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Research Article

Phytochemical and Antimicrobial Analyses of Terminalia Catappa Linn. Ethanol Leaf Extract and Its Effect on Treating Pimple

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Abstract

The air-dried leaf of *Terminalia cattapa* Linn. was pulverized and macerated with 95% ethanol for 48 hours. The mixture was filtered and concentrated in vacuo. The ethanol extract of the plant was analyzed for their phytochemical components and antimicrobial activity. Further, an ointment prepared from fresh leaf of the plant was tested on its healing effect in treating imple. Results of phytochemical analyses of the ethanol extract of the plant shows the presence of tannins, phenols, flavonoids and saponin. For the antimicrobial analyses, result shows that the ethanol extract of the plant is more effective in eliminating the growth of *Staphylococcus aureus* compared to the standard Cotrimoxazole. Results further shows that the ethanol extract of the plant has parallel effect on eliminating the growth of *Escherichia coli* bacteria compared with the standard Ampicillin. For the effect of *Terminali catappa* Linn. ointment, result shows that the ointment is moderately effective in healing pimple.

Keywords: Phytochemical, Antimicrobial, Terminalia Cattapa Linn, Ethanol Leaf Extract, Treating Pimple

Introduction

Plants are widely employed in folk medicine, mainly in communities with inadequate conditions of public health and sanitation (Tanaka, 2005). Medicinal plants have important contributions in the healthcare system of local communities, which serves as the main source of medicine for the majority of the rural populations (Tantiado, 2012). With the expensive cost of pharmaceutical drugs today, there is a need to explore the potentials of medicinal plants for ailments remedies (Francis, 2016). People all over the world suffer from different kind of illness and diseases especially nowadays, due to lack of sanitation (Desk ,2014).

The Philippines is bounded by many medicinal plants which are extensively useful as herbal medicines. Terminalia catappa Linn, locally known as Talisay, is known for its nutritional fruit and possesses medicinal benefit (Amand, 2015). The tree is found throughout the Philippines along seashores and is often planted inland (Quisumbing, 1978). Studies have shown that the bark and leaves of Talisay tree is an effective anti-bacterial and antifungal alternatives. Further studies showed that Talisay contains essential vitamins and minerals that help promote the body's overall health (Garcia, 2017). Talisay is also high in antioxidants that can protect the cells from oxidative damage which is a major contributor to aging and disease (Joe, 2018).

Skin diseases, particularly pimples, are most common form of infections occurring in people of all ages (Kumar, 2012). People with pimples often try out different remedies to improve the appearance of their skin (Lanset, 2002). Thus, the researchers, inspired by the foregoing statements, conducted the research to find out the effectiveness of Terminalia catappa, Linn in treating pimple.

Research Questions

Generally, the study aimed to determine the effectiveness of Terminalia catappa Linn. leaf extract as an alternative treatment for pimple. Specifically, the study sought answers to the questions hereafter enumerated.

1. What are the secondary metabolites present in the leaf extract of Terminalia catappa Linn.?
2. Does Terminalia catappa Linn. Leaf extract inhibits the growth of Staphylococcus aureus, Escherichia coli and Candida albicans?
3. Is the Terminalia catappa Linn. leaf ointment effective in treating pimple?

Literature Review

This section presents the information gathered by the researchers from books, internet, published and unpublished thesis, and other reading materials.

Description of Terminalia catappa Linn.

Terminalia catappa Linn. is found throughout the Philippines along seashores and is often planted inland. It is also occurring in the old world tropics and generally was introduced into a new world (Quisumbing, 1978).

Figure 1. Terminalia catappa Linn.

It is a large, deciduous tree; sometimes reaching a height of 25 meters it is smooth or nearly so. The branches are horizontally whorled. The leaves are shining, obovate, and 10 to 25 centimeters long, tapering below to a narrow and heart-shaped base. The leaf- stalks are short and stout. The flowers are white, small, and borne on spikers in the axials of the leaves, the spikers being 6 to 18 centimeters long. The fruit is smooth, compressed, ellipsoid, 3 to 6 centimeters long, and approximately 2-ridged, or keeled, down the sides. The pericarp is fibrous and fleshy, and the endocarp is hard (Quisumbing, 1978).

