Phytochemical Screening, Antioxidant, and Antibacterial Property of *Talisay* (*Terminalia catappa*) Leaves Ethanolic Extract Against *Staphylococcus aureus* Used as Formulated Ointment

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***Abstract*—The study aimed to evaluate the phytochemicals, antioxidant and antibacterial activity of Terminalia catappa leaves ethanolic extract. The extract was evaluated by phytochemical qualitative reactions for plant metabolites. The test was performed for flavonoids, phenols/tannins, and terpenoids for three trials. The color intensity or the precipitate formation was used as responses to these tests. The free radical scavenging activity of the ethanolic extract was quantitatively assessed using the DPPH radical method adopted for spectrophotometry. The antibacterial screening of Talisay extract against *Staphylococcus aureus* used the Kirky-Bauer Disk Diffusion method. Results of phytochemical showed that there is the presence of phenols/tannins, flavonoids and terpenoids based on the qualitative testing conducted on the test samples. Results of percentage DPPH scavenging activity of the ascorbic acid revealed substantially higher antioxidant activity (34.33%±0.6597) when compared to Talisay extract (23.88%±2.9621). Results of the mean diameter zone of inhibition of Talisay showed positive antibacterial activity with a value of 13.3±1.1547. The findings clearly indicated that the plant extract used has potential antioxidant and antibacterial agents. Demonstration of phytochemicals, antioxidant and antibacterial activity of *Terminalia catappa* provides the scientific basis and may help to discover new chemical classes of antioxidant and antibacterial substances that could serve as selective agents against degenerative diseases. This investigation has opened up the possibility of the use of Talisay leaves extract in producing an antioxidant and antibacterial agents that function as an alternative to highly available antioxidant and antibacterial product in drug stores.**

Index Terms*—antibacterial property, antioxidant activity, *Talisay*, *Terminalia catappa

I. Introduction

Research studies have shown that medicinal plants contain various components with antioxidant which fights cancer, arthritis, aging, autoimmune and other several degenerative diseases that are connected to the development of free radicals [1] Free radicals is an imbalance formation of electrons that undergone to the process of oxidative stress which damages proteins, carbohydrates, lipids and DNA in cells [2]. When a cell undergoes an abnormal change or growth and spreads within the body, it is called cancer. This uncontrolled growth of abnormal cells will then turn into tumors that can be classified as benign or malignant [3] Cancer is one of the major health problem around the world. It is ranked as the second most cause of death in many countries following the cardiovascular diseases, however, with the vast improvement of treatment method and preventive ways, cancer will soon be the leading cause of death around the world [4].

Cancer placed third in the leading causes of death in the Philippines next to communicable diseases and cardiovascular diseases respectively [5]. Free radicals and oxidants are both harmful and beneficial compounds for they both have adverse and helpful effect to the body. They are caused by pollution, cigarette smoke, radiation, medication [6]. The demand to the supply for more antioxidants from natural origin is important and have garnered interest among people for its protection against free radicals [7].

On the other hand, skin-related ailments such as rashes, acne, dermatitis, eczema, and psoriasis can be caused by bacteria. Furthermore, studies have shown that the main pathogens that can cause these skin infections are *Staphylococcus aureus* and *Escherichia coli* [8]. In relation to this, tropical ointment containing antibacterial properties have been studied and proven to be useful in preventing and treating this kind of infection-causing bacteria; thus, tropical drugs is now made available in the market. However, various synthetic processes used to make most of the available drugs involve chemicals and may have probable side effects. The several constituents present with the variety of healing properties and the production of more synergistic effect to fight the bacteria is what differentiates the antibiotic drug and herbal antibiotic, making it not only limited to the effect of one chemical [9].

