

***In vitro* Thrombolytic Activity of *Nypa fruticans* Wurmb Fruit Pulp**

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A thesis submitted to the School of Pharmacy in partial fulfillment of the requirements for the
Degree of Bachelor of Pharmacy (B.Pharm.)

School of Pharmacy

Brac University

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Deceleration

It is hereby declared that

1. The thesis submitted is my own original work while completing my degree at BRAC University.
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3. The thesis does not contain material which has been accepted or submitted, for any other degree or diploma at a university or other instruction.
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Ethics Statement

Ethical permission has been achieved from Department of Pharmacy, Southeast University, Dhaka, Bangladesh.

Abstract

The onset of ischemic heart disease and stroke is significantly influenced by abnormal thrombosis. Despite their effectiveness, synthetic thrombolytic drugs have certain drawbacks. Hence, there is a need to create anti-thrombotic medications that are relatively safer and made from natural resources like plants. The current study serves as a foundational study for these initiatives. This study was carried out to investigate the thrombolytic activity of fruit pulp of *Nypa fruticans* wurmb, a plant prevalent in the tropical regions of Bangladesh which parts are utilized for a wide range of medical purposes. Methanolic extract of *N. fruticans* fruit pulp (NFP) was used for the in vitro clot analysis assay with human blood samples. The percent clot lytic activity of NFP extract was compared with water ($17.83 \pm 0.05\%$, negative control) and streptokinase ($43.96 \pm 0.99\%$, standard). Compared to the positive and negative controls, the investigated extract's clot-dissolving ability shown a noteworthy $27.83 \pm 0.89\%$, according to the study. Nevertheless, comprehensive clinical trials and the identification of bioactive anti-thrombotic chemicals are necessary to establish the thrombolytic efficacy of its fruits in vivo. The present study found that *Nipa* fruit pulp possesses thrombolytic potential, suggesting that using it as a dietary supplement could help prevent thrombotic cardiovascular problems.

Key words: *Nypa fruticans* wurmb, fruit pulp, methanolic extraxct, thrombolytic activity, streptokinase,

Dedication

This work is dedicated to my parents, brother and also my project supervisor, Professor Dr. Farhana Alam Ripa for their continuous support and resolute reliance on me.

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I am grateful to the Almighty Allah for giving me the prospect to come in this and the thesis ensues

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List of Acronyms:

NFP	Nypa fruticans Pulp
BC	Before Christ
HTS	High throughput screening
mm	Millimetre
MFF	Mitochondrial fission factor
CSF	Cerebrospinal fluid
PESF	Pulsed electrostatic field
SPSS	Statistical package for the Social Sciences
SEM	Scanning Electron Micro Scopy

Chapter 1

Introduction

1.1 General Introduction

Plants come from the kingdom of plantae. They are basically eukaryotes. Plants get energy from the sunlight that they use for preparing their foods. By using chloroplasts they can produce water and carbon dioxide. From the first of human civilization people have totally depended on plants for food and medicine. Plants help in the ecosystem as they maintain the balance in the ecosystem. From ancient to modern life we totally depend on plants for our daily needs. From all the plants some are also more important as they are medicinal plants. Medicinal plants have more popularity all over the world. Medicinal plants help in several diseases. Some medicinal plants are aloe vera, shatavari, gooseberry, garlic, rosemary, turmeric, neem, tulsi, pepper, ginger etc. From ancient times medicinal plants have been counted as the best home remedies. In the world 35,000 to 70,000 medicinal plants are found. From ancient times medicinal plants are more popular in the countries of India, China, Greece, Egypt etc.



Figure 1: Medicinal Plants (Ng'ok et al., 2023)

For the purpose of drugs, disinfectants and aromatic agents medicinal plants are used in the world. For novel drugs medicinal plants are used a lot. They develop a lot in the therapeutic sector of therapy. For living organisms, plant parts are used. Some plant parts that are used for medicinal purposes are roots, seeds, flowers, fruits etc. Different countries used different medicinal plants as all are not available in the world. Some countries which are undeveloped like Asia, Africa use medicinal plants more than developed countries. Bangladesh is fertile and the climate is perfect for growing plants. In Bangladesh the use of medicinal plants is very popular. Most of the people of villages in Bangladesh are dependent on medicinal plants based home remedies. In Bangladesh most popular medicinal plants are shoeblackplant, basil, arjuna, gooseberry, neem, aloe vera, acorusclamus etc.

1.1.1 Definition of Medicinal Plants

Medicinal plants are used for the purpose of medicinal use. Medicinal plants are used in the seeds, barriers, roots, leaves, fruits and flowers for the purpose of medicinal use. Medicinal plants can be used by synthesis of drugs or it can be used for the purpose of therapeutic use. There are differences between non medicinal plants and medicinal plants. Medicinal plants are specially available to heal disease. Medicinal plants can develop the problem of cancer, diarrhea, cholera, hypertension etc.



Figure 2 :Therapeutic use of medicinal plants (Tanwar et al., 2023)

1.1.2 Use of medicinal plant in ancient sketch

Medicinal plants are most popular from ancient times. From the ancient time medicinal plants were widely used directly from animal or plant sources. For several diseases medicinal plants are used with the synthesis drug. Some sketch of traditional medicine -

- At first pharmacopeia was compiled by Sheng Nun who was an emperor
- Some important medicinal plants and their use are written by Elbert in the time of 1500 BC



Figure 3:Medicinal plants in ancient times (Alwar et al., 2018)

- 400 remedies are written by Hippocrates. He is also popular as the father of modern medicine. The book he wrote was *MateriaMedica*.
- *HistoriaPlantarum* is a book which is very popular for medical science written by Athens.

1.1.2.1 Some evidence related to medicinal plants

At first written evidence was found from Sumerian clay slab which was Nagpur. It was around 5000 years ago, when the evidence was found about medicinal plants. Chinese and Egyptian plants were used for the purpose of making medicine at the time of 27 centuries BC. Later Greek scientists established The school of Medicinal Plants. In the book of Materia Medica around 600 plants are found which were medicinal plants. Evidence of medicinal plants

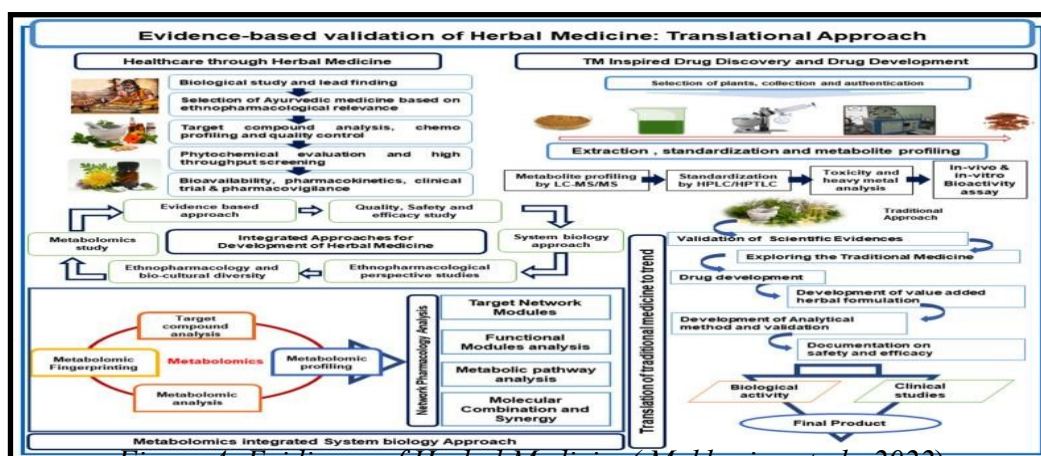


Figure 4: Evidence of Herbal Medicine (Mukherjee et al., 2022)

Several traditional medicine are -

- Chinese Traditional Medicine
- Korean Traditional Medicine
- Indian Traditional Medicine
- European Traditional Medicine
- African Traditional Medicine
- Arabian Traditional Medicine

1.1.2.2 Use of medicinal plants in Egyptian history

For health and medicine Egyptians were very famous. For the problem of gastrointestinal and urinary tract they used medicinal plants. They used sedative, analgesics for the treatment of

gastrointestinal disorder. Besides, they also used some medicines for common colds (Nunn JF, 1996). They used all the medicinal plants internally and topically. Ebers Papyrus wrote the ancient Egyptian. He wrote about 700 medicinal plants (Oakes e al., 2003). The popular medicinal plants in that time were garlic, juniper, cannabis, aloe vera etc.



Figure 5: Egyptian Medicinal Plants (Elsabbagh et al., 2023)

1.1.2.3 Use of medicinal plants in Greek History

Greek was popular from ancient times for its contribution in pharmaceutical science. 500 crude drugs that were used in Greek were written by Aristotle. Besides, 400 medicinal plants are written by Hippocrates. Claudius also wrote books about 300 medicinal plants. The most popular medicinal plants at that time in Greek were mint, fennel, olive, and saffron.



Figure 6: Greek Medicinal process (Christodoulou et al., 2019)

1.1.2.4 Use of medicinal plants in Chinese History

At the time of 2953 BC, Fu His discovered a special thing about medicinal plants that was an exogenous factor. Later it was developed and made some changes by Shen Nong and Hong Ti. Moreover, Chinese Pharmacopeia offered several remedies that were done by medicinal plants. Using tongue diagnosis Wang Tao also contributed a lot at that time in Chinese medicine by medicinal plants.



Figure 7: Chinese Medicinal process (Wang et al., 2018)

1.1.2.5 Use of medicinal plants in Indian History

In India home remedies were very popular by using medicinal plants. At that time the oldest system was Ayurveda. Ayurveda was very popular at that time in India. Rig-Veda describes the ayurveda system in India at that time. Ayurveda was called Knowledge of life in India. Some medicinal systems in India at that time were-

- Ayurveda
- Homeopathy
- Siddha
- Unani
- Yoga and Neuropathy



Figure 8: Indian Medicinal process (Dhoke et al., 2014)

1.1.2.6 Use of medicinal plants in Arab History

Arab were most popular at that time for their contribution in medical science. For this reason Arab was called the golden period of medicinal plants. In Arab medicinal plants were very popular for several home remedies. They contribute to the pharmacy practice. They also translated the Greek and Roman books. At that time Ibn Sina contributed a lot to Arab medical science. He discovered drugs, poison, chemical construction etc. Chemicals also isolated by Jaber Bin Hanan at that time in Arab medical science.



Figure 9: Arab Medicinal process (Sari et al., 2007)

1.1.2.7 The use of medicinal plants in South and East Asia

South and East Asia were very popular in home remedies. For home remedies they used medicinal plants. Bangladesh, Bhutan, India, Myanmar, Nepal etc used different medicine systems. Some countries of South and East Asia used the system of ayurvedic, unani, chinese, siddha, yoga etc. Some medicinal plants systems that they used.

Table 1: Medicinal Plants System (Alam et al., 2007)

Bangladesh	Ayurvedic
India	Siddha, Yoga
Nepal	Ayurvedic
Bhutan	So-wa-rig-pa
Maldives	Dhivehi Beys
Myanmar	Chinese



Figure 10 : South and East Asia Medicinal process (Momo et al., 2022)

1.1.2.8 History of medicinal plants used in Bangladesh

From the 18th century Ayurvedic and Unani systems were very popular in Bangladesh. At the time of 1935, the modern medicinal system came to Bengal. It happened by the establishment of Calcutta Medical College. In the college they only help to practice unani and ayurvedic. In the mid 19th century Bangladesh made a great development in medical science. Dacca Medical School was established in the year 1874. After independence, Bangladesh developed a lot in medical science. Health is identified as a basic need after Independence of Bangladesh. Medicinal plants have made a huge change in the medical science in Bangladesh in the last two decades.