The Terminalia catappa Linn. tree has been spread widely by humans, so the native range is uncertain. It has long been naturalized in a broad belt extending from Africa to Northern and New Guinea through Southeast Asia and Micronesia into the Indian Subcontinent. More recently, the plant has been introduced to parts of the Americas. Until the mid-20th century, the tree had been used extensively in Brazilian urban landscaping, since being a rare case tropical deciduous (Encyclopedia of Fruit and Nuts, 2008).

A Global Food Book article notes that Terminalia catappa Linn. extracts are more potent than commercially-used antibiotics in combating bacterial infections. Likewise, certain components found in Terminalia catappa Linn. exhibited a dose-dependent efficacy in inhibiting the growth of fungi. The plant is found to contain potent antioxidant properties as well.

A 2015 study has shown that tropical almond extracts were able to inhibit the proliferation of free radicals by more than 73 percent (Nagappa, 2003).

Chemical Composition of Terminalia catappa Linn

The seeds contain 51.2 percent faxed oil (called catappa oil) with 54 percent olefins, palmitin, and tannin, Phytochemical screening of aqueous and organic solvent leaf extracts yielded tannins, saponins, flavonoids, anthraquinones, steroids, saponin glycosides and cardiac glycosides. Physiochemical analysis of sun dried mesocarp of fruits revealed about 12.65% ash, 84.93% carbohydrate, 0.37% oil, 316mg/g glucose, 0.1% protein, 1.30 mg/g tannin, 1.95% moisture, with 3434.5 kcal/kg calorific value. Seeds yield 4.13% moisture, 23.78% crude protein, 4.27% ash, 4.94% crude fiber, 51.80% fat, 16.02% carbohydrate and 548.78 Kcal calorific value. Classified in the oleic-linoleic acid group, oil contains high levels of unsaturated fatty acids, especially oleic (up to 31.48%) and linoleic (up to 28.93%). Study of essential oil from leaves by GC-MS analysis yielded 66 compounds. Main constituents were (Z)-phytol (41.2%), palmitic acid (11.0%), and (E)-nerolidol (4.7%), heptadecane (3.0%), hexadecane (2.3%). Studies also showed that Terminalia catappa Linn. are antioxidant / hepatoprotective, anti-Inflammatory, antimetastatic, antinociceptive, antioxidant, anti-Diabetics, anti-inflammatory, antibacterial, antidiabetic, anthelmintic, antinociceptive, antifungal, antimetastatic and anti-Ulcer Antioxidant (PAM, 2016).

Terminalia catappa Linn. has so many proteins and contained amino acids such as leucine, phenylalanine, isoleucine, histidine, valine, tryptophan, threonine, methionine, lysine and tyrosine. Terminalia catappa Linn. contains powerful antimicrobial, anti-fungal, and antibacterial properties that ward off a host of diseases.Terminalia catappa contains powerful antimicrobial, anti-fungal, and antibacterial properties that ward off a host of diseases.

Medicinal Uses of Terminalia catappa Linn

The bark is astringent and is used in dysentery from India throughout the Duct Indies to the Philippines. The roots and bark are similarly used in Brazil. The bark has been recommended for internal administration in the form of decoction as a remedy for gonorrhea and leucorrhoea as a cure for bilious fever. The leaves act as a sudorific and that they are applied to rheumatic joints and used fordysentery in Indo- China. The juice of the young leaves is

employed in southern India in the preparation of an ointment for scabies, leprosy, and other cutaneous diseases, and is also believed to be useful internally for headache and colic. The leaves, macerated in palm oil, are applied as a remedy in tonsillitis,

Terminlia catappa leaves applied to the head and sides are refreshing and sudorific. The leaves mixed with oil and rubbed on the breast to cure pain. The bark is astidysenteric (Quisumbing, 1978).

Terminalia catappa Linn. is also touted for its analgesic effects. According to a study published in 2013, Terminalia catappa possessed potent antinociceptive properties that inhibited the neurons from detecting an injurious or painful stimulus. Terminalia catappa Linn. is best known for its positive effects on the body's overall immunity. The plant is valued for its efficacy in maintaining a healthy digestive system as well. Likewise, the plant helps boost heart health and keeps the skin in top shape. The plant also supports the eyes, the bones and joints, and the respiratory tract. The fruits can be eaten raw, especially when young. The stones can be cracked to obtain the seeds, which can be eaten raw or used in preparing salads, smoother or side dishes. It promotes skin health and prevents the onset of premature skin-aging, wrinkles, hyper-pigmentation, and spots (Lasekan, 2009).

