



### **Management of Diabetic ulcer with synthesis of herbal banding techniques**

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#### **Abstract**

Siddha system is considered as a indigenous medicines because of its uniqueness in the medicine preparation methods and for its method of treatment. Their mode of treatment is based on the intake food which is converted into seven thathu's with the help of the bodily action which is essential for life of an human. But in current scenario due to the changes in food habits humans are facing various treads and they themselves reducing the life span. The diseases prevailing of these reasons are considered as life style diseases. Of these diabetes mellitus (DM) plays an essential role in driving the human lives. DM is considered only as a condition in accordance with the body glucose level however its complications serves a challenging evil. The primary complication in long term DM is diabetic ulcer and it's prognosis is also found to be an challenging one. In this study we aimed to quick healing of these wounds with banding techniques of herbal origin, which serves to be a cost-efficient to the current society and a pride of providing technological knowledge to traditional medications.

**Keywords:** Siddha, bandage, diabetic wound, wound, dressing.

#### **Introduction**

DM is considered only as a condition in accordance with the body glucose level however its complications serves a challenging evil. The primary complication in long term DM is diabetic ulcer and it's prognosis is also found to be an challenging one. Diabetic foot ulcers are the single biggest risk factor for Non-traumatic foot amputation in persons with diabetes. Foot ulcers occur in 12-25 percent of patients with diabetes and precede 84 percent of all non- traumatic wound in growing population<sup>[7]</sup>. In this study we aimed to quick healing of these wounds with banding techniques of herbal origin, which serves to be a cost-efficient to the current society and a pride of providing technological knowledge to traditional medications.

#### **Rationale**

By the year 2030, it is estimated that 366 million persons in the world have diabetes. The lifetime risk of a person with developing foot ulcer could be as high as 25%<sup>[7]</sup>. As diabetic ulceration has been shown to end up in amputation up to 85% of cases, at least 40% of amputation in Diabetic patients can be prevented with a team approach in wound care. In diabetic patient, even a small discontinuity in the skin can become a portal entry

for bacteria. Prolonged infection without proper care leads to gangrene and amputations. So there is an urge to establish an effective therapeutic strategy for the treatment of these ulcers to improve the quality in life of the affected individuals.

### Materials and method

The medication selected was Mathan thailam (medicated oil) which has major ingredients like leaf juice of Datura metal, Copper sulfate and coconut oil. It is processed as per the siddha texts.

### Literature evidences

**Datura metal (*uumathai*)**, As per our Siddha text, the leaves of the *uumathai* is administered for wounds as an anesthetic<sup>[1,2]</sup> and this is confirmed by the presence of the constituents like Atropine, Hyoscyamine and scopolamine, 1-oxo-21,24S-epoxy-(20S, 22S)-with a-2,5,25-trienolide, pyrrole derivative (2`-(3,4- dimethyl-2,5-dihydro-1 hpyrrol-2-yl)-1`-methylethyl pentanoate<sup>[9]</sup>.

**Copper sulfate (*thurusu, mayil thutham*)**, As per our Siddha text, copper sulfate inhibits the wound debris and healing property<sup>[1,2]</sup> and it is confirmed by various healing activities proved<sup>[10]</sup> and its toxicity is avoided by the purification(*suthi muraigal*) mentioned in our texts.

**Coconut oil (*thengai ennai*)**, As per our Siddha text, copper sulfate inhibits healing property<sup>[1,2]</sup> and it is confirmed by the presence of activities like like angiogenesis, wound healing etc<sup>[11]</sup>.



Figure 1: Datura metal (*uumathai*)



Figure 2: Copper sulfate (*thurusu, mayil thutham*).



Figure 3: Coconut oil (*thengai ennai*)

### Standard operating procedure for preparation

#### Collection of raw materials

The leaves of Datura metal L. belongs to the family of Solanaceae, were collected in Herbal garden, Sivaraj Siddha Medical College, Salem and was authenticated by botanist. Edible quality oil of *Cocos nucifera* Linn. and copper sulfate was procured from the local market. The copper sulfate was purified by dissolving in water followed by subsequent recrystallization.