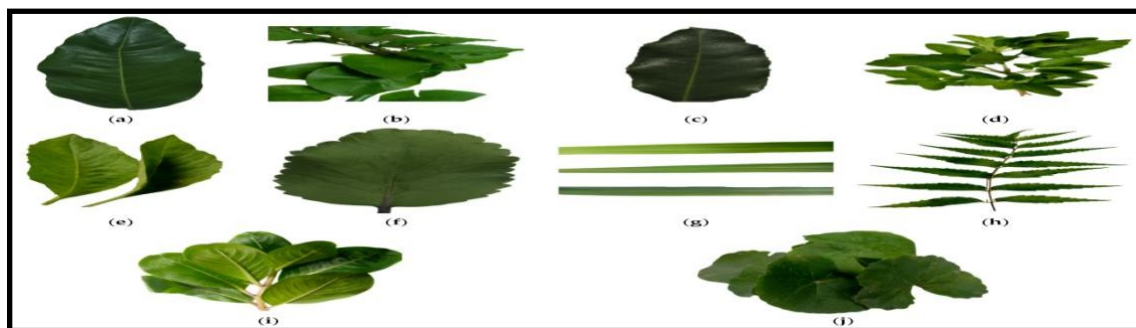


Figure 11: Medicinal Plants in Bangladesh (Uddin et al., 2023)

1.1.2.9. Modern era of medicinal plants

For new drugs production medicinal plants play a great role. The development of modern science happens because of medicinal plants. By the use of modern technology it is much easier

to develop in the sector of modern medicine. Medicinal plants are now easy to collect, extract, and use in any pharmaceutical work by the help of modern technology. Around 15 compounds that were natural were derived at the time of 2000 to 2003. All these compounds were very popular and now they are at the phase iii clinical trial process. Natural products are more important than synthesis drugs. Natural products are 100 times higher than synthesis drugs. Besides, not all the molecules are able to discover and develop the drug. Only some are able to develop and discover drugs.



1.1.3 Medicinal plants used in typical medicine

Nowadays chemical, clinical and pharmaceutical related drugs and study are totally dependent on medicinal plants. For making drugs most of the pharmaceutical companies used medicinal plants. Medicinal plants make our life easy. It helps a lot in our daily life. We can easily exact medicinal plants now. Most of the basis drug that used for typical medicine are-

- Morphine that comes from the Opium poppy
- Dioxin that comes from the foxglove
- Quinine comes from the Cinchona bark.



Figure 13: Traditional Medicine (Sohel et al., 2022)

1.1.4 Natural compounds used for drug discovery

Discovering natural drugs for ancient way

For pharmaceutical purposes medicinal plants were collected. At first the plant materials for use in the future. Fractionated happened in the exact time when any activity was detected. Then isolated was done for the active compound and lastly identified the compound. For the process at different stages biological tests happen. Besides, direct isolation also can happen. As it was ancient process, so the isolation was not perfect. It was slow, inadequate process (Sarker way, 2013) .

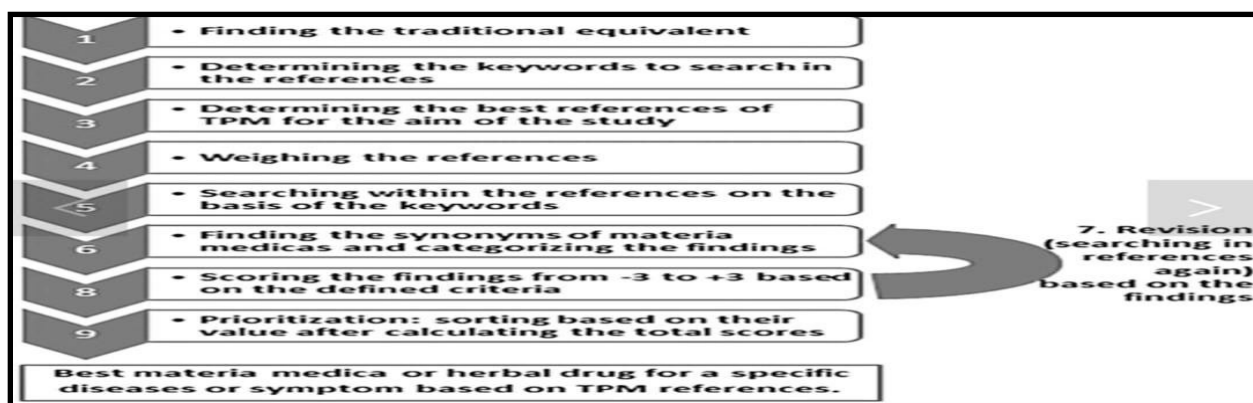


Figure 14: Ancient process (Mozaffarpur et al., 2020)

Discovering natural drugs for modern stage

High throughput screening used for the modern method. HTS are used for the discovery of natural drugs. For doing this method a library for the natural compound are established. In the ancient time it was very difficult to create these types of libraries. As the library takes more time, it is costly. Modern way makes it easier. For this reason it is easy to test, extract medicinal plants. For doing the modern way some steps are done. For discovering natural drugs in modern way 4 steps are done -

- Screening for 3 to 5 years for medicinal plants
- Pre- clinical process are done by 1 to 2 years
- Clinical trials are done by 6 to 7 years
- For regulatory approval 1 to 2 years are done

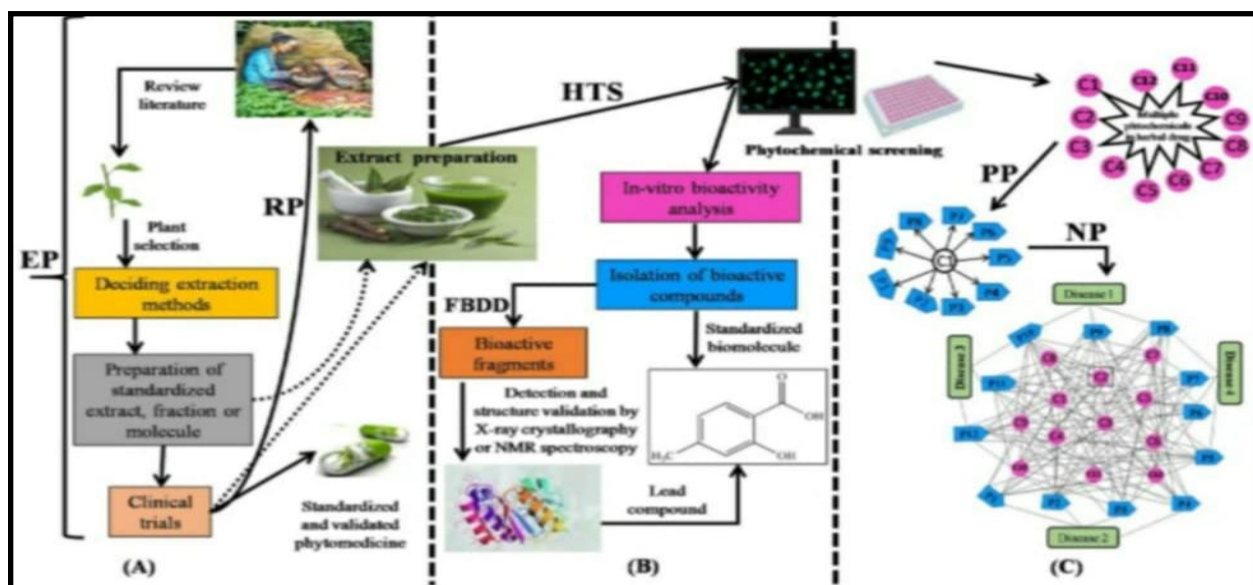


Figure 15: Modern Process (Nasim et al., 2022)

1.1.5 Widely used medicinal plants in Bangladesh

Most of the people in Bangladesh live in villages. The people of the village are mostly dependent on home remedies. About 80% of village people use home remedies. Home remedies are made from medicinal plants. Bangladesh has more than 6500 plants. Among them 500 are medicinal plants. For our day to day life 250 medicinal plants are used daily. In Bangladesh there is no restriction on selling the plant of medicinal values. Some medicinal plants that widely used in Bangladesh are -

- **Neem:** The scientific name of neem is *Azadirachta indica*. It is used for the treatment of inflammation, infections, fever etc. It is widely used in tooth plaque as it reduces it. Besides, it is also used in the treatment of lice.
- **Aloe vera :** Aloe vera used for not only orally but also topically. Aloe vera used for acne, fibrosis, burns etc. It is very popular for burns and cuts.

- **Mint:** The Scientific name of mint is *mentha*. It is helpful for the treatment of cancer. Besides, it is also used for the treatment of antimicrobial, antidiabetic. It is very helpful against toxicity.
- **Primrose oil :**Primula is the scientific name of primrose oil. It is widely used in Bangladesh as a popular medicinal plant. Primrose is used for rheumatoid arthritis, breast pain and menopause. It is also very good for the treatment of hormonal problems.
- **Lavender:** Lavandula is the scientific name of Lavender. Lavender oil is very popular as it is helpful for many diseases. Many problems can be solved easily with the help of lavender oil. It can solve the problem of insomnia, stress and anxiety. Besides, lavender is most helpful for the use of antibacterial and antivirals.
- **Tulsi :** The scientific name of Tulsi is *Ocimumtenuiflorum*. Tulsi is popular for the use of insect bites. Several fever and heart disease can also be solved by the help of tulsi. Besides, tulsi can be used for headaches, common cold and also for kidney stones.

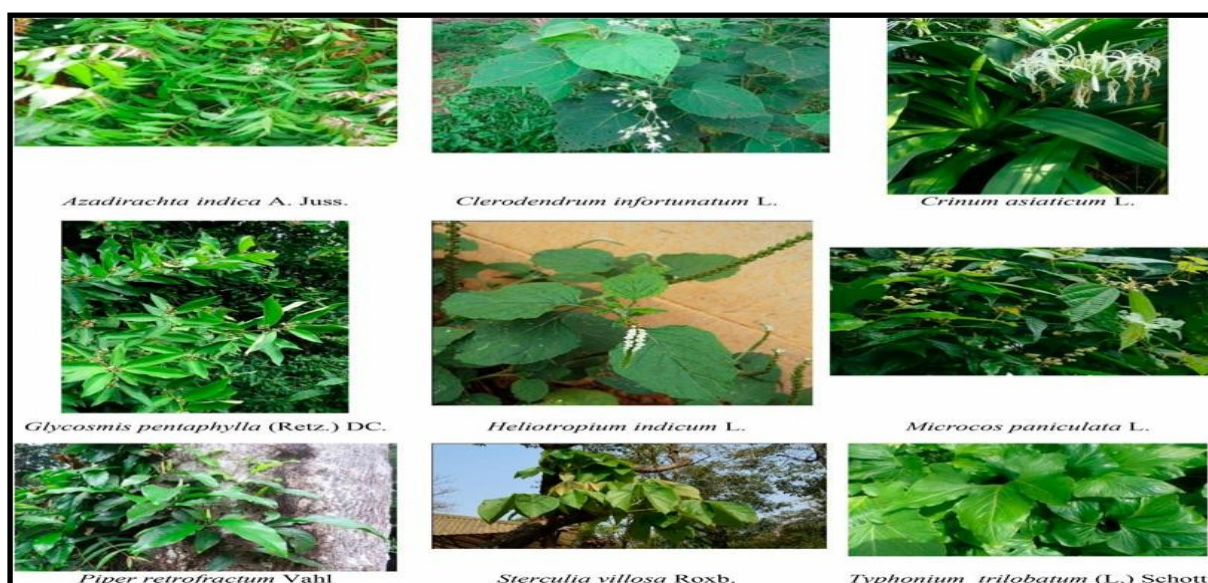


Figure 16: Bangladeshi Medicinal Plants (Akhtar et al., 2022)

1.1.6 Chemical construction

Nutrition and reproduction are closely related to chemical construction. Tannins, volatile oil, vitamins, resins etc play a vital role in the experiment. It has a great therapeutic effect. Some plants constitution with the help of therapeutic effect -

Table 2: Therapeutic Effect

Tannins	Gastrointestinal effect
Resin	Antibacterial
Glycosides	Antibacterial
Alkaloid	Anesthetic

1.1.7 Thrombolytic activity of medicinal plants

Medicinal plants plays a great role in thrombolytic activity. As soon as possible, solving the problem of clot is the major work of thrombolytic activity. It helps the heart to restart the flow of the blood. It also helps to prevent heart damage. It also helps to stop heart attacks. Some plants have great thrombolytic activity. Those plants are -

- *Curcuma longa*
- *Nigella sativa*
- *Flemingia*
- *Tamarindusindica*
- *Flemingia congesta*

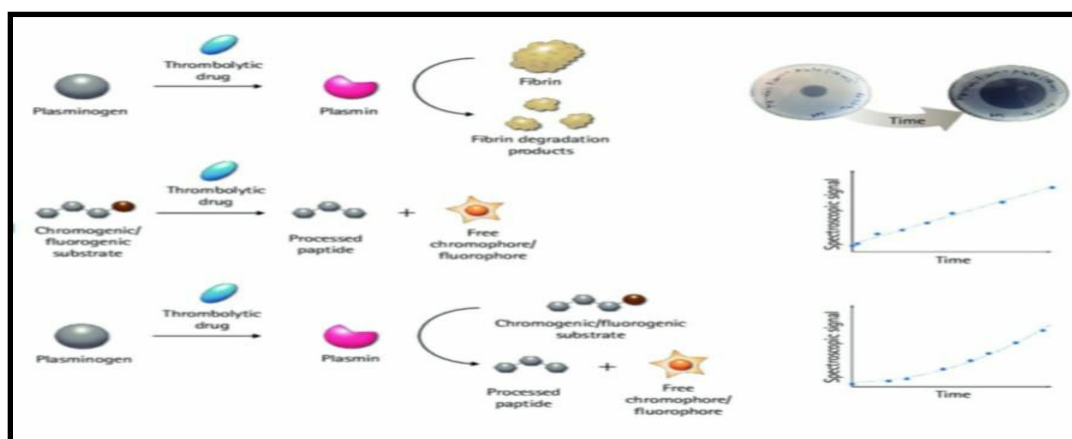


Figure 17: Thrombolytic Activity (Nikitin et al., 2021)

1.1.8 Thrombolytic activity of crude drug in Bangladesh

Thrombolytic activity deals with the treatment of dissolving dangerous clot. The medicinal plants help to dissolve clot. Plant helps to improve the flow of blood. Plants help not only blood clot but also prevent the tissue which are damaged. Several plants that help in dissolving clot problem -

Table 3: Dissolving Clot lysis (Mazid et al., 2012)

• <i>Tamarindus indica</i> plants which belong to the <i>Fabaceae</i> family help in thrombolytic activity.
• <i>Flemingia congesta</i> is a plant which belongs to the <i>Fabaceae</i> family and also helps in thrombolytic activity.
• <i>Lawsonia nermis</i> is a plant which belongs to the <i>Lythraceae</i> family is another one which helps in thrombolytic activity
• <i>Mesuanagass arium</i> is a plant that consists of the family of <i>Chusiaceae</i>.