Ethanol

Ethanol is a colorless volatile flammable liquid molecular formula of C_2H_5OH, Ethanol is the intoxicating agent in liquors and is also used as a solvent and fuel. It is called also as ethyl alcohol or grain alcohol (Merriam-Webster, 2017).

Extraction

Extractions, as the term is used pharmaceutically, involves the separation of medicinally active portions of the plant or animal tissue from the inactive orinert components by using selective solvent in standards instructions procedures.

The product obtained relatively impure liquids or semi-solid, or powders intended only for oral external used. This include classes of preparations known as decoction, infusions, fluid extract, tincture, pillar, extracts and powdered extract such preparations popularly have been called galenicals, named after Galen, the second century Greek physician. The extract thus obtain may be ready for used as the medicinal agent in the form of tinctures and fluid extracts, it may be further process to be incorporated in any dosage form such as tablets or capsules or it may be fractionated to isolated individual chemical entities such as ajmalicine, hyoscine and vincristine, which are modern's drugs (Handa , 2008).

Microbes

Microbes are tiny forms of life that surround us too small to be seen by the naked eye. They are found in water, in the soil, and in the air. The human body is also home to millions of these microbes, also called microorganisms. Some microbes make us sick, others are important for our health. The most common are bacteria, viruses and fungi. There are also microbes from the group of protozoa (De Gruyter, 2014).

Bacteria

Bacteria are microscopic, single-celled organisms that have no nucleus and a cell wall made of peptidoglycan. A large group of single-celled microorganisms, some cause infections and disease in animals and humans. Most bacteria are much smaller than our own cells, though a few are much larger and some are as small as viruses. They usually do not have any membrane-wrapped organelles (e.g., nucleus, mitochondria, endoplasmic reticulum), but they do have an outer membrane. Most bacteria are also surrounded by at least one layer of cell wall some bacteria need oxygen to survive and others do not. Some love the heat, while others prefer a cold environment. Well-known bacteria include for instance salmonella and staphylococci (Encyclopedia Britannica, 2011).

Most bacteria are not dangerous for human beings. Many of them even live on or in our body and help us to stay healthy. For instance, lactic acid bacteria in the bowel support digestion. Other bacteria help the immune system by fighting germs. Some bacteria are also needed in order to produce certain types of food, for example yoghurt, sauerkraut or cheese (Encyclopedia Britannica, 2011).

Fungi

Fungi are single-celled or multicellular organisms with nuclei and with cell walls made of chitin. They also have membrane-wrapped organelles, including mitochondria. Unlike plants, fungi cannot make their own food Familiar fungi include yeasts, molds, and mushrooms. Yeasts live as small, individual cells, between the size of bacteria and our own cells. Molds and mushrooms are actually the fruiting bodies of fungi that live as long, microscopic fibers. Several

species of fungi, mostly yeasts, live harmlessly on the human body. Just like bacteria, some fungi naturally occur on the skin or in the body. But fungi can also cause diseases (Encyclopedia Britannica, 2011).

Diseases caused by fungi are called mycoses. These include the common athlete's foot or fungal infection of the nails, for example. Fungal infections can sometimes also cause inflammations of the lungs or mucous membranes in the mouth or on the reproductive organs, and become life-threatening for people who have a weakened immune system (Encyclopedia Britannica, 2011).

Escherichia coli

Escherichia coli are a gram negative, non-spore forming rod. It may or may not be mobile (Some rods are flagellated and some are not). The organism is a facultative anaerobe and ferments simple sugars such as glucose to form lactic, acetic and formic acids (Tenaillon, 2000)

Escherichia coli are common inhabitant of the intestinal tract of man and warm-blooded animals. Most strains of E. coli are harmless and are a part of the normal intestinal microflora. These strains serve a useful function in the body by suppressing the growth of harmful bacteria and by synthesizing appreciable amounts of vitamins. However, within the species, there are 4 strains or categories that cause diarrheal illnesses or disease (HITM, 2011).

