

Evaluation for Phytochemicals, Total Phenolic Content, Antibacterial and Antioxidant Activities Determination for the Plant *Phaseolus Vulgaris*

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ARTICLE INFO

Received: 📅 August 12, 2024

Published: 📅 August 23, 2024

Citation: Lim Woei Xuan, Nabila Perveen and Naeem Hasan Khan. Evaluation for Phytochemicals, Total Phenolic Content, Antibacterial and Antioxidant Activities Determination for the Plant *Phaseolus Vulgaris*. Biomed J Sci & Tech Res 58(3)-2024. BJSTR. MS.ID.009144.

ABSTRACT

Objectives: To evaluate the phytochemical constituents, antibacterial, and antioxidant activity of *Phaseolus Vulgaris* by using maceration technique.

Method: Preparation of the *Phaseolus Vulgaris* extract was carried out by using maceration technique and absolute ethanol. Phytochemical screening for the plant was carried out. Antibacterial activity of *Phaseolus Vulgaris* was done by facilitating Well Diffusion method by comparing the clear inhibition zone of antibiotic (Ciprofloxacin), with the plant extract on Mullen-Hilton agar. Antioxidant activity of *Phaseolus Vulgaris* was done by using DPPH radical- scavenging activity.

Result: The phytochemicals screening of *Phaseolus Vulgaris* revealed the presence of terpenoids, tannins, flavonoids, and carbohydrates. For antibacterial activity of *Phaseolus Vulgaris*, the plant has showed no zone of inhibition against *Escherichia coli*, *Bacillus subtilis*, and *Staphylococcus epidermidis*. Besides this, for antioxidant activity, the plant has shown antioxidant activity on DPPH scavenging test.

Conclusion: After conducting this research, it can be concluded that more diverse research on *Phaseolus Vulgaris* is much needed to identify its pharmacological uses, to develop a contemporary drug.

Keywords: *Phaseolus Vulgaris*; Antibacterial; Antioxidant; Phytochemicals; Ciprofloxacin

Introduction

Phaseolus Vulgaris, also known as common bean, is one of the most versatile and widely cultivated plants, playing a crucial role in nutrition in humans. Due to its widespread consumption across the world, such as Myanmar, India, Brazil, Mexico, China, and Tanzania, researchers decided to carry out various studies as they believed that *Phaseolus Vulgaris* comprised of numerous benefits. The impressive genetic variation of *Phaseolus vulgaris* includes numerous types with differences in size, shape, color, and growth patterns. This variety enhances its ability to thrive in various environments and resist different biological and environmental pressures. Recognizing the genetic and phenotypic differences between various types of beans is essential

for breeding projects focused on enhancing productivity, resistance to diseases, and nutritional value. The objectives of this research study are threefold, firstly, to identify the phytochemical constituents present in *Phaseolus Vulgaris*; secondly, to investigate the antibacterial activity of the plant; and lastly, to access the antioxidant activity of *Phaseolus Vulgaris*. From antioxidants that combat oxidative stress to phytochemicals with potential health benefits and antibacterial properties that help maintain microbial balance, common bean emerges not just as a source of nourishment but as botanical allies in the quest for comprehensive well-being. Through an extensive analysis encompassing these aspects, this research imparts intuition that will aid in the development of new drug by using *Phaseolus Vulgaris* plant.

Figure 1 shows the plant part used for present research [1-5].



Figure 1: *Phaseolus Vulgaris* plant material used for present research.

Plant Profile of *Phaseolus Vulgaris*

Phaseolus Vulgaris (common bean) is widely known for its versatility and nutritional value. The Figure 1 shows the plant material used for present research and Table 1 shows the taxonomy classification of *Phaseolus Vulgaris*, respectively. According to the morphology of *Phaseolus Vulgaris*, this plant has exhibited various benefits in different parts of the plant. The leaves of the plant can be used in salad, soup, and stew consumption. Besides this, the stalk of the plant can be used as fodder when the beans are harvested. The pods of the plant contain antioxidant and phytochemical properties, which contribute to human health benefits. Also, these two properties also contributed to the color of the plant. For example, dark red kidney bean contains flavonoids, and for light red kidney bean, it contains anthocyanins. *Phaseolus Vulgaris* is a crucial nutritional resource with consequential health benefits attributed to its phytochemical constituents. The antibacterial and antioxidant properties of this plant significantly feature its therapeutic applications [6-12].

Table 1: Taxonomy classification of *Phaseolus Vulgaris*.

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Fabales
Family	Fabaceae
Genus	Phaseolus
Species	Phaseolus Vulgaris

Problem Statement

Phaseolus vulgaris, commonly known as the common or French beans, is a staple food crop with significant nutritional value. Despite its widespread use, there is a lack of comprehensive studies evaluating its phytochemical profile, antibacterial, and antioxidant activities. This gap in research limits the understanding of its full potential as a medicinal and nutritional resource. The objective of this thesis is to systematically evaluate the phytochemicals present in *Phaseolus vulgaris* and determine its antibacterial and antioxidant properties, providing insights that could enhance its utilization in health and nutrition applications.

Aim and Objectives

The objectives were designated to:

- i) Perform phytochemical screening of *Phaseolus Vulgaris*.
- ii) Identify the antibacterial activity of *Phaseolus Vulgaris*.
- iii) Antioxidant activity determination of *Phaseolus Vulgaris*.

Materials and Methods

The plant *Phaseolus Vulgaris* was obtained from a local fresh market. The plant was washed with distilled water to remove dirt. The total weight of the *Phaseolus Vulgaris* was measured and recorded. The plant was kept in an air-tight bag and placed inside the refrigerator to prevent any microbial contamination [13,14].