1.1.9 Mechanism of action of Thrombolytic activity

Thrombolytic acts directly or it can be work indirectly. It converts to plasminogen either directly or indirectly. Then it turns to cleavage lysis. At higher frequency happens in the time of clot dissolution and reperfusion. It happens because the therapy is initiated fastly after clot formation happens. For lysis thrombosis thrombolytic is the only one drug. They mainly work as a facilitating conversion of plasminogen which later turns to plasmin. It is a protease which is non specific. Especially it helps in digestion of fibrin clots.

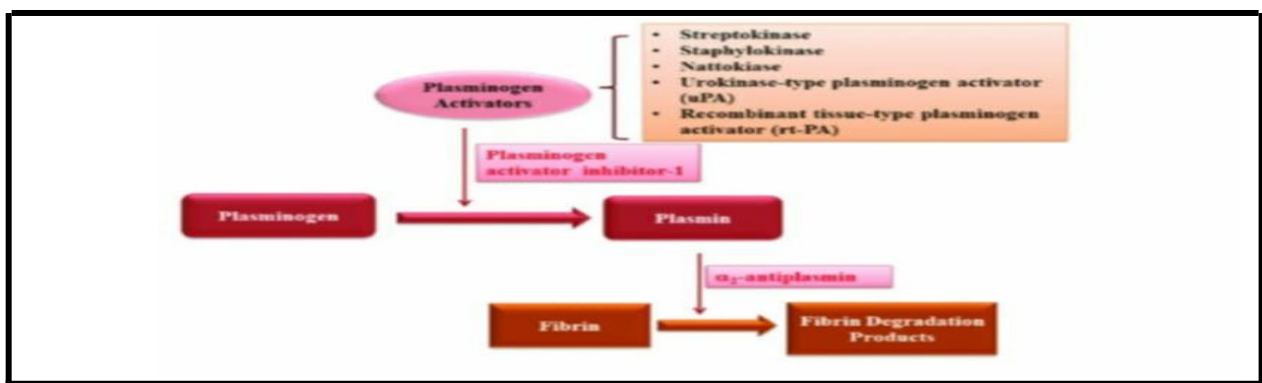


Figure 18: Mechanism of Thrombolytic Activity (Altaf et al., 2021)

1.1.10 Work process of thrombolytic activity

Thrombolytic properties are one of the clot busting drugs. It dissolves blood clots in such a way that blood flow. It is an enzyme that removes the process of breaking down proteins. It is quickly dissolving the clot problem if the problem can be major. It is important for solving the problem of damage to the heart muscle. It is useful for blood flow to restart. It can solve the problem of major heart attacks. Thrombolytic treatment is very popular for many diseases. For repairing the ischemic damage thrombolytic treatment is used. The thrombolytic treatment is also known as fibrinolytic therapy. It is useful for intravenous clot which is very dangerous. There are three main types found in thrombolytic drugs. They are

streptokinase, urokinase, tissue plasminogen activators. They all are useful for breaking down clots. Besides, tissue plasminogen activators are more specific in the problem of clot. Not only these but also some side effects are seen in tissue plasminogen activators. Thrombolytic agents activate the system. This is by the help of an enzyme which is inactive and the enzyme is called proenzyme. Besides, the help of plasminogen, an active enzyme which is called plasmin.

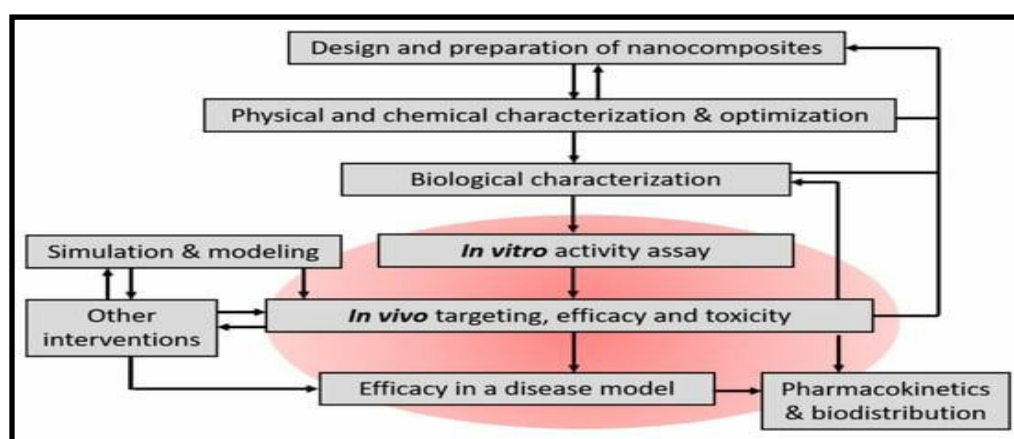


Figure 19: Thrombolytic work process (Ma et al., 2019)

The enzyme plasmin helps in degradation of fibrin. Lyse thrombi are done by the help of thrombolytic which is the only drug that actually does this. The main principle of thrombolytic activity is to facilitate conversion with the help of plasminogen to plasmin. The plasmin is a protease which is non specific. In the present time the most occurred cardiovascular diseases are stroke, myocardial infarction and also thrombosis in vein. The problem happens because of a block in the blood vessels (Fuster et al., 1992; Gao et al., 2021; Rodriguez and Harrington, 2021; Xue et al., 2021). Now -a - days one of the main problems is blood clotting. This happens by thrombus that hinder the blood flow by blocking the vessel. Besides, it also deprives the oxygen and also the normal blood flow. Thrombolytic drugs dissolve the thrombin by occluding coronary arteries for restoring blood supply in the ischemic myocardium. This is done for limiting necrosis and also improving prognosis (Laurence et al., 1992).

Thromboembolic disorder is one of the main problems in mortality and morbidity in Bangladesh like other developing countries. One of the problems that happens because of that is blood clot. (Islam et al., 2013). For solving the problem use some thrombolytic agents like anistreplase, streptokinase, urokinase, alteplase etc. (Collen et al., 1990). Thrombolytic drugs are the prolong of the half life. It enhances drug penetration and its precise targeting capability. Besides, the thrombolytic activity also reduces the hemorrhagic complication.

1.1.11 Effect of thrombolytic activity in dissolving clot

Thrombolytic drugs help in improving the ventricular function and reduce the mortality. After diagnosis of myocardial infarction the patient needs to give it immediately. It has no value if it gives in delay to the patient. Some fibrin thrombolytic drugs are alteplase, reteplase, tissue plasminogen activators. Some non- fibrin thrombolytic drugs are urokinase, anistreplase, streptokinase etc. Non fibrin drugs are bound with circulating and non circulating plasminogen. On the other hand fibrin specifically binds to plasminogen at the surface of fibrin. Thrombolytic drugs have an effect which is direct that dissolves the existing thrombus. Besides, it is used for the treatment of thrombosis. First generation thrombolytics are urokinase and streptokinase

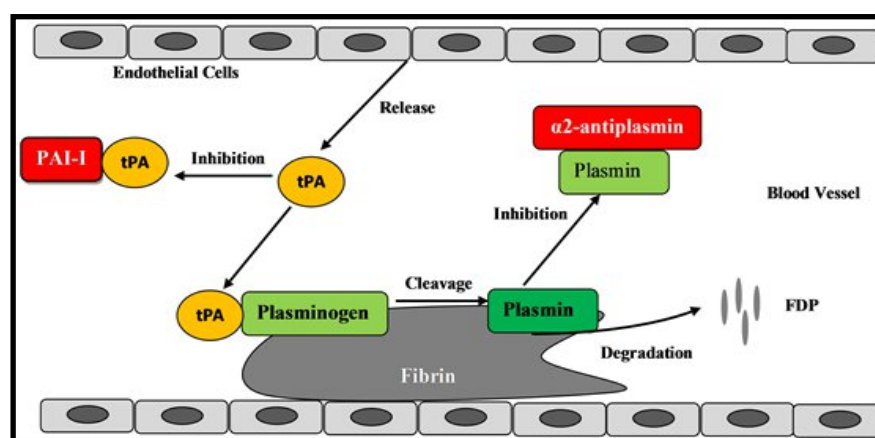


Figure 20: Dissolving Clot lysis (Hossain et al., 2019)

They are widely used for human thrombolytic proteins. This process is called the recombine technique. Alteplase and reteplase belong to short lives. Besides, they are compounds which have high clearance. This clearance totally depends on the hepatic blood flow. It is closely related to myocardial infarction which influences the blood flow of the liver. Not only these but also they are related to reteplase and alteplase. The other one is streptokinase. It is less dependent on the blood flow and renal excretion. It is administered by double bolus injection. If the shape and plasma concentration curve have the knowledge then there is a pharmacokinetics difference between them. In dose and dosage schedule can be seen in the clinical difference in the recombinant thrombolytic drugs. There is a relationship between the plasma and the final effect of the thrombolytic drugs. Its main concern is a multitude of other factors than plasma concentration. It shows the therapeutic effect of the thrombolytic drugs. Tissue plasminogen activator is a serine protease which regulates many other physiological processes. It can regulate neuronal migration, long term potentiation, synaptic plasticity etc. 5% to 10% proximal large vessel occlusion is the rate of alteplase mediated recanalization (Emberson et al., 2014). These modalities are not only costly but also have some side effects. Patients who need surgery are not able to use it. Patients need cheap and healthy anti-thrombolytic agents. There are several disorders that can be seen that happen because of immobility, pregnancy, cancer, surgery etc.

1.2 Exploration of *N. fruticans* Wurmb

N. fruticans are popular as nipa palm . In some places it is also known as mangrove. The species has only one member. The leaves and the flower stalks grow above the surface. In the ground the trunk grows under the ground. The *N. fruticans* produce woody nuts. Fruit is made of many seed segments. *N. fruticans* are worldwide distributed in the Eocene, it is in deposits from

polar latitudes. It is a slow- moving tidal which brings in nutrients. They are commonly found in rivers and coasts. In the environment the palm will survive for a short time dying. There are several uses of *N. fruticans*. Feathery leaves are used as roof material which are used by local people. Basketry and thatching are made by it. Fruit clusters are made by unripe fruits . It is very popular for its sweetness. Vinegar is also made from it. Sometimes sugar, alcohol and cake are made from the flower of *N. fruticans*. It is commonly used in biofuel. In the fermentation process it is used for the fermentation into ethanol or butanol. It is commonly used in sap production. It produces both fuel and food simultaneously.