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Terminalia catappa is a large and deciduous tree that has its parts used in traditional medicine [10]. In line with this, one Philippine native medicinal plant of interest to the researchers include Talisay (*Terminalia catappa*). It becomes imperative to know the different metabolites present in Talisay leaves extract, as well as to determine the absorbance, mean percent inhibition and significant difference of *Terminalia catappa* to ascorbic acid as positive control through DPPH radical scavenging activity since there is no known study found about the phytochemicals and antioxidant activity of Talisay in Davao City.

Furthermore, this study aims to address the problem concerning with the degenerative disease like cancer by discovering the phytoconstituents in the natural reservoir and knowing if it inhibits free radicals. Additionally, if the Talisay leaves ethanolic extract is proven effective as antioxidant and antibacterial property, the people will use this as available data in making a low-cost drug as alternative to commercially available drugs and formulated herbal ointment.

II. Methods

A. Research Design

This study used Design of Experiments (DOE). The statistical Design of Experiments (DOE) is a systematic direction for possible experiments so that the statistical data acquired can be analyzed to get rational and objective conclusions. It starts with determining the goal of a study and choosing the process factors for the experiment. Experimental design layouts a detailed plan in advance of doing the experiment [9]. In this paper the experimental design will be of great help in determining the presence of phytochemicals, the antioxidant and antibacterial activity of Talisay leaves.

B. Research Locale

Young leaves of Talisay (*Terminalia catappa*) were collected within the area of Barangay 14-B, Obrero, Davao City on March 14, 2018 from 11:00 to 11:30 a.m. The Talisay leaf was identified and authenticated in San Pedro College by Prof. Elsa May Baron, MS Bio.

C. Research Subjects

Talisay (*Terminalia catappa*) leaves ethanolic extract, the DPPH free radicals solution and *Staphylococcus aureus* were the subjects of the research study.

D. Measures

The statistical data collected were the absorbance, mean percent inhibition of DPPH radical scavenging and antibacterial activity of Talisay leaves extract using the spectrophotometer and agar-disc diffusion method as well as the significant difference of Talisay to the positive and negative controls.

E. Samples Preparation and Extraction

Fig. 1 showed that the leaves of Talisay plant were washed with water, drying was done overnight at room temperature and cut into smaller pieces. The dried leaves were weighed by an electronic weighing scale measuring 100 g and then the small pieces of leaves were extracted using 700 mL ethanol in Erlenmeyer flask for 48 hrs by the plant tissue homogenization method after which undergone filtration. The ethanolic leaves extract was concentrated using rotary evaporator and dry block heater respectively and kept at -20°C until used.

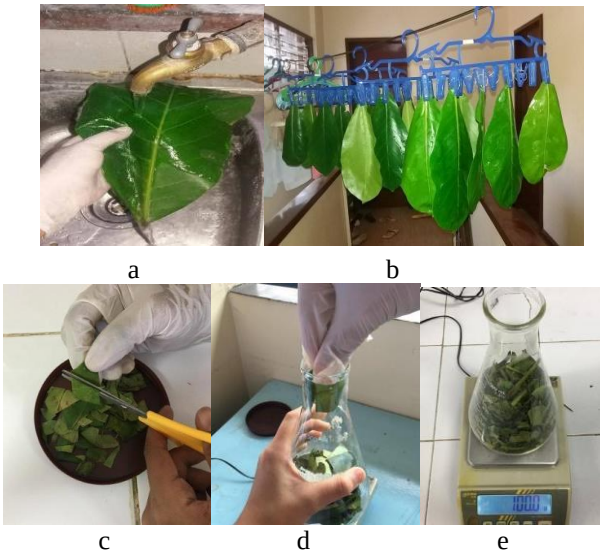

Figure 1. a) Washed with water; b) Drying of leaves; c) Cut into smaller pieces; d) Weighed measuring 100g; e) Extraction.

F. Phytochemical Screening

Fig. 2 displayed that the extract was evaluated by phytochemical qualitative reactions for usual plant metabolites. The screening was performed for flavonoids, tannins, and phenols, and terpenoids for three trials. The color intensity or the precipitate formation was used as analytical responses to these tests.

