%. Consequently, IC50 values demonstrate an inverse correlation with antioxidant activity; a reduced IC50 value indicates an improved antioxidant efficacy of the sample under evaluation. Table (2) illustrates the DPPH radical scavenging activity of methanolic extract of Gum Arabic (GA). The IC_{50} value for the extract of was determined to be 4461.05 µg/ml (**Figure 2**), indicating significant antioxidant properties. This observed activity may be attributed to the presence of phenolic compounds. In comparison, the IC_{50} value for the standard reference ascorbic acid was recorded at 4163.30 µg/ml (**Figure 3**).

Previous studies on antioxidants of the Gum Arabic extract using different solvents are aligned with the present study's results, including that the methanol extract showed a high level of antioxidants, where the maximum DPPH value was seen in methanol fraction (MF) at 235.34 ± 1.51 mg TE/100 g DW for Gum Arabic (GA) in contrast to acetone fraction (AF) at 234.85 ± 1.57 mg TE/100 g DW [36], Additionally, in another study, The IC_{50} value for the extract of (ASG) was determined to be 71.7 ± 0.3 mg TE/100 g DW [37], this shows no significant differences. Since there is no enough data related to DPPH values of crude gum extract and gum fractionations, therefore, it was proposed that gum methanol crude extract and gum fractions could have anti-radical scavenging activity [38]. Thus, more studies are urgently needed regarding antioxidant assays in Gum Arabic (GA).

Table 2 illustrates the dose-dependent increase in antioxidants activity, with the highest percentage of antioxidants observed at 5000 µg/ml and least percentage at 1000 µg/ml.

Table 2. DPPH radical scavenging activity of methanolic extract of Gum Arabic (GA) and ascorbic acid.

Concentration µg/ml	DHPP	Control Abs	Sample Abs	RSA% Sample	RSA% Control
5000	0.741	0.311	0.329	55.57	58.16
4000	0.619	0.304	0.336	45.77	50.86
3000	0.425	0.278	0.284	33.31	34.62
2000	0.295	0.219	0.24	20.47	25.61
1000	0.125	0.110	0.114	12.48	11.98
IC_{50} (µg/ml)				4461.05	4163.30

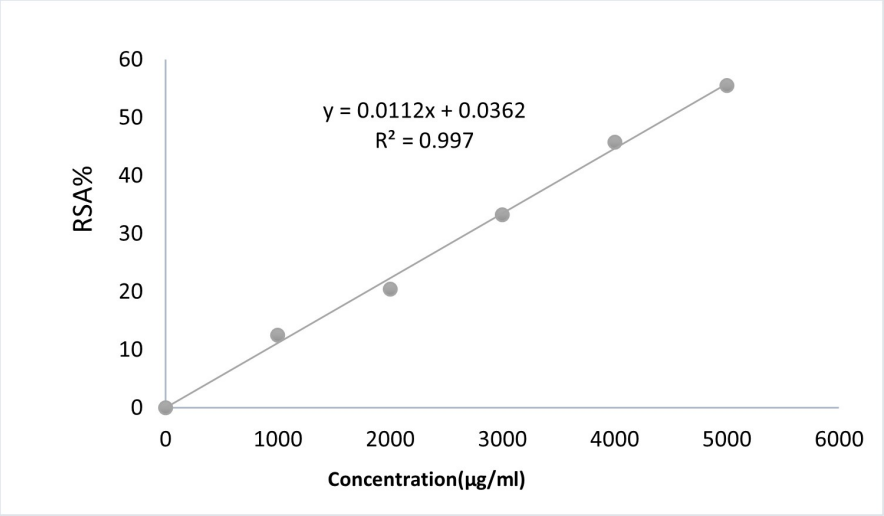

Figure 2. DPPH scavenging activity of methanolic extract of Gum Arabic (GA).