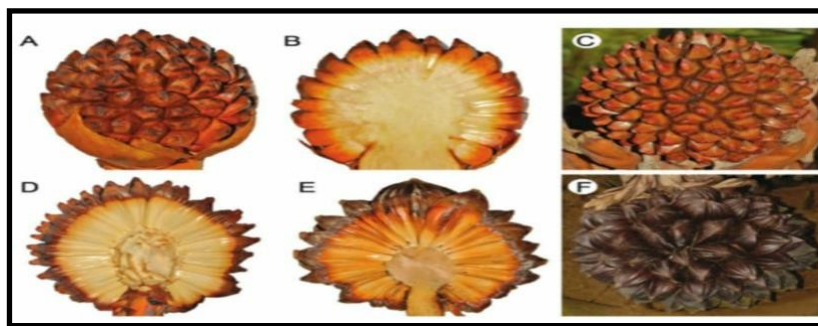


Figure 21: *N. fruticans* Wurmb (Bobrov et al., 2012)

1.2.1 Taxonomical Classification

Table 4: Taxonomical Classification (Vinit K et al., 2018)

Kingdom : Plantae
Division : Tracheophytina
Subdivision : Spermatophytina
Class : Magnoliopsida
Superorder : Lilianae

Order : Arecales
Family : Arecaceae
Genus : <i>Nypa</i>
Species : <i>N. fruticans</i> Wurmb

1.2.2 Distinct names of *N. fruticans* Wurmb

Different countries have different names for *N. fruticans* Wurmb. It is introduced in China, Bangladesh, England, Myanmar, Indonesia etc country in separate names. There are some names of *N. fruticans* Wurmb based on different countries:

- Bangladesh : Golpata
- India : Gulga
- China : Shui ye
- Sri Lanka: Gin pol
- Australia : Nipa palm



Figure 22: Golpata (Prasas et al., 2013)

1.2.3 Description of *N. fruticans* Wurmb

N. fruticans have several parts. All parts used for the medicinal purpose. It has roots, fruits, flowers, leaves, seeds etc. All parts of the plants described are -

- **Roots** - Roots are one of the important parts of the plants. The roots of *N. fruticans* are lighter, fibrous etc. It protrudes from the surface of the soil.
- **Flowers** - Flowers also one of the main parts of *N. fruticans*. It is the globular inflorescence. Woody nuts are produced from the flowers of *N. fruticans*.
- **Fruits** - The fruits of *N. fruticans* are the color of brown to dark brown. The fruits are shaped like a reversed egg. The size of the fruits is 8-11.
- **Leaves** - Leaves are one of the best useful parts in *N. fruticans*. For preparing the thatching, umbrellas and bags the leaves of *N. fruticans* are used. For fuel and arrows the leaves of *N. fruticans* are also used.
- **Pulp** - Pulp is another important part of *N. fruticans*. Pulp is covered by the hard shell. It also consists of cellulose. Pulp is used for many important works. The pulp is also used for the treatment of many diseases. The process of extraction of pulp from the plant is difficult. Several steps need to be followed for extraction pulp from the plants.

1.2.4 Distribution and Habitat of *N. fruticans*

The temperature of *N. fruticans* is 20-35°C and the level of N. fruticans is 1000 mm/ month. It is a mangrove plant. From all the plants of the Arecaceae family they are the only palm that can survive in the mangrove situation. *N. fruticans* can be seen in many countries. Each country has different names. They are very popular for their use. The plants *N. fruticans* are found in the country of Myanmar, Bangladesh, Malaysia, Sri- Lanka, Australia etc.

1.2.5 Secondary metabolites of *N. fruticans*

For finding the primary and secondary metabolite the method used a lot is the phytochemical method. By the help of primary metabolite plants development and growth happen. Secondary metabolites are known as bioactive substances. Secondary substances are those substances that help to protect plants from any critical situation (Yahaya et al. 2021). The phytochemical that are found in *N. fruticans* Wurmb are -

Table 5: Conformation of N.fruticans (Yahaya et al. 2021)

Water	13.57%
Protein	7.04%
Carbohydrates	61.53%
Maleic Acid	1.8%
Energy	106 Kcal

1.2.6 Medicinal Use

N.fruticans helps a lot in many diseases. It has the ability to antioxidants, anti inflammatory, analgesic etc (Nugroho et al., 2020). It has no side effects in ancient use. Several medicinal uses of *N. fruticans* Wurmb are -

Table 6 : Medicinal Use (Nugroho et al., 2020)

• Nipa palm vinegar are used for the use of antidiabetic
• Nipa palm sap are widely used for the treatment

- | |
|--|
| <ul style="list-style-type: none"> • Leaves are used for the treatment of ulcers |
| <ul style="list-style-type: none"> • Burnt nipa makes ashes that are used for the treatment of toothaches |

1.2.7 Aim of the experiment

For the evaluation of thrombolytic activity effect *N. fruticans* Wurmb are used.

1.3 Rational of the Study

The study is about to investigate thrombolytic activity in *N. fruticans*. The present study also indicates some secondary metabolites like tannins, melaic acid, carbohydrates etc are also responsible for the thrombolytic activity of *N. fruticans* fruit pulp methanolic extract.

1.4 Objective of the study

The main objective of the study is about the investigation of thrombolytic activity effect in *N. fruticans* Wurmb pulp. It determines whether the pulp can be useful for the treatment of clot. It helps to understand whether the pulp of *N. fruticans* Wurmb can be used for the treatment of heart damage, better blood flow and clot problem. Besides, the study also deals with the safety and quality of the treatment by the pulp.

Furthermore, the investigation also leads to whether the mechanism of action can be responsible for the thrombolytic activity by *N. fruticans* Wurmb. It is helpful for the treatment of dangerous blood clots. It especially helps to make better blood flow so that the clot problem can be resolved. Phytochemical identification also helps in the clot lysis which helps to find if

the pulp of *N. fruticans* can be helpful for treatment. Lastly, comprehensive study is about the scientific basis which leads to solving the problem of damaged tissue and organs.

1.5 Literature Survey of *N. fruticans*

Several analyses were done by *N. fruticans* to investigate the use of plant parts. Different parts have different pharmacological effects. Some analysis of *N. fruticans* Wurmb are -

Table 7: Literature Survey of *N. fruticans* (Mitra et al., 2024)

Fitri at 2023 investigates the antihyperglycemic effect of <i>N. fruticans</i> with the help of phenolic and flavonoid
Mitra in 2024 investigates cancer by the help of phytochemicals that consist of the <i>N. fruticans</i>
Zumbroich at 2020 analysis about ashes of the shell whether it has the effect in blackening teeth
Park at 2022 deals with the anti-inflammatory effect by the help of <i>N. fruticans</i> Wurmb.

1.6 Future Aspects of *N. fruticans*

As there is no experiment on thrombolytic activity which is exerted from *N. fruticans* Wurmb, this experiment helps a lot to understand a lot about it. There are several research scope by the help of *N. fruticans* Wurmb about the thrombolytic activity. This experiment helps a lot to understand the problem of clot lysis. Phytochemical compounds help a lot to understand the damage dissolving process. Besides, the experiment helps to understand about the

therapeutic effect of *N. fruticans*. The main theme of this study is to gain knowledge about the therapeutic effect of *N. fruticans*. As the *N. fruticans* Wurmb are closely dealt with the activity of thrombolytics which dissolve the problem of clot and makes better blood flow.

Chapter 2

Materials and Methods

2.1 Collection and Identification

N. fruticans were collected from Sundarban in the summer season which have been deposited for further references in Bangladesh National Herbarium, Dhaka (DACB Accession number : 42,861). In summer it is available in Sundarbans. It helps as a medicinal plant for doing the experiment of thrombolytic properties. At first fruit was taken from the *N. fruticans* tree. Then it was cleaned properly, cut into small pieces as it is important for doing the experiment. Air-dried was applied to dry the *N. fruticans*. It was done in several days. Lastly it was dried in the oven at 37° C by grinding it to facilitate size reduction. It was preserved for further use in a close container which was at 37°C.

2.2 Preparation and extraction of plant material

At first *N. fruticans* was collected from the tree after that the fruit pulp was separated. Then the part was dried up and the pulp was extracted by using methanol. By using cold maceration technique the extraction was done. At room temperature powder portions of the plant were soaked in 2500 ml with the help of methanol. That was done for 10 days with occasional stirring. By using Whatman's filter paper the solution was filtered through filter cloth. The

concentration designated as MFF was filtrate obtained and it was done by using the evaporation method which was under the ceiling fan and also the water bath which was below 37°C temperature.

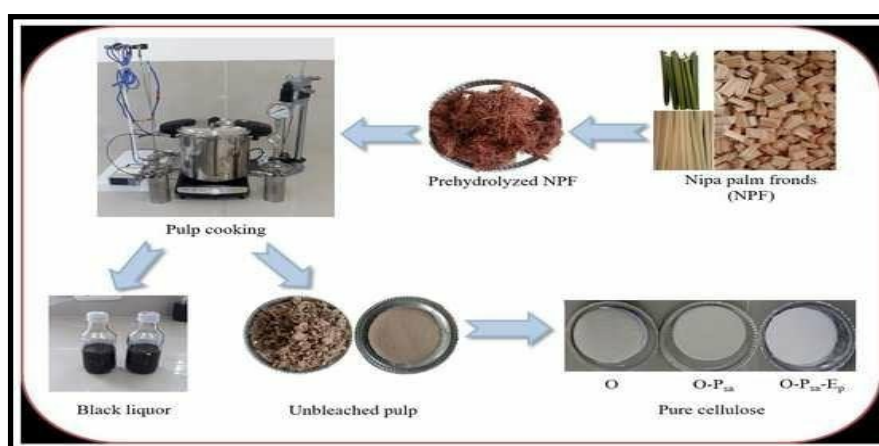


Figure 23: Preparation process(Evelyn et al., 2022)

2.3 Thrombolytic activity test

For doing the experiment streptokinase was used as a standard. Streptokinase was collected from a pharmaceutical company in Bangladesh . The value of streptokinase was 15,00,000 I. U. Sterile distilled water was added which was 5ml in the streptokinase vial and it was mixed properly for doing the experiment. For doing in vivo thrombolysis suspension 100µl which is 30,000 I.U. was used in the process (Prasad et al., 2007)

2.4 Preparation of sample

Streptokinase is used as a reference standard for evaluating the *N.fruticans* of the thrombolytic activity. For doing the experiment using 100 mg of MEF of *N.fruticans* was dissolved. It is done by using 10 ml of methanol and distilled water. It was done by keeping it overnight and lastly decanted and filtered was done to the soluble supernatant .

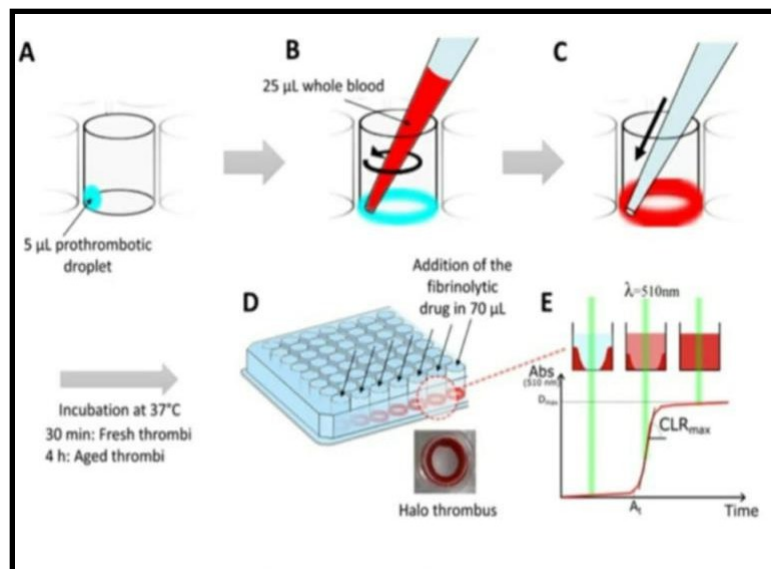


Figure 24: Preparation of Sample (Bonard et al., 2017)

2.5 Blood sample

From healthy volunteers blood samples were collected. The blood samples were collected by using aseptic conditions without anticoagulant therapy. For forming clot 1 ml of blood was transferred to the weighted microcentrifuge tubes. All the protocol was approved by the ethical committee.

2.6 Procedure

From each volunteers 5 ml of venous blood were collected that was taken separately from a weighted sterile microcentrifuge tube. It was incubated at 37° C and the time was 90 minutes. From the micro centrifuge tube fluid was released properly when the clot was formed. Then determine the weight of the clot that was done by subtraction weight of the clot containing the tube from the weight of the tube. Streptokinase 100ml was used for positive control and non thrombolytic was used for the negative control. Later in the micro centrifuge 100 ml distilled water with the help of each sample were added separately. For 90 minutes at the 37°C tubes were put in the incubator and that was done for observing the clot lysis. Then discarded was done by the released fluid. This process was done after incubation. After doing the clot disruption to observe the difference again we weighted the tube. Lastly, clot lysis was determined for doing the experiment. Clot lysis was done by using the following process -

$$\% \text{ of clot lysis} = (\text{weight of released clot} \div \text{clot weight}) \times 100$$

2.7 Ethical Approval

The Southeast University's (Dhaka, Bangladesh) Pharmacy Department's Ethical Committee approved the study protocol (approval number: SEU/Pharm/CERC/113/2024). Before their blood samples were drawn, every participant (n=5) in the study completed and signed a written consent form.