Figure 2. a) Measuring the leaves extract for 20 µL; b) Mixing plant extract with solution.

1) Test for phenols and tannins

20 µL of extract was mixed with 100 µL of phenols using electronic pipette. The testing was done for three trials. A blue-green or black coloration was the indication for the presence of phenols and tannins.

2) Test for terpenoids

20 µL of extract was mixed with 100 µL of terpenoids using electronic pipette. The testing was done for three trials. A reddish-brown coloration of the interphase was formed to show positive results for the presence of terpenoids.

3) Test for flavonoids

20 μL of extract was mixed with 100 μL of flavonoids using electronic pipette. The testing was done for three trials. Orange, red, pink, or purple coloration was the indication for the presence of flavonoids.

G. Evaluation of the Total Antioxidant Capacity

Fig. 3 showed the free radical scavenging activity of ethanolic extracts, was quantitatively assessed using the DPPH radical method adopted for spectrophotometry. Extracts that exhibited strong antioxidant activity was further pursued to quantify their antioxidant capacity using the DPPH method. Briefly, a 0.1 Mm solution of DPPH in ethanol was prepared and 150 μL of this solution was added to 20 μl of sample for three trials as well as the ascorbic acid and the negative control which is ethanol. After 20 minutes the absorbance was measured at 525 nm.

Figure 3. Determining the absorbance of the extract using UV-Vis spectrophotometer.

H. Antibacterial Activity against Staphylococcus aureus

1) Preparation of inoculum

Colonies of *Staphylococcus aureus* were inoculated onto 5 mL Mueller-Hinton Broth (MHB) and incubated at 35^0C for 2 hours to allow bacteria to grow. It was also adjusted using 0.5 McFarland standard solution with sterile NSS. These served as the standardized inoculum.

2) Preparation of seeded agar plate

Twenty mL of Mueller-Hinton Agar, MHA, was dispensed into each of sterile petri dishes to a depth of 4 mm and allowed to cool and solidify. A sterile cotton swab was dipped onto the standardized organism (inoculum) suspension, pressed and rotated firmly against the inside of the tube just above the fluid to remove the excess liquid. The entire surface of the solidified agar was swabbed evenly to ensure even and complete distribution of the inoculum. The plates were allowed to dry for 15 minutes. This preparation was done in the biosafety cabinet.

3) Position of paper disks for preliminary screening of antibacterial activity

Twenty microliters of each crude ethanolic extract were dispensed into sterile paper disks with the use of a pipette. The impregnated paper disks were air-dried under for two hours the biosafety hood. Using sterile forceps, the impregnated paper disks were placed in a clockwise order onto the seeded plate at equidistant positions. Tetracycline disk and distilled water were used as positive and negative controls, respectively. The drugs were allowed to diffuse through the agar for 60 minutes. The plates were inverted and incubated for 24 hours at 35^0C . The diameter of the zone of inhibition was measured in millimeter (mm) using a vernier caliper. The assay was done in triplicate and the means were computed.

4) Formulation of *Talisay extract ointment*

Stearyl alcohol and white wax were melted in a suitable evaporating dish on a steam bath. Cholesterol was added and stirred until it liquefied. The white petrolatum was added into the mixture until it liquefied. Heating was discontinued. The mixture was stirred until it began to congeal. Ointment base acts as a vehicle to hold the active ingredients over the site of application on infected area for a certain period.

III. Results

After the results gathered, the following findings were established.

Table I demonstrated that the phytochemical screening of Talisay (*Terminalia catappa*) in three consecutive trials is positive and resulted to the presence of the different metabolites in Talisay and these are phenols/tannins, flavonoids and terpenoids.

Table II reported that the positive control which is ascorbic acid got the lowest absorbance of post treatment with a value of 0.30%±0.0021. Whereas the Talisay leaves ethanolic extract got 0.35%±0.0124 which is much higher compared to the positive control. The blank as the negative control which is ethanol got 0.46 for mean and 0.0015 for standard deviation.