As one of the most common facultative anaerobic bacteria in the faeces of humans and animals and, because E. coli is easily cultured, it is often used as an indicator organism when testing for the presence of faecal contamination in water and food (Bentley, 1982).

While many of the strains of E. coli are harmless, some are harmful (pathogenic) causing gastroenteritis, urinary tract infections, meningitis, and other more severe secondary illnesses in humans. E. coli that cause diarrhea are classified primarily by their pathogenicity and virulence properties, and/or the pattern of adherence in cell culture. They can be further classified into serotypes according to specific markers or antigens on their cell surface and hair-like structures (O-antigens and H-antigens, respectively).

The routes for infection may be food borne, waterborne (drinking, processing or recreational), person-to-person contact or through farm environments and animal contact.

Pathogenic E. coli are most likely to cause illness in susceptible groups of people such as children, elderly people and immuno-compromised individuals (MPI, 2015).

Staphylococcus aureus

Staphylococcus aureus belongs to the family Micrococcaceae and is part of the genus Staphylococcus, which contains more than 30 species such as S. epidermidis, S. saprophyticusand S. haemolyticus. Among the staphylococcal species, S. aureus is by far the most virulent and pathogenic for humans. S. aureusis a 1 μm, Gram-positive cell that in the laboratory may be observed as single cells, in pairs or as grape-like irregular clusters. It is characterized as coagulase- and catalase positive, non-motile, non-spore-forming and as facultative anaerobic. It grows in yellow colonies on nutrient rich media and is referred to as the yellow staphylococci (Washington, 2006).

Staphylococcus aureus as the ability to adapt to different environments and it may colonize the human skin, nails, nares and mucus membranes and may thereby disseminate among recipient host populations via physical contact and aerosols (Lowy, 1998). Colonization with S. aureus is an important risk factor for subsequent S. aureus infection (Wertheim & Eiff 2001).

Staphylococcus aureus causes a wide range of infections from a variety of skin, wound and deep tissue infections to more life-threatening conditions such as pneumonia, endocarditis, septic arthritis and septicemia. This bacterium is also one of the most common species in nosocomial infections. However, little is known about the virulence factors behind all these conditions. In addition, S. aureus may also cause food poisoning, scalded-skin syndrome and toxic shock syndrome, through production of different toxins (Washington, 2006).

Since its discovery by Dr. Alexander Ogston in 1880, Staphylococcus aureus has been recognized as a versatile micro-organism worldwide (Ogston, Diekem, 2001). S. aureus may colonize the human body as a part of the normal flora. Approximately 30 % of healthy people are inhabited by S. aureus, mostly in the anterior (Akmato, 2014). S. aureus is also a leading cause of hospital-associated and community-associated bacterial infections in humans, associating with numerous mild skin and soft tissue infections, as well as life-threatening pneumonia, bacteraemia, osteomyelitis, endocarditis, sepsis and toxic shock syndrome (David & Daum, 2010). The increasing

prevalence of methicillin-resistant S. aureus and its ability to resist multiple drugs has posed a serious challenge for infection control (Junie, 2014).

Candida albicans

Candida albicans is normally a harmless commensal of human beings, but it can cause superficial infections of the mucosa in healthy individuals and (rarely) infections of the skin or nails. It can also become invasive, causing life-threatening systemic and bloodstream infections in immune compromised hosts, where the mortality rate can be as high as 50 %. It is the most common cause of serious fungal infection and is a common cause of nosocomial infections inhospitals. Some strains have been recognized that are resistant to azoles or echinocandins, which are the first-line antifungals for treatment of C. albicans infections (Gow & Yadav, 2017).

Pimple

A pimple is a small pustule. Pimples develop when sebaceous gland or oil glands, become clogged and infected, leading to swollen, red lesio filled with pus. Also known as spots or zits, pimples are a part of acne. They are most likely to occur around puberty but they can happen at any age. During puberty, hormone production changes. This can cause the sebaceous glands, located at the base of hair follicles, to become overactive. As a result, pimples are most likely to occur during the teenage years and around menstruation, for women. Pimples most often affect the face, back, chest, and shoulders. This is because there are many sebaceous glands in these areas of skin. Acne vulgaris, the main cause of pimples, affect over 80 percent of teenagers (Nordquist, 2017).