2.8 Statistical analysis

By using the SPSS version 28.0 (SPSS Inc. Chicago, IL. USA) the analyzes were done by the obtained data. The obtained value was analyzed by using mean $\pm$ SEM. One- way ANOVA was used for the analyzed data. By using one-way analysis of variance the test was done which followed the Dunnet's test. For statistical significance the value was considered $p < 0.05$.

Chapter 3

Results

3.1 Result of Dunnet's Test

The thrombolytic activity results are shown in the table. From the table it is clear that the plant *N. fruticans* fruit pulp extract has some secondary metabolites like tannins, melaic acid, carbohydrates etc. Besides, it can be predict that *N. fruticans* has thrombolytic activity which can be the reason of phytochemical.

Table 8: Result of thrombolytic activity by following Dunnet's Test

Sample	% of lysis
Water (Control)	17.83±0.5
Streptokinase (Standard)	43.96±0.99**
NFP	27.83±0.89*

The values are demonstrated as mean ± STD (n= 3) ; One- Way Analysis of Variance (ANOVA) followed by Dunnet's test. *P<0.05, **P<0.01 significant compared to the control.

Chapter 4

Discussion

From the experiment it is clear from the comparison of positive control with negative control that clot dissolution doesn't happen when water is added to the clot. Lastly, after treating clot the exact same with *N. fruticans* noticed an important activity which is thrombolytic activity. For getting the expected result used positive control that was compared with different concentrations. The same way with the negative control and lastly shows an significant thrombolytic activity by the test. The methanolic extract *fruit pulp N. fruticans* shows thrombolytic activity by doing the in vitro test. Besides, photochemical analysis also shows different result which prove that methanolic extract tannins, melaic acid, carbohydrates etc are the responsible for clot lysis activity.

For treatment of many diseases humans are totally dependent on plants. Nowadays phyto pharmacological investigation has made a new field in the for discovering plant that helps to derive drugs. 30% of pharmaceuticals are created from the plant derived that is now estimated to all (Leta et al., 2002). Platelet plays an important role . Platelet bonds bind to leukocytes that form an intricate process that helps to develop plaque. The experiment is about to investigate the thrombolytic activity of the *N.fruticans* which is a medicinal plant that is available in Bangladesh. Streptokinase is used as a positive control which is well known for thrombolytic drugs (Prasad et al., 2007). So from the experiment it is easy to understand that when water is added in a clot, the clot dissolution does not happen and the result shows by checking the NFP value that it has thrombolytic activity.

Chapter 5

5.1 Conclusion

In the study methanolic extracts of *N. fruticans* fruit pulp shows different components which are tannins, carbohydrates, maleic acid, flavonoids etc. The fruit pulp extracts are also shows thrombolytic activity (in Vitro) that can be the reason of phytoconstituents in the methanolic extract. From the study it is clear that the plant has significant implication in the field of thrombolytic. The study also shows the possibility of developing drug from *N. fruticans*. Besides, all these the study also indicating that the extract should be investigated pharmacologically and phytochemically for its better pharmaceutical use and potential of medicine. Lastly, by using the medicinal plant *N. fruticans* can be more developed in the sector of thrombolytic properties.

5.2 Future Anticipation

As there is not enough research about the thrombolytic activity of *N. fruticans*. For these reasons the experiment is done. Till now not enough work was done on thrombolytic activity. But I hope that in the future there will be enough scope to work on it. By using *N. fruticans* we can easily develop in the medicinal sector which helps to save people's life. Besides, for evaluating advantage and several applications of *N. fruticans* several departments like microbiology, anatomy, biochemistry also can collaborate with this field. Lastly, for better treatment and development in the medicinal sector need more experiments in the medicinal plants of *N. fruticans* Wurmmb.

References

- Laurence, DR., Bennett, P.N., Evaluation of thrombolytic potential of three medicinal plants available in Bangladesh, as a potent source of thrombolytic compounds. *National Library of Medicine*. 1992.[Google Scholar].
<https://www.scirp.org/reference/referencespapersreferenceid=96957>
- Islam, AK., Majumder, AA., Coronary artery disease in Bangladesh: A review. *IndianHeartJ*. 2013;65:424–35. [PubMed] [Google Scholar].
<https://pubmed.ncbi.nlm.nih.gov/23993003/>
- Collen D. Coronary thrombolysis: Streptokinase or recombinant tissue-type plasminogen activator? *AnnInternMed*. 1990;112:529–38. [PubMed] [Google Scholar].
<https://pubmed.ncbi.nlm.nih.gov/2107781/>
- Fuster, V., Badimon, L., Badimon, J. J., and Chesebro, J. H. (1992). The pathogenesis of coronary artery disease and the acute coronary syndromes. *NewEng. J. Med*. 326, 242–250. <https://pubmed.ncbi.nlm.nih.gov/1728735/>

Emberson J, Lees KR, Lyden P, Blackwell L, Albers G, Bluhmki E, et al. Effect of treatment delay, age, and stroke severity on the effects of intravenous thrombolysis with alteplase for acute ischaemic stroke: a meta-analysis of individual patient data from randomized trials. *Lancet*. 2014;384:1929–1935.[PubMed][Google Scholar].
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4441266/>

Vanwagenen BC, Larsen R, Cardellina JH, Randazzo D, Lidert ZC, Swithenbank C. Ulosantoin, a potent insecticide from the sponge *Ulosaruetzleri*. *JOrgChem*. 1993;58:335–337. [Google Scholar].
<https://www.semanticscholar.org/paper/Ulosantoin%2C-a-potent-insecticide-from-the-sponge-Vanwagenen-Larsen/7e0ff4201680fb626ae5b9ead9f4eb9304496c20>

Prasad S, Kashyap RS, Deopujari JY, Purohit HJ, Taori GM, Dagainawala HF. Effect of *Fagoniaarabica* (Dhamasa) on in vitro thrombolysis. *BMCComplementAltern Med*. 2007;7:36. [PubMed] [Google Scholar].
<https://bmccomplementmedtherapies.biomedcentral.com/articles/10.1186/1472-6882-7-36>

Leta GC, Mourao PAS, Tovar AMF. Human venous and arterial glycosaminoglycans have similar affinity for plasma low-density lipoproteins: *Biochim. BiophysActa*. 2002;586:243–253. [PubMed] [GoogleScholar].
<https://pubmed.ncbi.nlm.nih.gov/11997076/>

Kunsten, Genootschap, Batav, Verh. Nypafruticans Wurmb. *Powo.Science. kew.org*. 1:349 (1779). <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:668507-1>

Numbere, O., A., Mandingo, E., J., Scenarios of Nypafruticans Invasion: Impacts and Management Strategies in West and Central Africa. *J.ofCoastalResearch*. 39(1): 114-128(2022). <https://bioone.org/journals/journal-of-coastal-research/volume-39/issue-1/JCOASTRES-D-22A-00012.1/Scenarios-of-Nypa-fruticans-Invasion--Impacts-and-Management-Strategies/10.2112/JCOASTRES-D-22A-00012.1.short>

Eddy, S., Taufik, M., Setaawan, A., A., Utomo, B., Oktavia, M., Study of population distribution and benefits of Nipah (Nypafruticans). *E3SWebofConferences*. 475, 02007(2024). https://www.e3sconferences.org/articles/e3sconf/abs/2024/05/e3sconf_incasst2024_02007/e3sconf_incasst2024_02007.html

Siddique, H., Bangladeshi Medicinal Plants : Ethnopharmacology, Phytochemistry and Anti-Staphylococcal Activity. *School of Health,SportandBioscience*. 2019. https://repository.uel.ac.uk/download/93773951735855e7ca5f0e7bccba5c56b2e2c0d648b93f34ccfcf26d2d0f9bed/5260323/2019_PhD_%20Siddique.pdf

Rahmatullah, M., Khatun, Z., Barua, D., Alam, M., Jahan, S., Jahan, R., Medicinal Plants Used by Traditional Practitioners of the Kole and Rai Tribes of Bangladesh. *TheJournal of AlternativeandComplementary*. Vol. 19, No.6 (2013). <https://www.liebertpub.com/doi/abs/10.1089/acm.2012.0227>

Rahman, M., A., Traditional Medicinal Plants in the treatment of Important Human Diseases of Joypurhat District, Bangladesh. *Research Journal of Pharmaceutical Biological and Chemical Sciences*. 2(1):21-29.
https://www.researchgate.net/publication/288832434_Traditional_Medicinal_Plants_in_the_treatment_of_Important_Human_Diseases_of_Joypurhat_District_Bangladesh

Chaudhary, S., Godatwar, K., P., Sharma, R., In vitro thrombolytic activity of Dhamasa (*Fagonia arabica* Linn.), Kushta (*Saussurea lappa* Decne.), and Guduchi (*Tinospora cordifolia* Thumb. *National Library of Medicine*. 2015.36(4):421-424.
https://journals.lww.com/aayu/fulltext/2015/36040/in_vitro_thrombolytic_activity_of_dhamasa_fagonia.13.aspx

Felson, S., Thrombolysis, *WebMD*. 2023. <https://www.webmd.com/stroke/thrombolysis-definition-and-facts>

Prasad, S., Kashyap, S., R., Dagainawala, F., H., Development of an in vitro model to study clot lysis activity of thrombolytic drugs. *Thrombosis Journal*. 14 (2006).
<https://thrombosisjournal.biomedcentral.com/articles/10.1186/1477-9560-4-14>

Maqsood, M., Mushtaq, Z., Rasheed, T., Nisa, U., Z., Sher, F., Thrombolytic and cytotoxic activity of different bioactive extracts of *E. coli*. *ScienceDirect*. 2021.
<https://www.sciencedirect.com/science/article/pii/S2666016421000025>

Tabassum, F., Chadni, H., S., Mou, N., K., Hasif, I., K., Ahmed, T., Akter, M., In- vitro thrombolytic activity and photochemical evaluation of leaf extracts of four medicinal plants of Asteraceae family. *Journal of Pharmacognosy and Phytochemistry*. 6(4):1166-1169. 2017.
<https://www.phytojournal.com/archives/2017/vol6issue4/PartQ/6-4-135-559.pdf>

R., S., Saravanan, R., Pemiah, B., Ramalingam, S., Thrombolytic Activity of Punicagranatum Fruit and Peel Extract. *Asian Journal of Pharmaceutical and Clinical Research*. Vol 9, Issue 1, 2016.
<https://journals.innovareacademics.in/index.php/ajpcr/article/download/8004/3723/33431>

De- Hond, I., A., Castillo, D., D., M., In. Traditional Medicine. *ScienceDirect*. 2019.
<https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/traditional-medicine>

Zhao, L., Terry, D., P., Traditional medicine provides health care to many around the globe – the WHO is trying to make it safer and more standardized. *The Conversation*. 2023.
<https://theconversation.com/traditional-medicine-provides-health-care-to-many-around-the-globe-the-who-is-trying-to-make-it-safer-and-more-standardized-212502>

Borkatulla, B., Ferdous, J., Uddin, H., A., Mahmud, P., Bangladeshi Medicinal Plants Dataset. *National Library of Medicine*. 48:109211.(2023).
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10294007/>

Hoareau, L., DaSilva, J., E., Medicinal plants: a re-emerging health aid. *ElectronicJournal of Biotechnology*. Vol 2, No 2, 1999.

https://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0717-34581999000200002

Christodoulou, M., Medicinal Herbs in Ancient Greece. *TheNationalHerald*. 2019.

<https://www.thegreekherbalist.com/herbalcolumn/medicinalherbsinancientgreece>

Shahrajabin, H., M., Sun, W., Chinese Medicinal Plants with Antiviral Activities for Treatment of the Common Cold and Flu +. *BiologyandLifesciencesForum*.

26(1), 27(2023). <https://www.mdpi.com/2673-9976/26/1/27>

Ergil, V., K., Kramer, J., E., Ng, T., A., Chinese Herbal Medicine. *NationalLibrary of Medicine*. (2002). 176(4):275-279.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1071750/>

Algethami, A., Hawkins, A., J., Toneu, T., I., Medicinal plants used by women in Mecca: urban, Muslim and gendered knowledge. *Journal of EthnobiologyandEthnomedicine*.