TABLE I. Phytochemical Screening of Talisay Leaf Extract

Metabolites Tested	Trial 1	Trial 2	Trial 3	Description	Interpretation
Phenols/ Tannins	+	+	+	Positive	*Terminalia catappa* is positive in the presence of phenols/tannins since it revealed a blue-green coloration.
Flavonoids	+	+	+	Positive	*Terminalia catappa* is positive in the presence of flavonoids since it revealed a reddish-brown coloration.
Terpenoids	+	+	+	Positive	*Terminalia catappa* is positive in the presence of terpenoids since it revealed an orange coloration.

TABLE II. Antioxidant Activity or the Absorbance of the Samples Using the UV-VIS Spectrophotometer

Test variables	Mean	S.D.	T value	P value	Decision*
Talisay Extract	23.88	2.9621	5.97	0.0040	Significant
Ascorbic Acid	34.33	0.6597			

*Calculation was performed at the 0.05 level of significance.

Table III showed that the mean percent inhibition of Talisay leaves ethanolic extract using DPPH scavenging activity resulted to a mean of 23.88 and 2.9621 for its standard deviation, while the ascorbic acid got a higher percentage compared to Talisay with a mean of 34.33 and 0.6597 for its standard deviation. The results indicated that Talisay leaves ethanolic extract is capable of being an antioxidant agent.

TABLE III. DPPH SCAVENGING ACTIVITY TALISAY ETHANOLIC EXTRACT

	Test Sample	Trial Number			Mean	S.D.
		1	2	3		
DPPH Scavenging Activity	Ascorbic Acid	33.63	34.43	34.93	34.33	0.6597
	Talisay extract	21.98	22.37	27.29	23.88	2.9621

Table IV exhibited that the P value of the test samples is 0.0048 which is less than the 0.05 level of significance; this showed that there is a significant difference between the antioxidant activity of Talisay leaves ethanolic extract and ascorbic acid as positive control. Therefore, the hypothesis is rejected.

TABLE IV. TESTING THE SIGNIFICANT DIFFERENCE OF PERCENTAGE DPPH SCAVENGING ACTIVITY

Test Parameter	Test Sample	Trial Number			Mean	S.D.
		1	2	3		
Absorbance	Blank	0.455	0.456	0.458	0.46	0.0015
	Ascorbic Acid	0.302	0.299	0.298	0.30	0.0021
	Talisay extract	0.355	0.354	0.333	0.35	0.0124

Table V revealed that the antibacterial screening of Talisay extract plant against Staphylococcus *aureus* showed that the Talisay extract moderately inhibited the growth of the microorganism with the grand mean zones of inhibition of 13.3 mm. The highest antimicrobial activity was exhibited by the positive control with grand mean 17.7 mm, however the negative control did not exhibit inhibitory activity with grand mean zone of 6.0. This indicates that Talisay plant extract exhibit antimicrobial activity against Staphylococcus aureus.

TABLE V. ANTIMICROBIAL SCREENING OF TALISAY EXTRACT PLANT EXTRACT AGAINST *STAPHYLOCOCCUS AUREUS*

Treatment	Mean	S.D.	F value	P value	Remarks
Talisay Extract	13.3	1.1547	188.5	0.0001	Significant
Positive Control (Vancomycin 30 g)	17.7	0.5774			
Negative Control	6.0	0			

*Calculation was performed at the 0.05 level of significance)

Table VI illustrated that the one-way analysis of variance on the mean zones of inhibition among treatment showed that there is a significant difference on the mean zones of inhibition of the various treatment against staphylococcus aureus. The results indicated that the different treatment showed different capacity to inhibit the growth of S. aureus.