Preparation of *Phaseolus Vulgaris* Extract

Phaseolus Vulgaris, 95% Ethanol, Acetone Before proceeding to the extraction maceration process of *Phaseolus Vulgaris*, the plant was

cut into the smaller pieces. The pieces of the plant were washed again with distilled water [15-19].

Maceration Process

The extraction of *Phaseolus Vulgaris* was done by maceration process. The cut pieces were placed in conical flask and 95% ethanol was

poured until the level of the plant was fully immersed in ethanol. All of the conical flasks are covered with cotton wool and aluminum foil. Then, the conical flasks are then placed on the shaker for 7 days. Figure 2 shows the conical flasks filled with *Phaseolus Vulgaris* placed on the shaker.



Figure 2: Conical flasks filled with *Phaseolus Vulgaris* placed on the shaker.

After 7 days of continuous mechanical shaking, the extract content was collected and filtered through filter funnel and muslin cloth. The contents were collected in 1L beaker [20-29].

Evaporation

This is to remove solvent in order to concentrate the extract, which is ethanol, in the content. The following steps is the process of facilitating the evaporator:

- i) The round bottom flask was washed with acetone.
- ii) Ethanol was prepared and poured into the washed flask.
- iii) The content from the beaker was poured into round bottom flask.
- iv) The flasks are then fixed to the rotatory evaporator by screws.

v) The flask which is filled with extract content was adjusted into the position where the flask was 75% immersed in water.

vi) The rotatory evaporator is then turned on and rotate at 120 round per minute (rpm) and at 50 °C. Figures 3 & 4 shows the rotatory evaporator.

vii) When no further changes occurred, the extract was removed from the flask and transferred into the China dish.

viii) The China dishes are then placed on the water bath at 60 °C for further evaporation process.

ix) After 5 days, the extract became concentrated and in solid form. The evaporating dishes are then covered with aluminum foil and kept in the refrigerator for any further phytochemical screening, antibacterial and antioxidant activity.



Figure 3: Mullen Hilton Agar medium in sterile bottles.

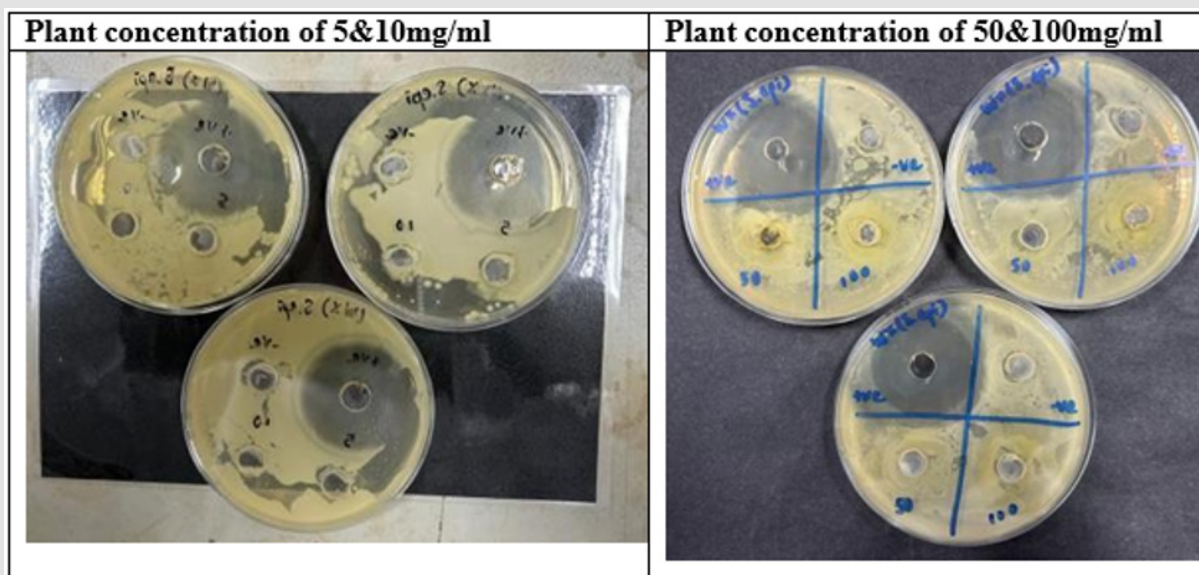


Figure 4.

Phytochemical Screening

The following chemicals were used for the phytochemical analysis.

- 2.0% Sulphuric acid,
- Dragendorff's reagent Fehling's A and B solutions, Chloroform
- 10% Hydrochloric acid

- 10% NH_3
- 0.2M Sodium hydroxide solution Ferric chloride
- Molisch's reagent

Antibacterial Analysis of Phaseolus Vulgaris

- *Phaseolus Vulgaris* extract
- Sterile distilled water

- 70% ethanol
- Nutrient agar medium
- Nutrient broth medium.

Preparation of Nutrient Agar Medium:

- 38g of Mullen Hilton agar powder was mixed with 1L of sterile distilled water in a 1L beaker. The mixture was stirred well thoroughly.
- The mixture was then poured into two 500ml sterile bottles carefully labelled.
- The bottles are then sent to autoclaved for two hours.
- After autoclaving, the sterile bottles were then allowed to cooled down by allowing cool tap water to run on the surface of the bottles and kept in the refrigerator at 6 °C as shown in Figure 3.