Methodology

This chapter presents the research design, local of the study, research instrument, materials used, preparation of sampling, drying of leaves, powdering of laves and extraction.

Research Design

The researchers used experimental design in the study. The effect of Terminalia catappa Linn. leaf extract in removing pimple was determined. Antimicrobial and phytochemical analysis of Terminalia catappa extract was also determined, such as the presence of alkaloid, saponin, tannin, flavonoids and phenols.

Phytochemicals Analysis of Plant Extract

The phytochemical screening of the sample was carried out as described by Tiwari et al., (2011). The crude extracts were tested to confirm the presence or absence of plant secondary metabolites such as alkaloid, flavonoid, tannins, phenols and saponin.

Mayer's Test for Alkaloids

1 ml of crude extract was dissolved in diluted hydrochloric acid and filtered. Filtrates were treated with Mayer's reagent (Potassium Mercuric Iodide). Formation of a yellow colored precipitate indicated the presence of alkaloids.

Lead Acetate Test for Flavonoids

1 ml of crude extract was treated with few drops of lead acetate solution. Formation of yellow color precipitate indicated the presence of flavonoids.

Gelatin Test for Tannins

1 ml of crude extract was treated with 1% gelatin solution containing sodium chloride. Formation of white precipitate indicated the presence of tannins.

Froth Test for Saponins

1 ml of crude extract was diluted with distilled water to 20 ml and this was shaken in a test tube for 15 minutes. Formation of 1 cm layer of foam indicated the presence of saponins.

Ferric chloride for Phenols

1 mL crude extract was treated with ferric chloride. Formation of bluish black precipitate indicated the presence of phenols.

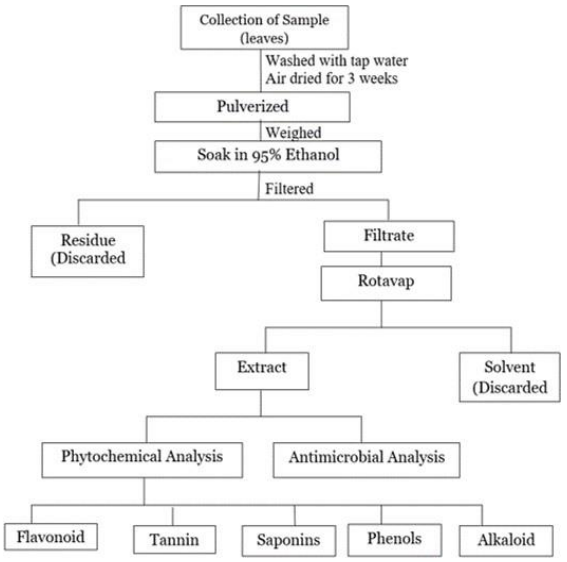

Figure 2. Schematic Diagram for the Phytochemical and Antimicrobial Analysis.

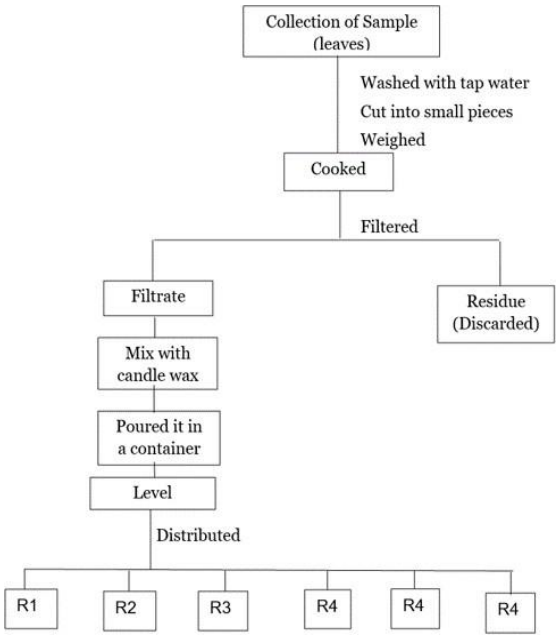

Figure 3. Schematic Diagram for the Preparation of Terminalia catappa Linn. Ointment

Collection of Sample

The leaves of the Terminalia Catappa tree were collected at Salbo, Datu, Saudi, Maguindanao on May 25, 2018.