TABLE VI. ONE-WAY ANALYSIS OF VARIANCE ON THE MEAN ZONES OF INHIBITION AMONG TREATMENT

Test Material	Replicate	Zone of Inhibition in mm	Mean±S.D.	Descriptive interpretation
Talisay Extract	1	14.0	13.3±1.1547	Moderate
	2	12.0		
	3	14.0		
Positive Control (Vancomycin 30 g)	1	18.0	17.7±0.5774	Strong
	2	17.0		
	3	18.0		
Negative Control	1	6.0	6.0±0	Negative

Table VII determined which treatment is more effective in terms of inhibiting the growth of *S. aureus*, the test LSD was done. The results confirm the finding that positive control has significantly inhibit the growth of S. aureus as compared to Talisay extract and negative control. It also shows the significance difference on the inhibitory activity of Talisay and negative control, indicating the capacity of the Talisay plant extract as antibacterial agent.

TABLE VII. MULTIPLE COMPARISON TEST (LSD – POST HOC) OF THE MEAN ZONES OF INHIBITION OF VARIOUS TREATMENTS

Mean Comparisons		Mean Difference	P value	Remarks
Positive Control (Vancomycin 30 g)	Talisay Extract	4.4	0.044	Significant
Positive Control (Vancomycin 30 g)	Negative Control	11.7	0.001	Significant
Talisay Extract	Negative Control	7.3	0.0001	Significant

*Calculation was performed at the 0.05 level of significance

IV. DISCUSSION

A. Discussions for the Results of the Phytochemical Screening of Terminalia catappa Leaves Ethanolic Extract

The results of the study indicated that *Terminalia catappa*, like most plants, contained phytochemicals with strong antioxidant activities which may prevent and control cancer and other diseases by protecting the cells from the deleterious effects of the 'free radicals' [11]. This study revealed that Talisay is proven and positive to have phenols/tannins, flavonoids and terpenoids. Accordingly, these phytochemicals are substances derived from plants that have potential health benefits. In this case, studies have shown that specific phytochemicals constituents can potentially reduce cancer risk [12].

Terminalia catappa is positive in the presence of phenols/tannins after it revealed a blue-green coloration. Polyphenols have diverse biological properties in the

human body. It can fight cancer cells and inhibit angiogenesis or the growth of blood vessels that feed a tumor [13]. It has the ability to fight free radicals and reduce the appearance of aging. Tea polyphenols and many tannin components were suggested to be anticarcinogenic [14]. Additionally, tannin molecules have also been identified for its capacity to reduce the mutagenic activity of a number of mutagens. These carcinogens and/or mutagens produce oxygen-free radicals for interaction with cellular macromolecules. Anticarcinogenic and antimutagenic can be related to the antioxidative property of tannins, which can be used as a defense from cellular oxidative damage, like lipid peroxidation.

Terminalia catappa also contains flavonoids since it revealed a reddish-brown coloration. The ability of flavonoids to reduce free radical formation and to scavenge free radicals is due to its antioxidant activity [15]. Several studies have already tested the capacity of flavonoids to act as antioxidants through in vitro and through the past years, its structure-activity relationships of the antioxidant activity have been significantly established. In addition, flavonoids are essential antioxidants which can promote several health effects. These molecules also provide anti-viral, anti-cancer, anti-inflammatory, and anti-allergic beneficial effect [16].

Results further showed that *Terminalia catappa* is positive in the presence of terpenoids/sterols after an orange coloration resulted. Many of the several classes of terpenoids are known for their antioxidant properties as well as their potential to fight for cancer [13]. He cited that the anticancer properties of terpenoids are associated with various mechanisms like counteraction of oxidative stress and potentiating endogenous antioxidants. Moreover, it can potentially improve detoxification, and disrupt cell survival pathways and induce apoptosis. In addition to the cholesterol lowering properties of plant sterols, they possess anti-cancer, anti-inflammatory, anti-atherogenicity, and anti-oxidation activities, and should thus be of clinical importance [17].