Preparation of Petri Plates:

- The laminar airflow was turned on and the petri plates are then placed inside the laminar.
- The solution was poured into the petri plates slowly until the level of half of the plates.
- The solution in the petri plates were allowed to solidify at room temperature.
- After solidification, the lid of the plates placed over. Any water vapor formed at the inner surface of the plates are wiped with clean tissue to prevent any microbial contamination.

Preparation of Nutrient Broth Medium:

- 13g of powdered nutrient broth medium was mixed with 250ml of distilled water.

The mixture was then stirred well with glass rod and poured into the 250ml bottle.

- The bottle which contains the mixture was then being sent to autoclave for 2 hours.

- At the same time, three universal bottles, micropipette tips, and cork-borer was also being sent to autoclave along with the mixture bottle.

- After autoclave, the mixture was poured carefully into the universal bottles until about $\frac{3}{4}$ of the bottle.

Preparation of Bacterial Strains:

- Escherichia coli*, *Bacillus subtilis*, and *Staphylococcus epidermidis* were obtained from the microbial culture bank, Faculty of Pharmacy, AIMST University.

- The bacterial strains were inoculated into the universal bottle containing sterile nutrient broth by using sterile inoculating loop. This process was carried out in laminar airflow.
- The nutrient broth was then incubated for 24 hours at 37 °C.

Preparation of Ciprofloxacin Antibiotic Solution: Standard antibiotic stock solution was prepared by dissolving 10mg of ciprofloxacin in 10ml distilled water in a beaker, making a concentration of 1mg/ml.

Preparation of Extract Solution by Dilution:

- The stock solution of the extract was done by dissolving 100mg of the extract in 100ml of distilled water, making a concentration of 1mg/ml of stock solution.
- Concentration of 5mg/ml, 10mg/ml, 50mg/ml, and 100mg/ml of extract solution was done from the stock solution by dilution method.
- All of the solutions were poured into the volumetric flask respectively and labelled accordingly.

Determination of Antibacterial Activity Using Well-Diffusion Method

- 2 agar plates are used for each bacterial strain, and the test was done in triplicate (total 6 plates for each strain).
- At each plate, divide it into four portions by using a marker pen, which were positive control (ciprofloxacin), negative control (distilled water), and 2 different concentrations of the extract.
- The test was done in laminar airflow.
- 0.1ml tested bacterial strains are measured by using micropipette, and inoculated onto the surface of the agar plate.
- The bacterial strain was then spread onto the surface of the agar plate by using sterile L- shaped spreader.
- After spreading, each region of the agar plates was punched to make holes by using sterile cork borer.
- After the holes were done, by using sterile micropipette, place 0.1ml of ciprofloxacin solution into the well of the positive control region, 0.1ml of distilled water into the well of the negative control region, and 0.1ml each of two different concentrations into the well of the concentration regions.
- This process was repeated triplicate for each bacterial strain.
- The agar plates were then stored in the incubator at 37 °C for 24 hours.
- The zone of inhibition of all plates was observed and mea-

sured by using a ruler, and the mean readings are calculated to identify the antibacterial activity of the plant.

Antioxidant Activity of Phaseolus Vulgaris

- *Phaseolus Vulgaris* extract,
- 2,2-diphenyl-1-picrylhydrazyl (DPPH) Ascorbic acid
- Ethanol.

Preparation of Different Concentrations of Phaseolus Vulgaris Extract

- Six different concentrations of the extract were prepared in 0.3, 0.6, 1.2, 1.8, 2.4, 3.0 mg/ml in dilution method.
- A stock solution of 3mg/ml was prepared by dissolving 300mg of the extract in 100ml of ethanol.
- From the stock solution, pipetted out 10ml, 8ml, 6ml, 4ml, 2ml, and 1ml into the volumetric flask, and make up to 10ml volume by ethanol. By doing so, 0.3, 0.6, 1.2, 1.8, 2.4, 3.0mg/ml was produced respectively.

Preparation of Different Concentration of Ascorbic Acid

- Ascorbic acid was used as standard for this assay.
- Six different concentrations were prepared in 0.3, 0.6, 1.2, 1.8, 2.4, 3.0mg/ml in dilution method.
- A stock solution of 3mg/ml was prepared by dissolving 300mg of the extract in 100ml of ethanol.
- From the stock solution, pipette out 10ml, 8ml, 6ml, 4ml, 2ml, and 1ml into the volumetric flask, and make up to 10ml volume by ethanol. By doing so, 0.3, 0.6, 1.2, 1.8, 2.4, 3.0mg/ml was produced respectively.

Preparation of DPPH Solution, Blank Solution and Control Solution

- Ethanol was selected as blank solution.
- The control solution was prepared by mixing 2.5ml of ethanol with 1ml of DPPH in test tube.
- 11.83mg of DPPH was mixed with 100ml of ethanol and stirred thoroughly.

DPPH Antioxidant Test

- Prepare 12 test tubes, 6 for extract, and another 6 for ascorbic acid.
- For extract, pipetted 2.5ml of extract into the test tube, and 1ml of DPPH was also pipetted into the test tube. This was done for another 5 test tubes.
- For standard, pipetted 2.5ml of ascorbic acid into the test tube, and 1ml of DPPH was pipetted as well into the test tube. This

was done for another 5 test tubes.

- All of the test tubes were wrapped fully with aluminum foil and allowed to incubate for 30 minutes.
- The absorbance values of both standard solution and extract solution were measured at wavelength=517nm at UV spectrophotometer, and the values were recorded at a table.

Total Phenolic Test

- *Phaseolus Vulgaris* extract Ethanol
- Gallic acid Sodium carbonate Distilled water
- Folin-Ciocalteu reagent.