62(2017). <https://ethnobiomed.biomedcentral.com/articles/10.1186/s13002-017-0193-4>

Davis, C., C., Choisy, P., Medicinal Plants meet modern biodiversity science. *ScineceDirect*. Volume 34, Issue 4 (2024).

<https://www.sciencedirect.com/science/article/pii/S0960982223017384>

Manzaro, S., E., Cardenas, G., A., J., Agugliaro, M., F., Worldwide Research Trends on Medicinal Plants. *NationalLibrary of Medicine*. 17(10) :3376. 2020.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7277765/>

Miraldi, E., Baini, G., Medicinal plants and Health in human history: From Empirical use to modern phytotherapy. *PagePressJournals*. Org. Vol 10, No. 1(2018).

<https://www.pagepressjournals.org/jsas/article/view/8529>

Hossain, S., Sarkar, B., Prottoy, I., N., M., Araf, Y., Taniya, A., M., Ullah, A., M., Thrombolytic Activity, Drug Likeness Property and ADME /T Analysis of Isolated Phytochemicals from Ginger (*ZingiberOfficinale*) Using In Silico Approaches. *ScientificResearch*. Vol. 8, No. 3 (2019).

<https://www.scirp.org/journal/paperinformation?paperid=95726>

Nikitin, D., Choi, S., Mican, J., Toul, M., Ryu, W., Damborsky, J., Mikulik, R., Kim, D., Development and Testing of Thrombolytics in Stroke. *NationalLibrary of Medicine*. 23(1) : 12-36. 2021. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7900387/>

Rivera- Bou, L., W., Faaem, M., Facep. Thrombolytic Tgerapy. *TheHeart*. Org. *Medscape*. 2021. <https://emedicine.medscape.com/article/811234-overview?form=fpf>

Kovacs, B., I., Yamamoto, J., Spontaneous Thrombolysis: A Forgotten Determinant of Life or Death. *Journals. Sagepub. Com.* 2006.

<https://journals.sagepub.com/doi/pdf/10.1177/1076029606291410>

Zamanlu, M., Eskandani, M., Mohammadian, R., Entekhabi, N., Rafi, M., Fardoushi, M., Spectrophotometric Analysis of Thrombolytic Activity: SATA assay.

National Library of Medicine. 2018; 8(1) : 31-38.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5915706/>

Kunwar, B., Jain, V., Verma, K., S., In Vitro Thrombolytic Activity of Moringaoleifera.

Nusantara Bioscience. 2022. <https://smujo.id/nb/article/download/10589/5650>

Aslanabadi, N., Safaie, N., Talebi, F., Dousti, S., Maleki, E., T., The Streptokinase Therapy Complications and its Associated Risk Factors in Patients with Acute ST Elevation Myocardial Infraction. *National Library of Medicine.* 17 (Suppl): 53-63. 2018.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5958324/>

Nugroho, D., G., Wiraatmaja, F., M., Pramadaningtyas, S., P., Febriyanti, S., Review :

Phytochemical Composition, Medicinal Uses and other utilization of *N. fruticans*.

Research Gate. 2022.

https://www.researchgate.net/publication/370509589_Review_Phytochemical_composition_medicinal_uses_and_other_utilization_of_Nypa_fruticans

Hossain, F., M., Utilization of mangrove forest plant: Nipa Plam (Nypa fruticans wurmb).

American Journal of Agriculture and Forestry. 3(4) : 156. 2015.

https://www.researchgate.net/publication/282451676_Utilization_of_Mangrove_Forest_Plant_Nipa_Palm_Nypa_fruticans_Wurmb

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Abstract

The onset of ischemic heart disease and stroke is significantly influenced by abnormal thrombosis. Despite their effectiveness, synthetic thrombolytic drugs have certain drawbacks. Hence, there is a need to create anti-thrombotic medications that are relatively safer and made from natural resources like plants. The current study serves as a foundational study for these initiatives. This study¹ was carried out to investigate the thrombolytic activity of fruit pulp of *Nypa fruticans* wurmb, a plant prevalent in the tropical regions of Bangladesh which parts are utilized for a wide range of medical purposes. Methanolic extract of *N. fruticans* fruit pulp (NFP) was used for the in vitro clot analysis assay with human blood samples. The percent clot lytic activity of NFP extract was compared with water ($17.83 \pm 0.05\%$, negative control) and streptokinase ($43.96 \pm 0.99\%$, standard). Compared to the positive and negative controls, the investigated extract's clot-dissolving ability shown a noteworthy $27.83 \pm 0.89\%$, according to the study. Nevertheless, comprehensive clinical trials and the identification of bioactive anti-thrombotic chemicals are necessary to establish the thrombolytic efficacy of its fruits in vivo. The present study found that *Nipa* fruit pulp possesses thrombolytic potential, suggesting that using it as a dietary supplement could help prevent thrombotic cardiovascular problems.

¹Chapter 1

Introduction

1.1 General Introduction

Plants come from the kingdom of plantae. They are basically eukaryotes. Plants get energy from the sunlight that they use for preparing their foods. By using chloroplasts they can produce water and carbon dioxide. From the first of human civilization people have totally depended on plants for food and medicine. Plants help in the ecosystem as they maintain the balance in the ecosystem. From ancient to modern life we totally depend on plants for our daily needs. From all the plants some are also more important as they are medicinal plants. Medicinal plants have more popularity all over the world. Medicinal plants help in several diseases. Some medicinal plants are aloe vera, shatavari, gooseberry, garlic, rosemary, turmeric, neem, tulsi, pepper, ginger etc. From ancient times medicinal plants have been counted as the best home remedies. In the world 35,000 to 70,000 medicinal plants are found. From ancient times medicinal plants are more popular in the countries of India, China, Greece, Egypt etc.

Figure 1: Medicinal Plants (Ng'ok et al., 2023)

For the purpose of drugs, disinfectants and aromatic agents medicinal plants are used in the world. For novel drugs medicinal plants are used a lot. They develop a lot in the

therapeutic sector of therapy. For living organisms, plant parts are used. Some plant parts that are used for medicinal purposes are roots, seeds, flowers, fruits etc. Different countries used different medicinal plants as all are not available in the world. Some countries which are undeveloped like Asia, Africa use medicinal plants more than developed countries. Bangladesh is fertile and the climate is perfect for growing plants. In Bangladesh the use of medicinal plants is very popular. Most of the people of villages in Bangladesh are dependent on medicinal plants based home remedies. In Bangladesh most popular medicinal plants are shoeblackplant, basil, arjuna, gooseberry, neem, aloe vera, acorus calamus etc.

3 1.1.1 Definition of Medicinal Plants

8 Medicinal plants are used for the purpose of medicinal use. Medicinal plants are used in the seeds, barriers, roots, leaves, fruits and flowers for the purpose of medicinal use. Medicinal plants can be used by synthesis of drugs or it can be used for the purpose of therapeutic use. There are differences between non medicinal plants and medicinal plants. Medicinal plants are specially available to heal disease. Medicinal plants can develop the problem of cancer, diarrhea, cholera, hypertension etc.

Figure 2 :Therapeutic use of medicinal plants (Tanwar et al., 2023)

1.1.2 Use of medicinal plant in ancient sketch

Medicinal plants are most popular from ancient times. From the ancient time medicinal plants were widely used directly from animal or plant sources. For several diseases medicinal plants are used with the synthesis drug. Some sketch of traditional medicine

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At first pharmacopeia was compiled by Sheng Nun who was an emperor

Some important medicinal plants and their use are written by Elbert in the time of 1500 BC

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Figure 3:Medicinal plants in ancient times (Alwar et al., 2018)

400 remedies are written by Hippocrates. He is also popular as the father of modern medicine. The book he wrote was MateriaMedica.

HistoriaPlantarum is a book which is very popular for medical science written by Athens.

1.1.2.1 Some evidence related to medicinal plants

At first written evidence was found from Sumerian clay slab which was Nagpur. It was around 5000 years ago, when the evidence was found about medicinal plants.

Chinese and Egyptian plants were used for the purpose of making medicine at the time of 27 centuries BC. Later Greek scientists established The school of Medicinal Plants. In the book of MateriaMedica around 600 plants are found which were medicinal plants. Evidence of medicinal plants

Figure 4: Evidence of Herbal Medicine(Mukherjee et al., 2022)

Several traditional medicine are -

Chinese¹ Traditional Medicine

Korean Traditional Medicine

Indian Traditional Medicine

European Traditional Medicine

African Traditional Medicine

Arabian Traditional Medicine

1.1.2.2 Use of medicinal plants in Egyptian history

For health and medicine Egyptians were very famous. For the problem of gastrointestinal and urinary tract they used medicinal plants. They used sedative, analgesics for the treatment of gastrointestinal disorder. Besides, they also used some

medicines for common colds (Nunn JF, 1996). They used all the medicinal plants internally and topically. Ebers Papyrus wrote the ancient Egyptian. He wrote about 700 medicinal plants (Oakes e al., 2003). The popular medicinal plants in that time were garlic, juniper, cannabis, aloe vera etc.

Figure 5: Egyptian Medicinal Plants (Elsabbagh et al., 2023)

1.1.2.3 Use of medicinal plants in Greek History

Greek was popular from ancient times for its contribution in pharmaceutical science. 500 crude drugs that were used in Greek were written by Aristotle. Besides, 400 medicinal plants are written by Hippocrates. Claudius also wrote books about 300 medicinal plants. The most popular medicinal plants at that time in Greek were mint, fennel, olive, and saffron.

Figure 6: Greek Medicinal process (Christodoulou et al., 2019)

1.1.2.4 Use of medicinal plants in Chinese History

At the time of 2953 BC, Fu His discovered a special thing about medicinal plants that was an exogenous factor. Later it was developed and made some changes by Shen Nong and Hong Ti. Moreover, Chinese Pharmacopeia offered several remedies that were done by medicinal plants. Using tongue diagnosis Wang Tao also contributed a lot at that time in Chinese medicine by medicinal plants.

Figure 7: Chinese Medicinal process (Wang et al., 2018)

1.1.2.5 Use of medicinal plants in Indian History

In India home remedies were very popular by using medicinal plants. At that time the oldest system was Ayurveda. Ayurveda was very popular at that time in India. Rig-Veda describes the ayurveda system in India at that time. Ayurveda was called Knowledge of life in India. Some medicinal systems in India at that time were-

Ayurveda

Homeopathy

Siddha

Unani

Yoga and Neuropathy

Figure 8: Indian Medicinal process (Dhoke et al., 2014)

1.1.2.6 Use of medicinal plants in Arab History

Arab were most popular at that time for their contribution in medical science. For this reason Arab was called the golden period of medicinal plants. In Arab medicinal plants were very popular for several home remedies. They contribute to the pharmacy practice. They also translated the Greek and Roman books. At that time Ibn Sina contributed a lot to Arab medical science. He discovered drugs, poison, chemical construction etc. Chemicals also isolated by Jaber Bin Hanan at that time in Arab medical science.

Figure 9: Arab Medicinal process (Sari et al., 2007).

1.1.2.7 The use of medicinal plants in South and East Asia

South and East Asia were very popular in home remedies. For home remedies they used medicinal plants. Bangladesh, Bhutan, India, Myanmar, Nepal etc used different medicine systems. Some countries of South and East Asia used the system of ayurvedic, unani, chinese, siddha, yoga etc. Some medicinal plants systems that they used.

Table 1: Medicinal Plants System (Alam et al., 2007)

Bangladesh

Ayurvedic

India

Siddha, Yoga

Nepal

Ayurvedic

Bhutan

So-wa-rig-pa

Maldives

Dhivehi Beys

Myanmar

Chinese

Figure 10 : South and East Asia Medicinal process (Momo et al., 2022)

1.1.2.8 History of medicinal plants used in Bangladesh

From the 18th century Ayurvedic and Unani systems were very popular in Bangladesh. At the time of 1935, the modern medicinal system came to Bengal. It happens by the establishment of Calcutta Medical College. In the college they only help to practice unani and ayurvedic. In the mid 19th century Bangladesh made a great development in medical science. Dacca Medical School was established in the year 1874. After independence, Bangladesh developed a lot in medical science. Health is identified as a basic need after Independence of Bangladesh. Medicinal plants have made a huge change in the medical science in Bangladesh in the last two decades.