These Phytochemicals are essential and must be found in an antioxidant agent when purchasing because they inhibit and protect cell from becoming cancerous and strengthen the immune function. Discovering the phytochemical constituents of *Terminalia catappa* helps us evaluate its potential antioxidant property and furthermore test if it inhibits free radicals. Antioxidants are substances that help fight the harmful effects of unstable molecules in your body called free radicals.

B. Discussions for the Results of the Antioxidant Test: UV-VIS Analysis of Terminalia catappa Leaves Ethanolic Extract

The free radical scavenging activity of ethanolic extracts was quantitatively assessed using the UV-VIS spectrophotometer, and results showed that Talisay extract is a potent candidate for the isolation of antioxidant principles and can be used as antioxidant agent. Antioxidants play an important role in the body's defense system against reactive oxygen species as they combine with reactive oxygen species and null their toxic effect [18].

The findings clearly indicated that the Talisay leaves ethanolic extract used has potential antioxidant agents. These antioxidants delay or inhibit cellular damage mainly through their free radical scavenging property [19]. Thus, antioxidants may inhibit free radicals that may cause chronic and degenerative disease such as cancer. In today's generation, the most efficient way to treat cancer is chemotherapy. Even though it significantly improves symptoms and the quality of life of cancer patients, only modest increase in survival rate can be achieved. The results of this study proving that Talisay leaves ethanolic extract is an effective antioxidant can be useful in addressing problems concerning with degenerative disease like cancer. Due to the chemical richness of *Terminalia catappa*, its large leaves contain agents for cancer prevention and antioxidant inhibitors, as well as anticlastogenic characteristics which has long been used in different traditional medicines for various purposes [20]. As a palliative care, many cancer patients use herbal therapies. Medicinal plants are well known for their immunomodulatory and antioxidant activities by enhancing both non-specific and specific immunity [21].

After computing individually, the percentage scavenging activity post treatment, overall analysis showed that low level of absorbance post treatment as compared to negative control is indicative of antioxidant property. The findings account to the potentials of the various treatments to act as antioxidant agents in the experiment.

C. Discussions for the Results of DPPH Scavenging Activity of Talisay Ethanolic Extract

Determination of percentage DPPH scavenging activity was done based on the absorbance of the DPPH solution. DPPH radical scavenging activity is a commonly used method to determine the antioxidant activity of natural and/or artificial resources [22]. In vitro assays of antioxidant can help indicate whether or not a particular plant extract is a significant source of natural antioxidant, which then, can be helpful in the prevention of various oxidative stress [23].

When the absorbance was measured with a spectrophotometer, the color turned to yellow from purple through time when the antioxidant samples were mixed with DPPH reagent solution. This determines the antioxidant activities is the Talisay leaves ethanolic extract. Antioxidant components of plants protect biological systems against free radical damage which can therefore be effective in preventing many diseases such as cardiovascular conditions, cancer, inflammatory diseases and early ageing caused by oxidative stresses [22].

D. Discussions for the Results of Testing the Significant Difference of Percentage DPPH Scavenging Activity of T. cattapa Leaves Ethanolic Extract

The Talisay extract, the positive control which is ascorbic acid, and negative control which is ethanol showed free radical scavenging potentials. Nonetheless,

ascorbic acid (the positive control) still showed a higher radical scavenging activity when compared to Talisay extract. According to, the National Center for Biotechnology Information, ascorbic acid, also known as vitamin C, is one of the potent naturally occurring antioxidants in a biological system.

Furthermore, statistical analyses showed that there is significant difference ($p<0.05$) in the percentage DPPH scavenging activities of the ethanolic Talisay extract and ascorbic acid. The results showed that ascorbic acid remains to be the agent that is most potent antioxidant agent as compared to the test samples. Nevertheless, the findings account to the potential of both test samples to significantly produced scavenging effect against DPPH. The absorbance of the Talisay ethanolic extract using the spectrophotometer is near to the ascorbic acid. Thus, it is still a potent antioxidant candidate that can fight oxidative stress and inhibit free radicals.