Preparation of Stock Solution of the Plant Extract and Gallic Acid

- Prepare a stock solution of 1mg/ml by dissolving 300mg of plant extract with 100ml of ethanol. Only one concentration of the extract was prepared for this test.
- For gallic acid, prepare a stock solution of 1mg/ml by dissolving 100mg of gallic acid with 100ml of ethanol.

Preparation of Different Concentration of Gallic Acid

- Gallic acid was used as standard for this assay.
- Six different concentrations of gallic acid solutions were prepared, which 0.3, 0.6, 1.2, 1.8, 2.4, 3.0mg/ml. The concentrations were prepared with serial dilution method.
- From the prepared gallic acid solution, pipette 10, 8, 6, 4, 2, 1 ml out into 10ml volumetric flask respectively, and make up to 10ml volume by ethanol.

Preparation of 2.5% Sodium Carbonate Solution

2.5% sodium carbonate solution, dissolve 2.5g of sodium carbonate with 100ml distilled water.

Total Phenolic Content Test

- 1ml of extract was pipetted into a test tube by using micropipette. Then, added 1ml of Folin-Ciocalteu agent, and 2ml of 2.5% sodium carbonate solution into that test tube.
- For the gallic acid solution, prepare another 6 test tubes, where each containing 1ml of different concentrations of the gallic acid solution. Then, added 1ml of Folin-Ciocalteu agent, and 2ml of 2.5% sodium carbonate solution into each test tubes.
- For control solution, add 1ml of ethanol, 1ml of Folin-Ciocalteu agent and 2ml of 2.5% sodium carbonate solution.
- 3ml of ethanol was added to another new test tube to act as blank solution.

- v) All of the test tubes containing solutions were allowed to stand for 2 hours.
- vi) The absorbance values of both standard solution, extract solution was measured at wavelength=760nm at UV spectrophotometer, and the values were recorded.

Results

Phytochemical Screening of *Phaseolus Vulgaris* In Ethanol Extract

Results of phytochemical screening of *Phaseolus Vulgaris* extract is shown in Table 2.

Table 2: Results of phytochemical screening of *Phaseolus Vulgaris* extract.

S. No.	Analysis Test	Screening	Result
1	Test for alkaloids		Negative
2	Test for reducing sugars	-	Negative
3	Test for saponins	-	Negative
4	Test for terpenoids	+	Positive
5	Test for anthraquinones	-	Negative
6	Test for glycosides	-	Negative
7	Test for tannins	+	Positive
8	Test for flavonoids	+	Positive
9	Test for carbohydrates	+	Positive

Antioxidant Activity of *Phaseolus Vulgaris*

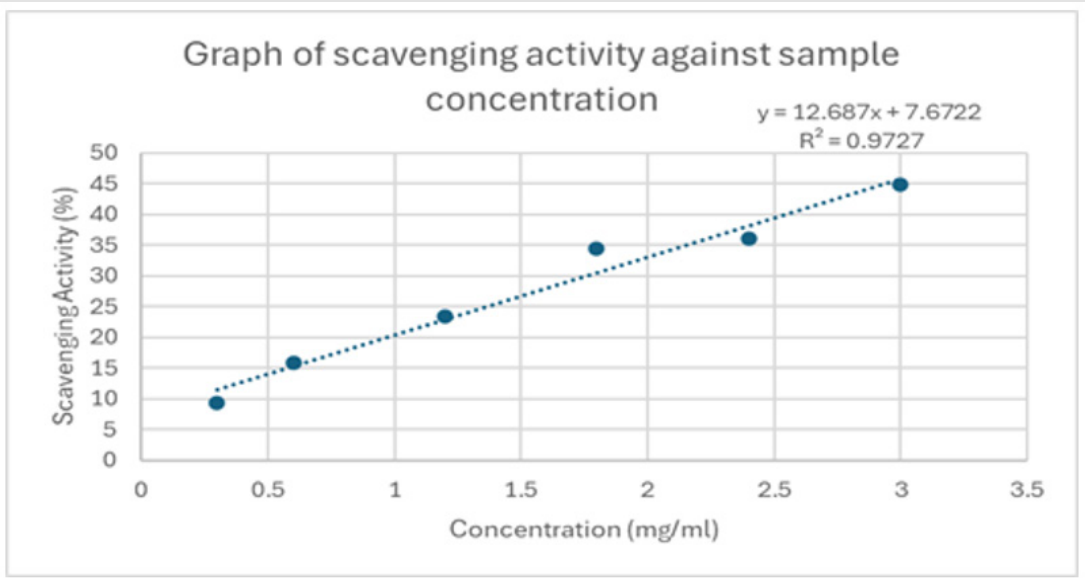
DPPH Scavenging Assay of *Phaseolus Vulgaris* Extract: Table 3 shows the DPPH scavenging assay of *Phaseolus Vulgaris* extract and DPPH scavenging activity of ascorbic acid is given in Table 4 respectively. Scavenging activity of *Phaseolus Vulgaris* extract against sample concentration is shown in Graph 1 and scavenging activity of ascorbic acid against standard concentration is given in Graph 2, respectively.

Table 3: DPPH scavenging assay of *Phaseolus Vulgaris* extract.