Figure 11: Medicinal Plants in Bangladesh (Uddin et al., 2023)

1.1.2.9. Modern epoch of medicinal plants

For new drugs production medicinal plants play a great role. The development of modern science happens because of medicinal plants. By the use of modern technology it is much easier to develop in the sector of modern medicine. Medicinal plants are now easy to collect, extract, and use in any pharmaceutical work by the help of modern technology. Around 15 compounds that were natural were derived at the time of 2000 to 2003. All these compounds were very popular and now they are at the phase iii clinical trial process. Natural products are more important than synthesis drugs. Natural products are 100 times higher than synthesis drugs. Besides, not all the molecules are able to discover and develop the drug. Only some are able to develop and discover drugs.

Figure 12: Medicinal Plants in Modern era (Akor et al., 2021)

1.1.3 Medicinal plants used in typical medicine

Nowadays chemical, clinical and pharmaceutical related drugs and study are totally dependent on medicinal plants. For making drugs most of the pharmaceutical companies used medicinal plants. Medicinal plants make our life easy. It helps a lot in our daily life. We can easily exact medicinal plants now. Most of the basis drug that used for typical medicine are-

Morphine that comes from the Opium poppy

Dioxin that comes from the foxglove

Quinine comes from the Cinchona bark.

Figure 13: Traditional Medicine (Sohel et al., 2022)

1.1.4 Natural compounds used for drug discovery

Discovering natural drugs for ancient way

For pharmaceutical purposes medicinal plants were collected. At first the plant materials for use in the future. Fractionated happened in the exact time when any activity was detected. Then isolated was done for the active compound and lastly identified the compound. For the process at different stages biological tests happen. Besides, direct isolation also can happen. As it was ancient process, so the isolation was not perfect. It was slow, inadequate process (Sarker way, 2013) .

Figure 14: Ancient process (Mozaffarpur et al., 2020)

Discovering natural drugs for modern stage

High throughput screening used for the modern method. HTS are used for the discovery of natural drugs. For doing this method a library for the natural compound are established . In the ancient time it was very difficult to create these types of libraries. As the library takes more time, it is costly. Modern way makes it easier. For this

reason it is easy to test, extract medicinal plants. For doing the modern way some steps are done. For discovering natural drugs in modern way 4 steps are done -

Screening for 3 to 5 years for medicinal plants

Pre- clinical process are done by 1 to 2 years

Clinical trials are done by 6 to 7 years

For regulatory approval 1 to 2 years are done

Figure 15: Modern Process (Nasim et al., 2022)

1.1.5 Broadly used medicinal plants in Bangladesh

Most of the people in Bangladesh live in villages. The people of the village are mostly dependent on home remedies. About 80% of village people use home remedies. Home remedies are made from medicinal plants. Bangladesh has more than 6500 plants. Among them 500 are medicinal plants. For our day to day life 250 medicinal plants are used daily. In Bangladesh there is no restriction on selling the plant of medicinal values. Some medicinal plants that widely used in Bangladesh are

-

Neem: The scientific name of neem is *Azadirachta indica*. It is used for the treatment of inflammation, infections, fever etc. It is widely used in tooth plaque as it reduces it.

Besides, it is also used in the treatment of lice.

Aloe vera : Aloe vera used for not only orally but also topically. Aloe vera used for acne, fibrosis, burns etc. It is very popular for burns and cuts.

Mint: The Scientific name of mint is mentha. It is helpful for the treatment of cancer.

Besides, it is also used for the treatment of antimicrobial, antidiabetic. It is very helpful against toxicity.

Primrose oil :Primula is the scientific name of primrose oil. It is widely used in Bangladesh as a popular medicinal plant. Primrose is used for rheumatoid arthritis, breast pain and menopause. It is also very good for the treatment of hormonal problems.

Lavender: Lavandula is the scientific name of Lavender. Lavender oil is very popular as it is helpful for many diseases. Many problems can be solved easily with the help of lavender oil. It can solve the problem of insomnia, stress and anxiety. Besides, lavender is most helpful for the use of antibacterial and antivirals.

Tulsi : The scientific name of Tulsi is Ocimumtenuiflorum. Tulsi is popular for the use of insect bites. Several fever and heart disease can also be solved by the help of tulsi. Besides, tulsi can be used for headaches, common cold and also for kidney stones.

1.1.6 Chemical construction

Nutrition and reproduction are closely related to chemical construction. Tannins, volatile oil, vitamins, resins etc play a vital role in the experiment. It has a great therapeutic effect. Some plants constitution with the help of therapeutic effect -

Table 2: Therapeutic Effect

Tannins

Gastrointestinal effect

Resin

Antibacterial

Glycosides

Antibacterial

Alkaloid

Anesthetic

1.1.7 Thrombolytic activity of medicinal plants

Medicinal plants plays a great role in thrombolytic activity. As soon as possible, solving the problem of clot is the major work of thrombolytic activity. It helps the heart to restart the flow of the blood. It also helps to prevent heart damage. It also helps to stop heart attacks. Some plants have great thrombolytic activity. Those plants are -

Curcuma longa

Nigella sativa

Flemingia

Tamarindus indica

Flemingia congesta

Figure 17: Thrombolytic Activity (Nikitin et al., 2021)

1.1.8 Thrombolytic activity of crude drug in Bangladesh

Thrombolytic activity deals with the treatment of dissolving dangerous clot. The medicinal plants help to dissolve clot. Plant helps to improve the flow of blood. Plants help not only blood clot but also prevent the tissue which are damaged. Several plants that help in dissolving clot problem -

Table 3: Dissolving Clot lysis (Mazid et al., 2012)

Tamarindus indica plants which belong to the Fabaceae family help in thrombolytic activity.

Flemingia congesta is a plant which belongs to the Fabaceae family and also helps in thrombolytic activity.

Lawsonia inermis is a plant which belongs to the Lythraceae family is another one which helps in thrombolytic activity

Mesua argentea is a plant that consists of the family of Clusiaceae.

1.1.9 Mechanism of action of Thrombolytic activity

Thrombolytic acts directly or it can be work indirectly. It converts to plasminogen either directly or indirectly. Then it turns to cleavage lysis. At higher frequency happens in the time of clot dissolution and reperfusion. It happens because the therapy is initiated fastly after clot formation happens. For lysis thrombosis thrombolytic is the only one drug. They mainly work as a facilitating conversion of plasminogen which later turns to plasmin. It is a protease which is non specific. Especially it helps in digestion of fibrin clots.

Figure 18: Mechanism of Thrombolytic Activity (Altaf et al., 2021)

1.1.10 Work process of thrombolytic activity

Thrombolytic properties are one of the clot busting drugs. It dissolves blood clots in such a way that blood flow. It is an enzyme that removes the process of breaking down proteins. It is quickly dissolving the clot problem if the problem can be major. It is important for solving the problem of damage to the heart muscle. It is useful for blood flow to restart. It can solve the problem of major heart attacks. Thrombolytic treatment is very popular for many diseases. For repairing the ischemic damage thrombolytic treatment is used. The thrombolytic treatment is also known as fibrinolytic therapy. It is useful for intravenous clot which is very dangerous. There are three main types found

in thrombolytic drugs. They are streptokinase, urokinase, tissue plasminogen activators. They all are useful for breaking down clots. Besides, tissue plasminogen activators are more specific in the problem of clot. Not only these but also some side effects are seen in tissue plasminogen activators. Thrombolytic agents activate the system. This is by the help of an enzyme which is inactive and the enzyme is called proenzyme. Besides, the help of plasminogen, an active enzyme which is called plasmin.

Figure 19: Thrombolytic work process (Ma et al., 2019)

The enzyme plasmin helps in degradation of fibrin. Lyse thrombi are done by the help of thrombolytic which is the only drug that actually does this. The main principle of thrombolytic activity is to facilitate conversion with the help of plasminogen to plasmin. The plasmin is a protease which is non specific. In the present time the most occurred cardiovascular diseases are stroke, myocardial infarction and also thrombosis in vein. The problem happens because of a block in the blood vessels (Fuster et al., 1992; Gao et al., 2021; Rodriguez and Harrington, 2021; Xue et al., 2021). Now -a - days one of the main problems is blood clotting. This happens by thrombus that hinder the blood

flow by blocking the vessel. Besides, it also deprives the oxygen and also the normal blood flow. Thrombolytic drugs dissolve the thrombin by occluding coronary arteries for restoring blood supply in the ischemic myocardium. This is done for limiting necrosis and also improving prognosis (Laurence et al., 1992). Thromboembolic disorder is one of the main problems in mortality and morbidity in Bangladesh like other developing countries. One of the problems that happens because of that is blood clot. (Islam et al., 2013). For solving the problem use some thrombolytic agents like anistreplase, streptokinase, urokinase, alteplase etc. (Collen et al., 1990). Thrombolytic drugs are the prolong of the half life. It enhances drug penetration and its precise targeting capability. Besides, the thrombolytic activity also reduces the hemorrhagic complication.

1.1.11 Effect of thrombolytic activity in dissolving clot

Thrombolytic drugs help in improving the ventricular function and reduce the mortality. After diagnosis of myocardial infarction the patient needs to give it immediately. It has no value if it gives in delay to the patient. Some fibrinolytic drugs are alteplase, reteplase, tissue plasminogen activators. Some non-fibrinolytic drugs are urokinase, anistreplase, streptokinase etc. Non fibrinolytic drugs are bound with circulating and non circulating plasminogen. On the other hand fibrin specifically binds to plasminogen at the surface of fibrin. Thrombolytic drugs have an effect which is direct that dissolves the existing thrombus. Besides, it is used for the treatment of thrombosis. First generation thrombolytics are urokinase and streptokinase

Figure 20: Dissolving Clot lysis (Hossain et al., 2019)

They are widely used for human thrombolytic proteins. This process is called the recombine technique. Alteplase and reteplase belong to short lives. Besides, they are compounds which have high clearance. This clearance totally depends on the hepatitis blood flow. It is closely related to myocardial infarction which influences the blood flow of the liver. Not only these but also they are related to reteplase and alteplase. The other one is reteplase. It is less dependent on the blood flow and renal excretion. It is administered by double bolus injection. If the shape and plasma concentration curve have the knowledge then there is a pharmacokinetics difference between them. In dose and dosage schedule can be seen in the clinical difference in the recombinant thrombolytic drugs. There is a relationship between the plasma and the final effect of the thrombolytic drugs. Its main concern is a multitude of other factors than plasma concentration. It shows the therapeutic effect of the thrombolytic drugs. Tissue plasminogen activator is a serine protease which regulates many other physiological

processes. It can regulate neuronal migration, long term potentiation, synaptic plasticity etc. 5% to 10% proximal large vessel occlusion is the rate of alteplase mediated recanalization (Emberson et al., 2014). These modalities are not only costly but also have some side effects. Patients who need surgery are not able to use it. Patients need cheap and healthy anti- thrombolytic agents. There are several disorders that can be seen that happen because of immobility, pregnancy, cancer, surgery etc.

¹ 1.2 Exploration of N. fruticans Wurmb

N. fruticans are popular as nipa palm . In some places it is also known as mangrove. The species has only one member. The ¹leaves and the flower stalks grow above the surface. In the ground the trunk grows under the ground. The N. fruticans produce woody nuts. Fruit is made of many seed segments. N. fruticans are worldwide distributed in the Eocene, it is in deposits from polar latitudes. It is a slow- moving tidal which brings in nutrients. They are commonly found in rivers and coasts. In the environment the palm will survive for a short time dying. There are several uses of N. fruticans. Feathery leaves are used as roof material which are used by local people. Basketry and thatching are made by it. Fruit clusters are made by unripe fruits . It is very popular for its sweetness. Vinegar is also made from it. Sometimes sugar, alcohol and cake are made from the flower of N. fruticans. It is commonly used in biofuel. In the fermentation process it is used for the fermentation into ethanol or butanol. It is commonly used in sap production. It produces both fuel and food simultaneously.

Figure 21: *N. fruticans* Wurm (Bobrov et al., 2012)

1.2.1 Taxonomical Classification

Table 4: Taxonomical Classification (Vinit K et al., 2018)

1	Kingdom : Plantae
	Division : Tracheopsida
	Subdivision : Spermatophytina
	Class : Magnoliopsida
	Superorder : Lilianae
	Order : Arecales
	Family : Arecaceae
	Genus : <i>Nypa</i>
	Species : <i>N. fruticans</i> Wurm

1.2.2 Distinct names of *N. fruticans* Wurm

Different countries have different names for *N. fruticans* Wurmb. It is introduced in China, Bangladesh, England, Myanmar, Indonesia etc country in separate names.