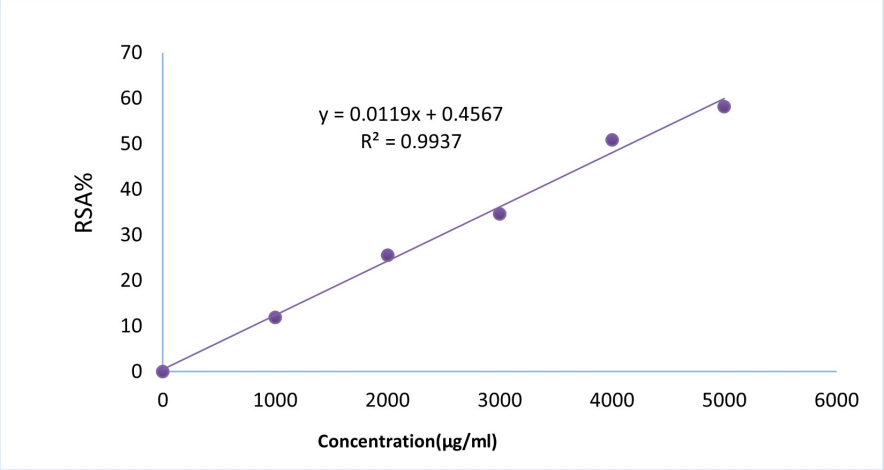

Figure 3. DPPH scavenging activity of ascorbic acid.

3.4. Antibacterial Studies

The antibacterial Concentrations were tested on the six species of bacteria includ-

ing: (*Staphylococcus aureus*, *Streptococcus spp*, *Escherichia coli*, *Klebsiella spp*, *Psuedomones spp* and *Protues spp*) the extract was under a variable concentration (5000, 4000, 3000, 2000, 1000 µg/ml). At the concentration of 1000 µg/ml, the extract showed a positive effect on the two types of bacteria and was (*Staphylococcus aureus*, *Streptococcus spp*). In a concentration of 2000 µg/ml, it showed a positive effect on four types of bacteria and was (*Staphylococcus aureus*, *Streptococcus spp*, *Escherichia coli*, *Klebsiella spp*). In a concentration of 3000 µg/ml, the extract showed a highly positive effect on all types of bacteria. As for a concentration of 4000 and 5000 µg/ml, they showed the highest positive effect on all types of bacteria. The obtained results were consistent with the results obtained by researchers in the reference [39]. Through our study,we noticed that the higher the concentration of the extract, the stronger its effect on bacteria.

It is known that gum Arabic (GA) encompasses Crypton and Hydroquinone, which possess notable antibacterial and antifungal properties [40]. Additionally, long-chain unsaturated fatty acids (LCUFAs), exemplified by triacetic acid lactone present in gum Arabic (GA), also demonstrate pronounced antibacterial efficacy and are regarded as vital constituents of antimicrobial agents, food additives, and certain antibacterial functionalities [41]. Furthermore, Calder [42] has documented a comparable examination regarding these compounds as anti-inflammatory agents. Consequently, the existence of such bioactive compounds within the gum Arabic solvents is deemed to be of paramount significance in daily pharmacological practices. Hence, the reassessment of gum Arabic (GA) as both a food additive and an emulsifying agent is of exceptional importance.

Table 3. Antibacterial Activities of methanolic extract of Gum Arabic (GA).

Concentration µg/ml	*Staph. aureus*		*Streptococcus spp*		*E. coli*		*Klebsiella spp*		*Pseudomonas spp*		*Protues spp*	
	A*	%	A*	%	A*	%	A*	%	A*	%	A*	**%**
5000	++	50	++	40	+	30	+	35	++	55	+	**35**
4000	++	45	++	45	+	25	+	30	++	40	+	**25**
3000	++	40	++	40	+	25	+	20	++	40	+	**20**
2000	+	30	+	30	+	20	+	25	-	30	-	**20**
1000	+	25	+	20	-	5	-	5	-	10	-	**10**

Percentage of Inhibition: Below 20% = (-) low active, 20% - 40% = (+) Active, 40% - 60% = (++) mildly active & 60% - 80% = (+++) moderately active, (80%, up) = (++++) highly active, *Activity.

Table 3 illustrates the dose-dependent increase in antibacterialactivity, with the highest inhibition observed at 5000 µg/ml and least inhibition at 1000 µg/ml.

4. Conclusion

Gum Arabic (GA) constitutes a significant medicinal resource that has historically been employed in various therapeutic applications. It displays pharmacological characteristics comparable to those of a prominent succulent, aromatic perennial

herb. In addition, the (GA) exhibited remarkable antioxidant and antimicrobial characteristics. The present study underscores the prospective utilization of GA extracts as a source of antioxidants. Moreover, it intends to evaluate the total phenolic content present in the (GA) and its antibacterial properties. The phenolic concentration was determined to lie within the range of 1079 - 4944 mg GAE/g of extract. The assessment of antioxidant activity was performed utilizing the DPPH assay methodology. The IC_{50} value was established to be 4461.05 μg/ml.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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