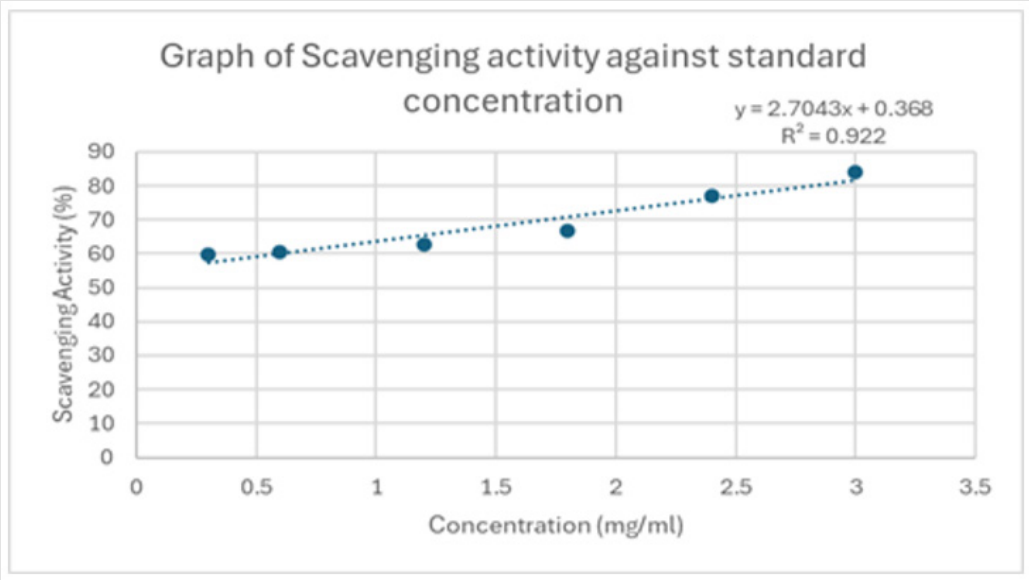
Concentration (mg/ml)
0.3
0.6
1.2
1.8
2.4
3.0

Table 4: DPPH scavenging activity of ascorbic acid.

Concentration (mg/ml)	Absorbance (WL517)	Scavenging activity (%)
0.3	0.616	59.92
0.6	0.605	60.64
1.2	0.572	62.79
1.8	0.513	66.62
2.4	0.351	77.16
3.0	0.248	83.86



Graph 1: Scavenging activity of *Phaseolus Vulgaris* extract against sample concentration.



Graph 2: Scavenging activity of ascorbic acid against standard concentration.

IC₅₀ of Antioxidant Activity of *Phaseolus Vulgaris* Extract

$y = 12.687x + 7.6722$
 $50 = 12.687x + 7.6722$
 $12.687x + 7.6722 = 50$
 $12.687x = 50 - 7.6722$
 $12.687x = 42.3278$
 $x = 3.34 \text{ mg/ml}$

IC₅₀ of Antioxidant Activity of Ascorbic Acid

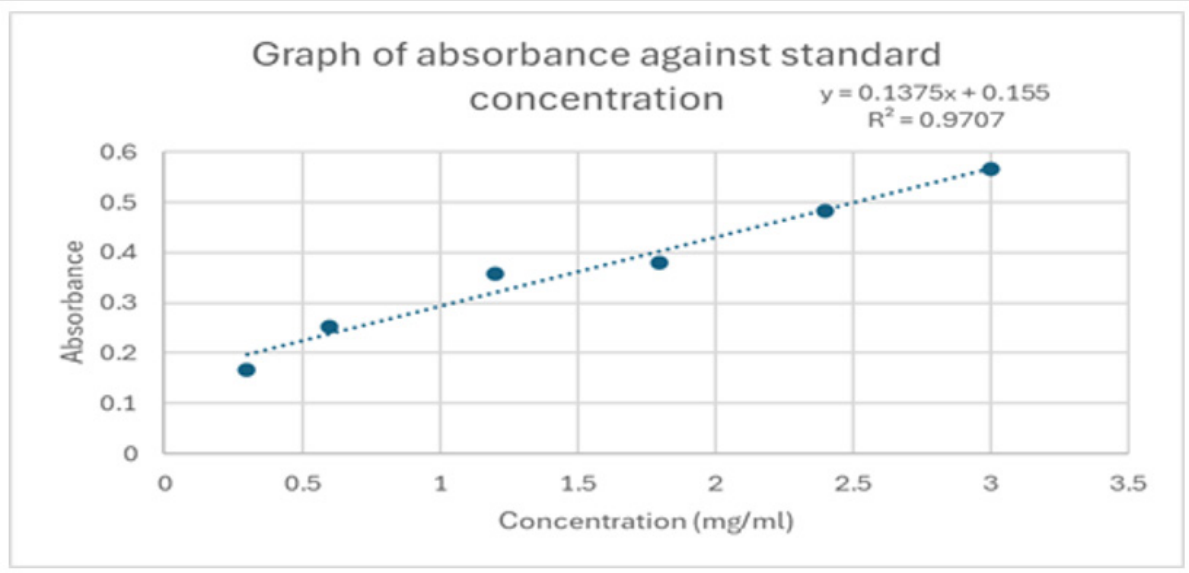
$y = 2.7043x + 0.368$
 $50 = 2.7043x + 0.368$
 $2.7043x + 0.368 = 50$
 $2.7043x = 50 - 0.368$
 $2.7043x = 49.632$
 $x = 18.35 \text{ mg/ml}$

Total Phenolic Content Test

Absorbance value of different concentration of gallic acid is laid down in Table 5 and Graph 3 shows the absorbance against gallic acid concentration, respectively.

Table 5: Absorbance value of different concentration of gallic acid.

Concentration (mg/ml)	Absorbance (WL760)	
	Plant extract	Gallic acid
0.3	0.226	0.167
0.6	0.226	0.253
1.2	0.226	0.359
1.8	0.226	0.380
2.4	0.226	0.483
3.0	0.226	0.567



Graph 3: Absorbance against gallic acid concentration.