There are some names of *N. fruticans* Wurmb based on different countries:

Bangladesh : Golpata

India : Gulga

China : Shui ye

Sri Lanka: Gin pol

Australia : Nipa palm

Figure 22: Golpata (Prasad et al., 2013)

1.2.3 Description of *N. fruticans* Wurmb

N. fruticans have several parts. All parts used for the medicinal purpose. It has roots, fruits, flowers, leaves, seeds etc. All parts of the plants described are -

Roots - Roots are one of the important parts of the plants. The roots of *N. fruticans* are lighter, fibrous etc. It protrudes from the surface of the soil.

Flowers - Flowers also one of the main parts of *N. fruticans*. It is the globular inflorescence. Woody nuts are produced from the flowers of *N. fruticans*.

Fruits - The fruits of *N. fruticans* are the color of brown to dark brown. The fruits are shaped like a reversed egg. The size of the fruits is 8-11.

Leaves - Leaves are one of the best useful parts in *N. fruticans*. For preparing the thatching, umbrellas and bags the leaves of *N. fruticans* are used. For fuel and arrows the leaves of *N. fruticans* are also used.

Pulp - Pulp is another important part of *N. fruticans*. Pulp is covered by the hard shell. It also consists of cellulose. Pulp is used for many important works. The pulp is also used for the treatment of many diseases. The process of extraction of pulp from the plant is difficult. Several steps need to be followed for extraction pulp from the plants.

1.2.4 Dissemination and natural surroundings of *N. fruticans*

The temperature of *N. fruticans* is 20-35°C and the level of *N. fruticans* is 1000 mm/month. It is a mangrove plant. From all the plants of the Arecaceae family they are the only palm that can survive in the mangrove situation. *N. fruticans* can be seen in many countries. Each country has different names. They are very popular for their use. The plants *N. fruticans* are found in the country of Myanmar, Bangladesh, Malaysia, Sri Lanka, Australia etc.

1.2.5 Secondary metabolites of *N. fruticans*

For finding the primary and secondary metabolite the method used a lot is the phytochemical method. By the help of primary metabolite plants development and growth happen. Secondary metabolites are known as bioactive substances.

Secondary substances are those substances that help to protect plants from any critical situation (Yahaya et al. 2021). The phytochemical that are found in *N. fruticans*

Wurmb are -

Table 5: Conformation of N.fruticans (Yahaya et al. 2021)

Water

13.57%

Protein

7.04%

Carbohydrates

61.53%

Maleic Acid

1.8%

Energy

106 Kcal

1.2.6 Medicinal ply

N.fruticans helps a lot in many diseases. It has the ability to antioxidants, anti inflammatory, analgesic etc (Nugroho et al., 2020). It has no side effects in ancient use. Several medicinal uses of N. fruticans Wurmb are -

Table 6 : Medicinal Use(Nugroho et al., 2020)

Nipa palm vinegar are used for the use of antidiabetic

Nipa palm sap are widely used for the treatment

Leaves are used for the treatment of ulcers

Burnt nipa makes ashes that are used for the treatment of toothaches

1.2.7 Aim of the experiment

For the evaluation of thrombolytic activity effect *N. fruticans* Wurmb are used.

1.3 Rational of the Study

The study is about to investigate thrombolytic activity in *N. fruticans*. The present study also indicates some secondary metabolites like tannins, melaic acid, carbohydrates etc are also responsible for the thrombolytic activity of *N. fruticans* fruit pulp methanolic extract.

1.4 Objective of the study

The main objective of the study is about the investigation of thrombolytic activity effect in *N. fruticans* Wurmb pulp. It determines whether the pulp can be useful for the treatment of clot. It helps to understand whether the pulp of *N. fruticans* Wurmb can be used for the treatment of heart damage, better blood flow and clot problem. Besides, the study also deals with the safety and quality of the treatment by the pulp.

Furthermore, the investigation also leads to whether the mechanism of action can be responsible for the thrombolytic activity by *N. fruticans* Wurmb. It is helpful for the treatment of dangerous blood clots. It especially helps to make better blood flow so that the clot problem can be resolved. Phytochemical identification also helps in the clot lysis which helps to find if the pulp of *N. fruticans* can be helpful for

treatment. Lastly, comprehensive study is about the scientific basis which leads to solving the problem of damaged tissue and organs.

1.5 Literary texts of *N. fruticans*

Several analyses were done by *N. fruticans* to investigate the use of plant parts. Different parts have different pharmacological effects. Some analysis of *N. fruticans* Wurmb are -

Table 7: Literary texts of *N. fruticans* (Mitra et al., 2024)

Fitri at 2023 investigates the antihyperglycemic effect of *N. fruticans* with the help of phenolic and flavonoid

Mitra in 2024 investigates cancer by the help of phytochemicals that consist of the *N. fruticans*

Zumbroich at 2020 analysis about ashes of the shell whether it has the effect in blackening teeth

Park at 2022 deals with the anti-inflammatory effect by the help of *N. fruticans* Wurmb.

1.6 Functions of *N. fruticans*

As there is no experiment on thrombolytic activity which is exerted from *N. fruticans* Wurmb, this experiment helps a lot to understand a lot about it. There are several research scope by the help of *N. fruticans* Wurmb about the thrombolytic activity. This experiment helps a lot to understand the problem of clot lysis. Phytochemical compounds help a lot to understand the damage dissolving process. Besides, the

experiment helps to understand about the therapeutic effect of N.fruticans. The main theme of this study is to gain knowledge about the therapeutic effect of N.

fruticans. As the N. fruticans Wurmb are closely dealt with the activity of thrombolytics which dissolve the problem of clot and makes better blood flow.

Chapter 2

Materials and Methods

2.1 Collection and Identification

N. fruticans were collected from Sundarban in the summer season which have been deposited for further references in Bangladesh National Herbarium, Dhaka (DACB Accession number : 42,861). In summer it is available in Sundarbans. It helps as a medicinal plant for doing the experiment of thrombolytic properties. At first fruit was taken from the N. fruticanstree. Then it was cleaned properly, cut into small pieces as it is important for doing the experiment. Air- dried was applied to dry the N.fruticans. It was done in several days. Lastly it was dried in the oven at 37° C by grinding it to facilitate size reduction. It was preserved for further use in a close container which was at 37°C.

2.2 Preparation and extraction of plant material

At first N.fruticans was collected from the tree after that the fruit pulp was separated. Then the part was dried up and the pulp was extracted by using methanol. By using

cold maceration technique the extraction was done. At room temperature powder portions of the plant were soaked in 2500 ml with the help of methanol. That was done for 10 days with occasional stirring. By using Whatman's filter paper the solution was filtered through filter cloth. The concentration designated as MFF was filtrate obtained and it was done by using the evaporation method which was under the ceiling fan and also the water bath which was below 37°C temperature.

Figure 23: Preparation process(Evelyn et al., 2022)

2.3 Thrombolytic activity test

For doing the experiment streptokinase was used as a standard. Streptokinase was collected from a pharmaceutical company in Bangladesh . The value of streptokinase was 15,00,000 I. U. Sterile distilled water was added which was 5ml in the streptokinase vial and it was mixed properly for doing the experiment. For doing in vivo thrombolysis suspension 100µl which is 30,000 I.U. was used in the process (Prasad et al., 2007)

2.4 Preparation of sample

Streptokinase is used as a reference standard for evaluating the N.fruticans of the thrombolytic activity. For doing the experiment using 100 mg of MEF of N.fruticans was dissolved. It is done by using 10 ml of methanol and distilled water. It was done by keeping it overnight and lastly decanted and filtered was done to the soluble supernatant .

Figure 24:Preparation of Sample (Bonard et al., 2017)

2.5 Blood sample

From healthy volunteers blood samples were collected. The blood samples were collected by using aseptic conditions without anticoagulant therapy. For forming clot 1 ml of blood was transferred to the weighted microcentrifuge tubes. All the protocol was approved by the ethical committee.

2.6 Procedure

From each volunteers ⁶ 5 ml of venous blood were collected that was taken separately from a weighted sterile microcentrifuge tube. It was incubated at 37° C and the time was 90 minutes. From the micro centrifuge tube fluid was released properly when the clot was formed. Then determine the weight of the clot that was done by subtraction ¹¹ weight of the clot containing the tube from the weight of the tube. Streptokinase 100ml was used for positive control and non thrombolytic was used for the negative control. Later in the micro centrifuge 100 ml distilled water with the help of each sample ¹³ were added separately. For 90 minutes at the 37°C tubes were put in the incubator and that was done for observing the clot lysis. Then discarded was done by the released fluid. This process was done after incubation. After doing the clot disruption to observe the difference again we weighted the tube. Lastly, clot lysis was determined for doing the experiment. ³ Clot lysis was done by using the following process -

$$\% \text{ of clot lysis} = (\text{weight of released clot} \div \text{clot weight}) \times 100$$

2.7 Ethical Approval

The Southeast University's (Dhaka, Bangladesh) Pharmacy Department's Ethical Committee approved the study protocol (approval number: SEU/Pharm/CERC/113/2024). Before their blood samples were drawn, every participant (n=5) in the study completed and signed a written consent form.

2.8 Statistical analysis

² By using the SPSS version 28.0 (SPSS Inc. Chicago, IL. USA) the analyzes were done by the obtained data. The obtained value was analyzed by using mean ±

SEM. One- way ANOVA was used for the analyzed data. By using one-way analysis of variance the test was done which followed the Dunnet's test. For statistical significance the value was considered $p < 0.05$.

Chapter 3

Results

3.1 Result of Dunnet's Test

The thrombolytic activity results are shown in the table. From the table it is clear that the plant *N. fruticans* fruit pulp extract has some secondary metabolites like tannins, melaic acid, carbohydrates etc. Besides, it can be predict that *N. fruticans* has thrombolytic activity which can be the reason of phytochemical.

Table 8: Result of thrombolytic activity by following Dunnet's Test

Sample

% of lysis

Water (Control)

17.83±0.5

Streptokinase (Standard)

43.96±0.99**

NFP

27.83±0.89*

5 The values are indicated as mean $\pm$ STD (n= 3) ; One- Way Inspection of Variance (ANOVA) followed by Dunnet's test. *P<0.05, **P<0.01 important compared to the control.

Chapter 4

Discussion

7 From the experiment it is clear from the comparison of positive control with negative control that clot dissolution doesn't happen when water is added to the clot. Lastly, after treating clot the exact same with *N. fruticans* noticed an important activity which is thrombolytic activity. For getting the expected result used positive control that was compared with different concentrations. The same way with the negative control and lastly shows an significant thrombolytic activity by the test. The methanolic extract fruit pulp *N. fruticans* shows thrombolytic activity by doing the in vitro test. Besides, photochemical analysis also shows different result which prove that methanolic extract tannins, melaic acid, carbohydrates etc are the responsible for clot lysis activity. For treatment of many diseases humans are totally dependent on plants. Nowadays phyto pharmacological investigation has made a new field in the for discovering plant that helps to derive drugs. 30% of pharmaceuticals are created from the plant derived that is now estimated to all (Leta et al., 2002). Platelet plays an important role . Platelet bonds bind to leukocytes that form an intricate process that helps to develop plaque. 1 The experiment is about to investigate the thrombolytic activity of the *N.fruticans* which is a medicinal plant that is available in Bangladesh. Streptokinase is

used as a positive control which is well known for thrombolytic drugs (Prasad et al., 2007). So from the experiment it is easy to understand that when water is added in a clot, the clot dissolution does not happen and the result shows by checking the NFP value that it has thrombolytic activity.

Chapter 5

5.1 Conclusion

In the study methanolic extracts of *N. fruticans* fruit pulp shows different components which are tannins, carbohydrates, maleic acid, flavonoids etc. The fruit pulp extracts are also shows thrombolytic activity (in vitro) that can be the reason of phytoconstituents in the methanolic extract. From the study it is clear that the plant has significant implication in the field of thrombolytic. The study also shows the possibility of developing drug from *N. fruticans*. Besides, all these the study also indicating that the extract should be investigated pharmacologically and phytochemically for its better pharmaceutical use and potential of medicine. Lastly, by using the medicinal plant *N. fruticans* can be more developed in the sector of thrombolytic properties.

5.2 Future Forecast

As there is not enough research about the thrombolytic activity of *N. fruticans*. For these reasons the experiment is done. Till now not enough work was done on thrombolytic activity. But I hope that in the future there will be enough scope to work on it. By using *N. fruticans* we can easily develop in the medicinal sector which helps

to save people's life. Besides, for evaluating advantage and several applications of *N. fruticans* several departments like microbiology, anatomy, biochemistry also can collaborate with this field. Lastly, for better treatment and development in the medicinal sector need more experiments in the medicinal plants of *N. fruticans* Wurmb.

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