Drying Leaves

1. The researchers washed the fresh leaves then air dried them for two weeks in a ventilated area. The leaves were evenly spread.
2. The leaves were gathered when fully dried, which was crispy to the touch and crumble a little when touched.
3. The gathered leaves were stored in the clean and sterilized glass jar.

Pulverizing of Leaves

1. The researchers placed the dried leaves in an electric blender to pulverize them.
2. Remaining leaves not pulverized by the electric blended were crushed through the use of ceramic mortar and pestle.
3. The researchers stored the powder in a sterilized jar.

Extraction

The researchers macerated the powdered leaves using 95% ethanol solvent in a beaker. The jar closed with a lid was stored in a cool, dry and dark place. The researchers waited 48 hours for extraction process.

1. After 48 hours, the mixture was filtered to separate the leaves.
2. The researchers stored the extract in a rotary evaporator. The researchers stopped concentrating the extract when it turned dark green.
3. The remaining extract was stored in a plastic vial.

Preparation of Treatments

1. The researchers dissolved 100 mg Doxycycline in 10 mL distilled water.
2. The researchers dissolved 160 mg of Cotrimoxazole with 10 mL distilled water.
3. The researchers dissolved 500 mg of Ampicillin in 10 mL distilled water.
4. Fungisol are no longer diluted.
5. The researchers prepared 10 mL of distilled water.
6. The researchers also prepared the Terminalia catappa Linn. leaf extract.

Media Used

Two different media were used as a source of food for the microbes, namely; Nutrient Agar (NA) for Staphylococcus. aureus and Escherichia. Coli, and Sabouraud Dextrose Agar (SDA) for Candida. albicans.

Preparation of Growth Media

1. The researchers dissolved 14.4g of NA in 720mL distilled water.
2. The researchers dissolved 15.6g of SDA in 240mL distilled water.
3. The growth media were heated and stirred using a hot plate and a magnetic stirrer at 370^{0}C, 260 rpm and at 260^{0}C, 130 rpm, respectively.
4. After the growth media were completely dissolved, it was sterilized in an oven at 121^{0}C for 15 minutes.
5. While sterilizing the growth media, the researchers wrapped the Petri dishes in papers and dried them at 30-37^{0}C in an oven, for not more than 30 minutes.
6. The researchers cooled the growth media to 40-50 C, ^{0}then poured it into assigned Petri dishes on a flat surface to have a uniform depth of 4mm and allowed to solidify. The growth medium was moist but free of water droplets on the surface.

Inoculation of Microorganism

1. The researchers dipped a cotton swab into an Escherichia coli culture. The head of the cotton swab was fully covered with the inoculum.
2. The growth medium in one of the Petri dishes assigned to Escherichia coli was inoculated by streaking it with the swab containing the inoculum.

Step 1 was repeated for each Petri dish assigned to Escherichia coli.
3. The researchers allowed the surface of each growth medium to dry for 1-2 minutes for the absorption of the excess moisture.
4. Steps 1 to 3 were replicated for Staphylococcus aureus and Candida albicans.

Testing the Extract

1. Filter discs 6 mm in diameter was prepared in a Petri dish.
2. A medicine dropper was used to drop extracts on the filter discs.
3. Forceps were used to place 3 immersed filter discs in each Petri dish. The filter discs were equidistant from each other.
4. The plates were incubated in an inverted position at 30^0C. Zone of inhibition was observed after 24 and 48 hours interval.

Reading and Measurement of Zones of Inhibition

The diameter of the zones of inhibition was measured using Vernier caliper.