Gallic Acid Equivalent Calculation

$y=0.1375x+0.155$
 $0.226=0.1375x+0.155$
 $0.1375x+0.155=0.226$
 $0.1375x=0.226-0.155$
 $x=0.516\text{mg/ml}$
 $C= (c\times V)/m$
 $= (0.516\times 10)/0.3$
 $=17.2\text{mg/g}$

Antibacterial Activity Of *Phaseolus Vulgaris* Extract

Escherichia Coli

No zone of inhibition was observed in each concentration of the plant extract.

Bacillus Subtilis

No zone of inhibition was observed in each concentration of the plant extract.

Staphylococcus Epidermidis

No zone of inhibition was observed in each concentration of the plant extract (Figures 5 & 6) (Table 6).

Table 6.

Microorganism	Concentration of plant extract (mg/ml)	Zone of inhibition observed (diameter in mm)	Ciprofloxacin (diameter in mm)	Sterile distilled water (diameter in mm)
<i>Escherichia coli</i>	5	-	50	-
	10	-	53	-
	50	-	52	-
	100	-	55	-
<i>Bacillus subtilis</i>	5	-	49	-
	10	-	53	-
	50	-	54	-
	100	-	51	-
<i>Staphylococcus epidermidis</i>	5	-	55	-
	10	-	54	-
	50	-	52	-
	100	-	56	-

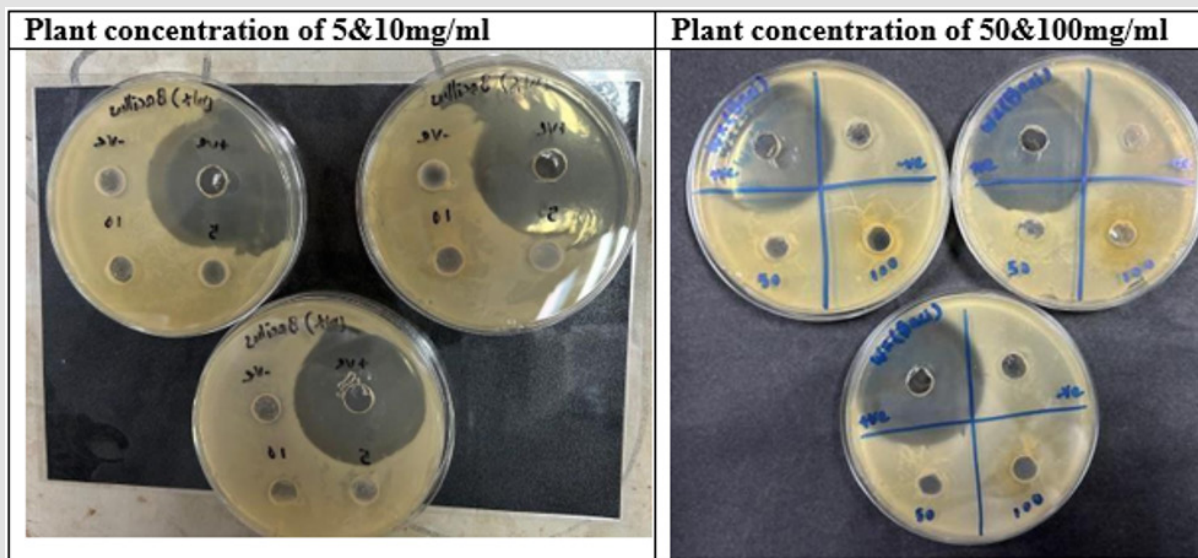


Figure 5.

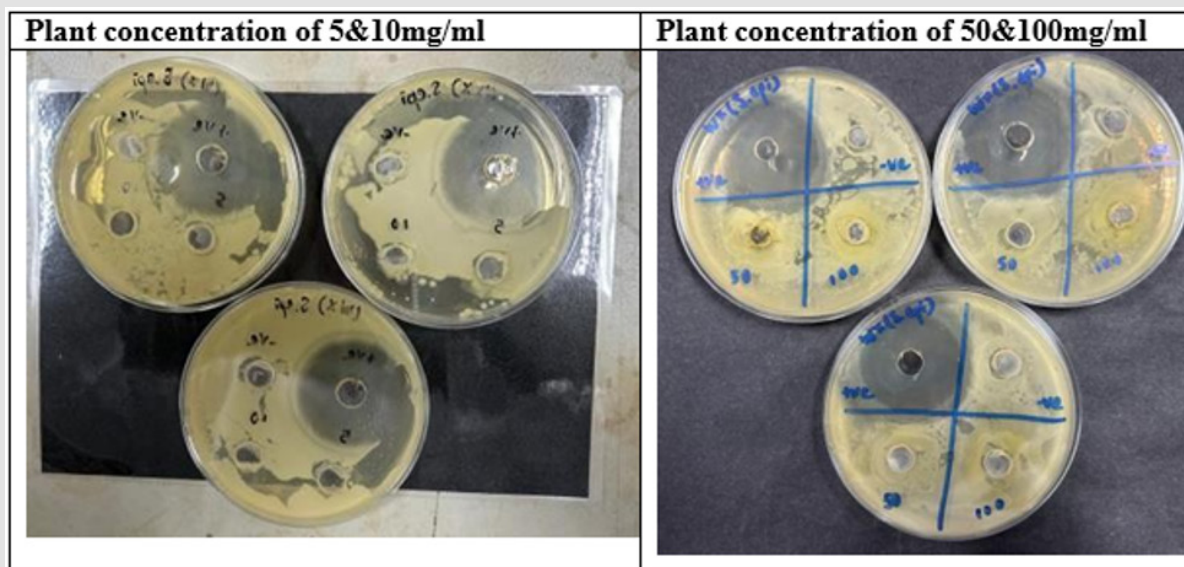


Figure 6.