#### Preparation of oil

Fresh leaves of Datura metal were cleaned with running water and drained enough to remove excess water. Fresh juice were obtained from macerated leaves of D. metal references from Siddha Formulary of India (listed in schedule I of DC act 1940) and Gunapadam was followed for Mathan thailam preparation. Copper sulfate (350g)

was dissolved completely in leaf juice of D. metal (3.500L). coconut oil (1,400L) was added to this, mixed and heated by using hard fire wood on mid flame in properly seasoned clay vessel and proper temperature were monitored below 171<sup>0</sup> C (since smoking point of coconut oil is 171<sup>0</sup> C ). mixture in the open vessel was stirred intermittently till it attains required characters like desired smell, color, free of cracking sound, disappearance of froth and rolling of the herbal residues between the fingers. When rolled material was ignited, it burnt without spurting and noise. Finally, the mixture is filtered and stored in glass bottle and stoppered until use [8].



Figure 4: prepared medicated oil (mathan thailam)

### Discussion & result

Pathogenesis in diabetic foot ulcer

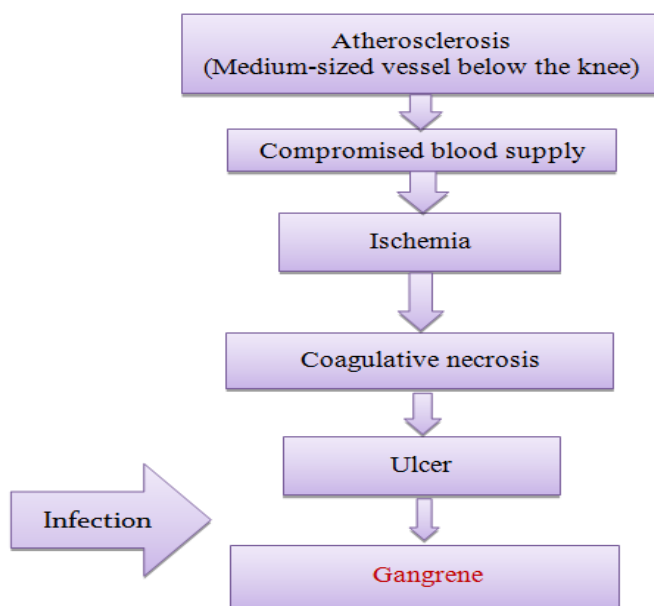


Figure 5: flow chart in pathogenesis of diabetic ulcer leads to gangrene

### Synthesis of bandage

For synthesis of bandage we have selected two materials made up of bamboo (bamboo fabric and bamboo viscose). These materials and the coating rod used were heat sterilized at 121<sup>0</sup>C using an autoclave to get rid of microbes.

### Standard operating procedure for synthesis of bandage:

Two sets of the materials [bamboo rayon (2pieces) and bamboo viscose (2pieces)] were placed on the glass plate. The medicated oil (mathan thailam) were standardized and diluted to various concentrations starting from 4mg/dl (which is found to be minimum inhibitory concentration MIC<sup>[5]</sup>) to 8mg/dl.

The two concentrations 4mg/dl (Sample A) and 8mg/dl (Sample B) were fixed. Sample A is poured on one side of each materials (one bamboo rayon and other bamboo rayon) and Similarly, Sample B is poured on other two materials. Using a coating rod, spread the oil over the material, until it spreads evenly. Allow it to air dry for 2 days. Finally the banding material is packed in an air-tight strip under aseptic condition.



In-vitro Assay's (evaluation of Anti-Microbial Activity)

### Collection of sample

The organism take up for study were *Staphylococcus aureus* (gram+) and *Escherichia coli* (gram-) which were

obtained from a diabetic foot ulcer swab in a patient of Sivaraj Siddha Medical College and Hospital, Salem with consent of the patient and the organisms were isolated with their selective media's .The isolated organisms cultured in Mueller hinton broth at 37<sup>0</sup>C for 18 hours and then stopped at 4<sup>0</sup>C in Mueller hinton agar.