Interpretation Results

1. Results of the experiment was interpreted using T-test
2. Calculator was used manually to compute the statistics

Preparation of Terminalia catappa Linn. Leaves Ointment

1. Fresh leaves of Terminalia catappa was collected by the researchers.
2. The leaves were washed with top water to remove the dirt.
3. The leaves were cut into small pieces with stainless knife and weighed.
4. 235 grams fresh leaves was mixed with 1000ml Canola oil in a beaker.
5. The mixture was moderately heated until the leaves became crispy.
6. The mixture was strained and the oil extract was added with 94grams wax.
7. Immediately, the oil extract was poured in a container and cooled until it solidified.
8. The researchers labeled the ointment as Tropical Almond Ointment
9. The ointments were distributed to the five (5) respondents of the study.

Instruction in Using the Ointment in Treating Pimples

1. The respondents should wash their face with soap and water and dried with clean face towel.
2. The respondents applied enough amount of the ointment to the affected area twice a day morning and before bed time.
3. The researchers took pictures of the respondents ‘face every tree days.
4. The treatments lasted for tree (3) weeks.

Results and Discussion

This chapter include the presentation, analysis and interpretation of data gathered. The data were presented in tables followed by textual interpretation.

Bioactive Components of the Plant Extract

Table 1 shows the result of the phytochemical analysis of 95% Ethanol Leaf Extract of the *Terminalia catappa* Linn.

Table 1. *Phytochemical Analysis of 95% Ethanol Leaf Extract of theTerminalia catappaLinn.*

Bioactive Components	*Presence*
Alkaloid	(-) Negative
Flavonoid	(+) Positive
Tannin	(+) Positive
Saponin	(+) Positive
Phenols	(+) positive

Legend: (-) means no presence of compound in the plant extract.
(+) means there is presence of compound in the plant extract.

Table 1 shows that flavonoid, tannin, saponin and phenols are present in the ethanol leaf extract of Terminalia catappa Linn. but negative for alkaloid. Crude extract treated with three drops of lead acetate solutions resulted to a formation of yellow precipitate which mean positive for flavonoids. For tannins, crude extract treated with 1% gelatin showed a white pprecipitate which mean positive for tannins. For saponin, 1 ml crude extract treated with 5 ml distilled water resulted to the formation of 1 cm layer of foam, which indicated the presence of saponin. And for phenols, 1 ml crude extract treated with 3 drops of ferric chloride solution resulted to a bluish black precipitate indicating the presence of phenol.

The results of the study were similar to the study conducted by Sharma and Rajani (2012) that revealed the presence of flavonoids, tannins, and saponins in

Terminalia catappa Linn.

Antimicrobial Activity of Terminalia catappa Linn. Leaf Extract

Table 2 presented in subsequent page shows the antimicrobial activity of the treatments of Terminalia catappa Linn. ethanol leaf extract against Staphylococcus aureus expressed as zone of inhibition measured in millimeter.

Table 2. *Mean and Susceptibility Description Distribution of Staphylococcus aureus*

Treatment	*Zones of Inhibition (mm)*			*Mean (mm)*	*Susceptibility*
	Trial 1	*Trial 2*	*Trial 3*		
T1 - Negativecontrol (Distilled water)	0	0	0	0.00	R
T2 - Cotrimoxazole	14.27	13.8	12.8	13.62	R
T3 - Doxycycline	31	32.33	32.47	31.63	S
T4 - Ampicillin	23	20.63	22	21.88	S
T5 -*Terminalia catappa*	19.63	17.03	21	19.39	S

Susceptible means the susceptibility of bacteria to antibiotic expressed as:
R - Resistant if the Mean value is ≤ 14 mm,
I - Intermediate if the Mean value is = 15 to 18 mm, and
S - Sensitive if the Mean value is ≥ 19 mm.

Table 2 shows that Cotrimoxazole has a mean of 13.62mm, Doxycycline 31.63mm, Ampicillin 21.88mm, and Terminalia catappa 19.39mm. Doxycycline (T3) showed the highest mean of zone of inhibition with a mean of 31.63mm while the lowest is Cotrimoxazole with 13.62mm. table 2 further shows that Terminalia catappa extract is more effective than Cotrimoxazole with a mean of zone of inhibitions 19.39mm for Terminalai catappa and 13.62mm for Cotrimoxazole.