Discussion

The primary aim of this thesis was to evaluate the phytochemical composition, antioxidant, and antibacterial properties and activities of the plant *Phaseolus Vulgaris*. The readings obtained from this comprehensive analysis consist of noteworthy implications of the scientific community and the context of public health. In this research, phytochemical screening of the plant *Phaseolus Vulgaris* was the initial step conducted to identify the presence of any phytochemicals present in

this plant. In a general point of view, phytochemicals can be defined as a natural bioactive compound found in plant foods which consists of nutrients that bring benefits to human health. Many researchers have investigated the mechanism of action of the chemicals, which then found out that phytochemicals did exhibit therapeutic effects which are beneficial to our human health. Later, phytochemicals were classified into several groups, which are carotenoids (beta carotene, lycopene), Phenolic compounds (phenolic acid, flavonoids, anthra-

quinone, tannins, isoflavones), and others (alkaloids, organosulfur compounds). In this research, these phytochemicals were investigated through standard quantitative analysis methods. Before the phytochemical screening of the plant *Phaseolus Vulgaris* was carried out, extraction of this plant was done before hand. The method of extraction in this research was maceration.

Ethanol was used as the solvent to extract the plant. The extraction process took around 1 to 2 weeks to be done. The phytochemicals identified in *Phaseolus Vulgaris* extract by using quantitative analysis method were terpenoids, tannins and carbohydrates. Terpenoid, which is also known as isoprenoids, is a type of secondary metabolite which can be found in numerous plant foods. It is made up of five carbon isoprene units linked together, an oxidized methyl group and other various functional groups. Depending on the number of carbon units, terpenoids can be classified as monoterpenoids (2 isoprene units), sesquiterpenoids (3 isoprene units), diterpenoids (4 isoprene units), triterpenoids (6 isoprene units), tetraterpenoids (8 isoprene units), and polyterpenoids (more than 8 isoprene units). Despite its structural differences, terpenoids are being used to treat a wide range of ailments in human health. According to the studies, terpenoids contribute to fragrance and flavor in products such as cosmetics and perfumes. In medical treatment, it is used as a topical agent as actinic keratosis. Tannin belongs to the family of phenolic compounds. It can be classified into condensed tannins, complex tannins, ellagitannins and gallotannins. Condensed tannins consist of a linkage between C4 of a catechin and C6 of another catechin.

Complex tannins are where a catechin unit is linked to a gallotanin or ellagitannin. Ellagitannins consists of two galloyl units and it does not contain any glycosidic linkage. Lastly, gallotannins consists of galloyl units which bound to catechin or triterpenoid units. Tannins are widely used in clarifying beer and wine, and act as dye mordant, and astringents. Carbohydrates are naturally occurring compounds, which are made up of carbon, hydrogen, and oxygen. It can be classified into simple and complex carbohydrates. For simple carbohydrates, it consists of monosaccharides (glucose, fructose, and galactose) and disaccharides (maltose, lactose, and sucrose). For complex carbohydrates, it consists of polysaccharides (starch and glycogen). Other phytochemicals such as saponins and anthraquinones were not identified in this phytochemical screening process. This may indicate that these phytochemicals are not present in the plant *Phaseolus Vulgaris*. This diverse phytochemical profile underscores the potential of *Phaseolus vulgaris* as a functional food with multiple health benefits.

Antibacterial susceptibility test refers to the ability of the compound to inhibit the growth of the bacteria. This was conducted to determine the antibacterial resistance and the microorganism sensitivity against the selected antibiotics. This is vital for controlling the bacteria infections and preventing the spread of disease. Antibacterial agents consist of a wide range of functions, such as disrupting synthesis of the cell wall, inhibiting the synthesis of protein, and interfering

with the replication of nucleic acid. In other words, the higher the efficiency of antibacterial agent, the more the bacterial population can be reduced. Due to the emergence of antibacterial resistance, bacteria evolve to withstand the antibiotic effects, giving rise to global health challenges. The global health threat posed by antibiotic resistance underscores the urgency of identifying new and effective antibacterial agents. Antibacterial resistance may be due to overdosage or misuse of the antibiotics, leading to the selection of resistant strains.

Additionally, the antibacterial efficiency of the plant extract may be influenced by factors such as extraction method and geographic origin. Absence of antibacterial activity of the plant *Phaseolus Vulgaris* extract, as identified in this study, emphasizes the demand for substitute techniques to battle against the antibacterial resistance. Further studies should investigate these variables to optimize the extraction and utilization of phytochemicals from *Phaseolus vulgaris*. The antibacterial activity of *Phaseolus Vulgaris* was evaluated against *Escherichia coli*, *Bacillus subtilis*, and *Staphylococcus epidermidis* by using the well diffusion assay. Despite the documented antibacterial properties of *Phaseolus Vulgaris*, this study does not find any significant antibacterial activity against the tested bacterial strains. By using well diffusion assay method, the results shown that the extract of *Phaseolus Vulgaris* does not produce any zone of inhibition at the concentration of 5, 10, 50 and 100 mg/ml. The study concluded that *Phaseolus Vulgaris* is ineffective as an antibacterial agent at inhibiting bacterial growth at these concentrations. Thus, due to this unexpected outcome, further research regarding this topic may be required. By doing so, factors influencing the antibacterial efficiency of the plant extract and to investigate any potential modifications to enhance its antibacterial properties. In overall point of view, this study does not show any significant antibacterial activity of the plant *Phaseolus Vulgaris* extract.