The pathologic bacteria culture was inoculated into sterile nutrient broth and incubated at 37<sup>0</sup>C for 3 hours until the culture attained a turbidity of 0.5Mc Farland units and finally standardized to 10<sup>5</sup>CFU/ml.

**Preparation of disc**

The films each of 20mg were dissolved in dimethyl sulfoxide (DMSO). The sterile blotting paper disc 10mm was soaked in the diluted solution each of 60µl. The prepared discs were dried in controlled temperature to remove excess of solvent used in this study.

**Anti-microbial activity using disc diffusion**

The inoculums were spread over the nutrient agar plate using a sterile cotton swab in order to get a uniform microbial growth. The prepared antibacterial discs were Placed over the lawn with controls as chloramphenicol at center.

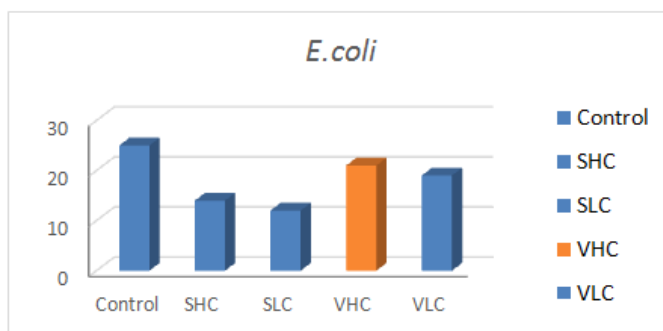
The plated were incubated at 37<sup>0</sup>C for 18 hours and the diameter of Zone of inhibition was measured (Table1)

Organism	Control	Mathan thailam <sup>20</sup>	Bamboo fiber(high concentration)	Bamboo fabric(low concentration)	Viscose (high concentration)	Viscose (low concentration)
<i>E. Coli</i>	25	10	14	12	21	19
<i>S. aureus</i>	27	16	16	13	23	17

Table 1: Diameter of Zone of Inhibition in mm.

**Anti-bacterial activity against E. coli**

This graph denotes that the bandage made up of bamboo viscose with sample B shows higher area of zone of inhibition in comparison with others.



Graph 1: Diameter of Zone of Inhibition in mm

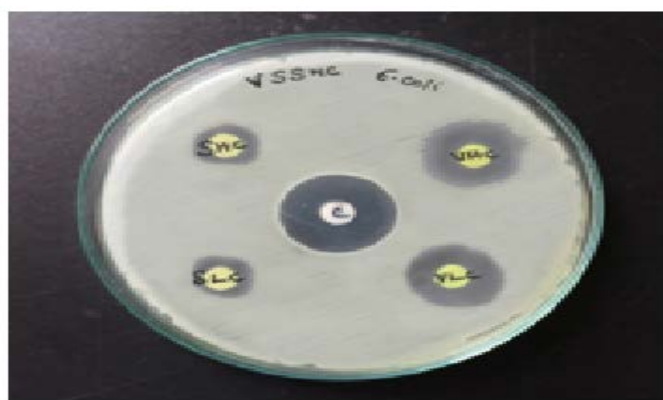


Figure 1: zone of inhibition against E.coli

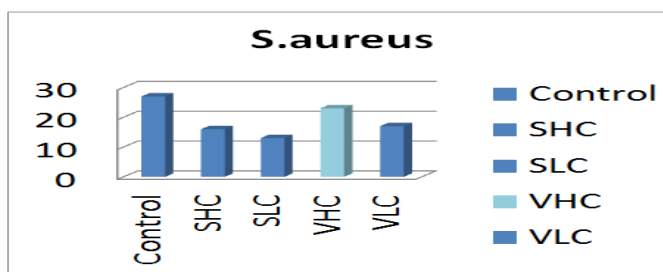
SHC- Sample with bamboo fabric in high concentration (with Sample A)

SLC- Sample with bamboo fabric in low concentration (with Sample B)