Table 3. *Mean and Susceptibility Description Distribution of Escherichia coli.*

Treatment	*Zones of Inhibition (mm)*			*Mean (mm)*	*Susceptibility*
	Trial1	*Trial2*	*Trial3*		
T1 - Negative control (Distilled water)	0	0	0	0.00[c]	R
T2 - Cotrimoxazole	30.57	19.2	19.7	23.04	S
T3 - Doxycycline	39.5	38.87	42.67	40.41	S
T4 - Ampicillin	17.73	23.07	27.73	22.84	S
T5 -*Terminalia catappa*	25.37	23.13	19.73	22.74	S

Susceptible means the susceptibility of bacteria to antibiotic expressed as:
R - Resistant if the Mean value is ≤ 14 mm,
I - Intermediate if the Mean value is = 15 to 18 mm, and
S - Sensitive if the Mean value is ≥ 19 mm.

Table 3 shows that Cotrimoxazole has a mean of 23.04mm, Doxycycline 40.41mm, Ampicillin 22.73mm, and Terminalia catappa 22.74mm. Among the treatments used against Escherichia coli, Doxycycline (T3) has the highest mean of 40.41 mm whileTerminalia catappa, ethanol leaf extract (T4) is the lowest with 22. 74mean. The results implied that Doxycycline is the most effective against Escherichia coli and Terminalia catappa, the least. Further, the results indicated that Terminalia catappa is least effective against Escherichia coli.

Table 4. *Mean and Susceptibility Description Distribution of Candida albicans*

Treatment	*Zones of Inhibition (mm)*			*Mean (mm)*	*Susceptibility*
	Trial 1	*Trial 2*	*Trial3*		
T1 - Negative control (Distilled water)	0	0	0	0.00	R
T2 - Fungisol	33.03	24,03	25.83	27.63	S
T3 -*Terminalia catappa*	19	18.87	21.33	21.33	S

Susceptible means the susceptibility of bacteria to antibiotic expressed as:
R - Resistant if the Mean value is ≤ 14 mm,
I - Intermediate if the Mean value is = 15 to 18 mm, and
S - Sensitive if the Mean value is ≥ 19 mm.

Table 4 shows the mean of zone of inhibition for Fungisol and Terminalia catappa against Fungus Candida albicans. The results show that Fungisol (T2) is more effective than the Terminalai catappa, with a mean of 27.63 for Fungisol and 21.33mm for Terminalai catappa.

Table 5. *Frequency, Weighted Mean and Description Distribution of level of effectiveness of Terminalia catappa Linn. Ointment*

Item	*Frequency*				*Weighted Mean*	*Description*
	4	*3*	*2*	*1*		
Level of effectiveness of *Terminalia catappa* Linn. leaves ointment in treating pimple	1	4	1	0	3.00	Slightly effective

Table 5. shows the frequency counts, weighted mean and description distribution of level of effectiveness of Terminalia catappa Linn. leaves Ointment against pimple. Results showed that Terminalia catappa Linn. leaves ointment was slightly effective against pimple as indicated by the mean of 3.00.

Conclusion

The findings of the study are hereafter presented. (1) Phytochemical analysis of the Terminalia catappa Linn ethanol leaf extract showed the presence of flavonoid, tannin, and saponin but with alkaloid absent. (2) In terms of microbes staphylococcus aureus the extract of Terminalia catappa is susceptible or effective in inhibiting the growth of bacteria with the mean zone of inhibition of 19.39mm. (3) The ethanol leaf extract of Terminalia catappa is also effective in inhibiting the growth of Escherichia coli with the mean zone of inhibition of 22.74mm. (4) In terms of Fungus Candida albicans Terminalia catappa is also susceptible or effective in inhibiting the growth of fungus with the mean zone of inhibition of 21.33mm. (5) Comparing the affectivity of Terminlia catappa ethanol extract against the positive control Cotrimizaxole doxycycline ampicillin, and Fungisol with the microbes Staphylococcus aureus, Echrichia coli, and Candida albicans result of study shows that Terminalia catappa extract is only effective against Cotrimooxazole with the microbes Staphylococcus aureus. (6) The Terminalia catappa Linn. Ointment is moderately effective in treating pimple.

The researchers offered the recommendations: (1) Future researchers could also try using polar and non-polar solvents to extract the phytochemical components of the plants. (2) Other parts of Terminalia catappa can also be studied for Phytochemical and Antimicrobial analysis.

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