Diverse research is needed to understand the potential of the phytochemicals present in the plant in fighting against the antibiotic-resistant bacteria, ensuring the effective treatment available for the future. For antioxidant activity of the plant *Phaseolus Vulgaris* which was determined through biochemical assays such as DPPH scavenging activity and Total Phenolic Content (TPC) test. These assays determine the plant's ability to neutralize the free radicals and reduce the oxidative stress. DPPH (2,2-diphenyl-1-picrylhydrazyl) scavenging activity method is used due to its simplicity and reproducibility. It is to identify the ability of the free radicals to scavenge for antioxidants. This assay determines the ability of antioxidants to donate hydrogen atoms to neutralize DPPH radicals, which results in a color change from purple to yellow. In this research, it reflects the plant *Phaseolus Vulgaris* extract was able to act as hydrogen donor and neutralize free radicals, which can reduce the oxidative damage to other biomolecules. The identification of antioxidant property of the plant *Phaseolus Vulgaris* was carried out by using a UV spectrometer. It measures the absorbance of light passing through the sample at a certain wavelength. The absorbance obtained from this test can identify the to-

tal phenolic content of the plant. Usually, the absorbance measured at wavelengths where the compound exhibits peak absorption. The greater the absorbance values observed, the higher the concentration of the antioxidant compound.

In this study, the plant extract with a concentration of 10mg/ml showed an absorbance of 0.846, having a color change of the solution from purple to yellow. The findings of significant antioxidant activity in *Phaseolus vulgaris*, related to its high phenolic content and strong DPPH scavenging activity, as well as the validation through UV spectrophotometer analysis, suggest several important implications. Firstly, promoting the consumption of common beans can contribute to better health outcomes by providing natural antioxidants that combat oxidative stress. This can be particularly beneficial in reducing the incidence of chronic diseases. The antioxidant property of the plant *Phaseolus Vulgaris* is closely related to the presence of phenolic compounds in the plant. Studies have investigated that phenolic compounds such as flavonoids act as antioxidants to reduce the oxidative damage to the cells and tissues in our body.

The total phenolic content (TPC) test was conducted to determine the presence and value of phenolic compounds in the plant *Phaseolus Vulgaris*. In this test, Folin-Ciocalteu reagent was used in this test, and this test was conducted to determine the ability of the phenolic compounds of the plant to reduce this agent. A color change can be observed in this test, which is a dark green solution. By using a UV spectrometer, the absorbance can be measured at a wavelength of 760nm. The higher the phenolic content in the plant extract, the higher the absorbance value, which correlates with greater antioxidant activity. This study concluded that *Phaseolus Vulgaris* reinforce its potential as a rich source of natural antioxidants. Further research should focus on isolating and characterizing the specific phenolic compounds responsible for the observed antioxidant activity. Understanding the bioavailability and metabolism of these compounds in the human body is crucial for developing effective dietary recommendations and potential therapeutic applications. Additionally, exploring the genetic diversity of *Phaseolus vulgaris* varieties could help identify those with the highest concentrations of beneficial phenolics, aiding in the development of enhanced bean cultivars. In conclusion, the antioxidant activity of *Phaseolus vulgaris*, closely linked to its total phenolic content, strong DPPH scavenging activity, and confirmed by UV spectrophotometer analysis, highlights the potential health benefits of this common bean. Continued research and promotion of its consumption could play a significant role in improving public health and preventing oxidative stress-related diseases.

Conclusion and Future Perspective

This study comprehensively evaluated the phytochemical constituents, antibacterial, and antioxidant activities of *Phaseolus vulgaris*. The findings highlight the significant presence of phenolic compounds, which are primarily responsible for the observed anti-

oxidant activity. The strong DPPH scavenging activity further underscores the bean's potential in neutralizing free radicals. The use of UV spectrophotometer analysis validated the high antioxidant capacity by quantifying the phenolic content accurately. However, the antibacterial assays yielded negative results, suggesting limited efficacy against multi-drug resistant bacteria. These results suggest that while *Phaseolus vulgaris* holds promise as a potent antioxidant source, its antibacterial properties warrant further investigation. Future research should focus on isolating specific phenolic compounds and exploring their therapeutic potential, as well as improving antibacterial efficacy through advanced extraction techniques or combining with other natural products. The study reaffirms the potential health benefits of *Phaseolus vulgaris*, advocating its inclusion in dietary practices for enhanced antioxidant protection. This thesis underscores the significant antioxidant potential of *Phaseolus vulgaris*, attributed to its high total phenolic content and strong DPPH scavenging activity. Future research should delve deeper into isolating and characterizing individual phenolic compounds responsible for these activities. Additionally, further studies on the genetic diversity of *Phaseolus vulgaris* can identify varieties with enhanced antioxidant properties, contributing to the development of functional foods and nutraceuticals.

Funding Details

The authors are much grateful to the Faculty of Pharmacy, AIMST University, Malaysia for funding and providing all facilities to carry out this research project.

Conflict of Interests

Authors declare that there is no conflict of interests.

Acknowledgment

Thanks to the science officers, Ms. Amalina and Ms. Jaya of MDL 3 and 4 of Faculty of Pharmacy, AIMST University, Malaysia.

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ISSN: 2574-1241

DOI: 10.26717/BJSTR.2024.58.009144

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