E. Discussion for the Results of the Mean Diameter Zone of Inhibition of Talisay Against Staphylococcus Aureus

The results showed that *Talisay Extract* plant extract exhibit antibacterial activity against *Staphylococcus aureus*. It moderately inhibited the growth of the microorganism with grand mean zones of inhibition of 13.3 mm in the three-replicate test. The highest antimicrobial activity was exhibited by the positive control, which was the ascorbic acid, with a strong inhibitory activity of 17.7 mm, whereas the negative control did not exhibit inhibitory activity towards the test organism. Nonetheless, the findings clearly indicated that the Talisay leaves ethanolic extract is comparable to the antibacterial capacity of the positive control which is the ascorbic acid. Both are reasonably a potential antibacterial agent that can inhibit the growth of *Staphylococcus aureus*. Talisay leaves extract can be, therefore, used as a new resource for producing agents or drugs that could act as alternatives to commercially available antibiotics in the treatment of antibiotic-resistant bacteria.

Billions of pesos are loss from the importation of drugs in the Philippines and unknown to most Filipinos, the country has various plants and herbs, which can cure a number of ailments. Furthermore, the discovery of the Talisay leaves ethanolic extract as a potential antibiotic is now of great importance to our country. Using this a natural alternative for chemically synthesized drugs is more affordable, as it alleviates concerns regarding side-effects caused by chemical (synthetic) medicines, it and allows the public in a locale more access to health information.

V. Conclusion

After thorough investigation of results, the researchers deduced the following conclusions: *Terminalia catappa* is positive in the presence of flavonoids, phenols and terpenoids and these phytochemicals must be found when purchasing an antioxidant agent or drug because it inhibits the free radicals that may cause cancer.

In addition, results showed that the positive control which is ascorbic acid with a value of 34.33% has more antioxidant potential than the other test samples. *Nevertheless*, the findings clearly indicated that the Talisay leaves (23.88%) extract and ascorbic acid (34.33%) were proportional for antioxidant capacity. In other words, both have the potential for the antioxidant agent. Furthermore, we can use the Talisay leaves extract in producing antioxidant agent that serves as alternative to highly available antioxidant product in drug stores nationwide. Moreover, there is a significant difference between the Talisay (*Terminalia catappa*) leaves and ascorbic acid. In addition, the results indicate that *Talisay Extract* plant extract exhibit antimicrobial activity against *Staphylococcus aureus*. It moderately inhibited the growth of the microorganism with grand mean zones of inhibition of 13.3 mm in the three-replicate test. The highest antimicrobial activity was exhibited by the positive control which has a strong inhibitory activity of 17.7 mm, whereas the negative control did not exhibit inhibitory activity towards the test organism.

VI. Recommendations

Based on the findings and conclusions formulated in the research study, the following recommendations are hereby proposed:

1) A further study that will isolate the constituents in Talisay (*Terminalia catappa*) leaves ethanolic extract and test the isolated component for antioxidant property;
2) A further study that will explore other pharmacological characteristics of the test samples;
3) A further study that will conduct other pharmacological effect of plant extract which include but not limited to: Antipyretic, antihelmenthic and anti-viral;
4) A further study that will do the structure elucidation of the study to identify the component that made the plant antioxidant agent;
5) Drug companies should manufacture drugs as antioxidant involving Talisay since it was proven that it contains phytochemicals with strong antioxidant capacity which may prevent cancer and other diseases;
6) The government should provide funds in the making of antioxidant drug involving Talisay as stated in Republic Act 8423;
7) Community should do an in-depth research on Talisay (*Terminalia catappa*) to formulate drugs that will counterpart the higher cost of commercially available antioxidant agents;
8) The school should educate the students on exploring phytoconstituents in the natural reservoir and if it inhibits free radicals;
9) The future researchers should serve this as basis of future studies involving phytochemical screening, antioxidant and antibacterial activity.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

The authors equally contributed to the conduct of the research study.

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