VHC- Sample with viscose in high concentration (with Sample A)

VLC- Sample with viscose in low concentration (with Sample B)

**Anti-bacterial activity against S. aureus**



Graph 2: Diameter of Zone of Inhibition in mm



Figure 2: Figure 1: zone of inhibition against S. aureus

### Properties of bamboo (*Bambusa vulgaris*) fabric

#### a) Anti-bacterial activity<sup>[4]</sup>

◦ Bamboo (*Bambusa vulgaris*) fiber naturally possess many functions like anti-bacteria, anti-fungal and deodorization character because of its unique bio-agent named `Bamboo kun`.

#### b) Anti-UV radiation property<sup>[4]</sup>

◦ It protects the human skin from the effects of sunlight.

#### C) Thermal regulatory property<sup>[4,6]</sup>

◦ In Chinese native medicine, Bamboo fiber is called as `Air vitamin` or long lived element. It releases 2600 anions per cm<sup>3</sup>. These anions are helpful for human health activating cell of our body, Purifying blood, Assisting with recovery, Calming vegetative nervous system, Hypo-allergic constitution, Antistatic, Thermal resistance, Moisture management.

### Properties of Bamboo Viscose

Viscose is a man-made fabric obtained from the wood pulp (phloem part) of bamboo composed of regenerated cellulose. The raw materials were further processed by mechanical processing and woven into fabric. Viscose contain cellulose of lower degree of polymerization than cotton<sup>[6]</sup>.

### Physical properties

#### 1) Density:

The density of viscose rayon is **1.53g/cc**.

Also available in three densities 1.5,3.0 and 4.5

#### 2) Tensile strength:

The tensile strength of the fiber is less when the fiber is wet than when dry.

Dry state-1.5-2.4 gpd

Wet state-0.7-1.2gpd

#### 3) Stiffness:

Stiffness of viscose fiber is **11.2g/d**.

#### 4) Moisture absorption:

It absorbs more **moisture than cotton**. For viscose rayon is 13% moisture absorbs at 21<sup>0</sup>c

#### 5) Elasticity:

The elasticity of viscose rayon is less than 2-3%

#### 6) Action of heat:

At 150<sup>0</sup>c or more, viscose rayon loses its strength and begins to decompose at (175-204<sup>0</sup>c)

### Composition of viscose fabric

Components	Percentage
Cellulose	40-50%
Lignin	20-30%
Hemicellulose	10-30%
Polysaccharide	Mildly

Table 2: Composition of viscose fabric

### Advantages in using viscose fabric`s

- User friendly
- Bio-degradable
- Low cost and cosmetically acceptable.

Because of its **high content of cellulose** it has various beneficiary activities like

1. Bio-adhesive and Muco-adhesive drug delivery system

2. Extended release in dosage forms.
3. Osmotically active to deliver drugs
4. Maintain moist environment around the wound
5. Permit the diffusion of gases.
6. Provides mechanical protection.
7. Control local temperature.
8. Easy and comfortable to remove/ change.
9. Prevent wound desiccation.
10. Non allergic and elastic

#### Drawbacks in current wound dressings

1. Inability to prevent microbial invasion.
2. Leads to trauma for patients, as they adhere to the wound surface.
3. Low absorption of wound exudates and leads to accumulation then becomes the site of microbial attack.
4. No proper permeability to gases.
5. Not efficient for chronic wounds.
6. Providing dry environment which slower the healing process.

Further innovative techniques



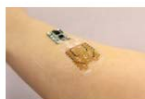
Adhesive bandages



Medical clothings



Sanitary napkins



Sensor designed bandages

#### Conclusion

From this study, the designed banding material provides higher efficacy and other beneficiary properties when compared to other currently available materials. This

study aimed at only the effectiveness in wound healing, but the excellent management lies in monitoring of blood glucose level. From this study, the designed bandage made up of viscose fabric provide better efficacy in wound healing. This can also be used for treating various wounds like Cut wounds, Traumatological wounds, etc.....

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