Ethnobotany and antimicrobial activities of medicinal plants used for skin infections in Jimma, Ethiopia

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Received 12 August; accepted 14 September; published online 01 October; printed 16 October 2012

ABSTRACT

To document the valuable knowledge on herbal remedies to cure skin infections, ethnobotanical survey was conducted from October 2006 to November 2007 in Jimma an Ethiopian town. The survey identified nineteen plants and twenty two recipes to cure skin infections. Selected plants were evaluated for their antibacterial activity against Staphylococcus aureus and Streptococcus pyogenes commonly found in the wounds by agar well diffusion method. The results revealed that Sphaeranthus suaveolens showed maximum inhibition against S. aureus and Dodonia angustifolia against S.pyogenes. The medicinal plants have, therefore, the potential to be exploited as antimicrobial agents awaiting further investigation on identification of the active ingredients to standardise the dose.

Keywords: Ethnobotanical survey, skin infection, Staphylococcus aureus, Streptococcus pyogenes, Dodonia angustifolia, Sphaeranthus suaveolens.

1. INTRODUCTION

Ethnobotany: It is the scientific study of how plants, people and their culture are interlinked and work in harmony to maintain a healthy social life.

Ethnobotanical Survey: Reveals the role of plants in people’s life apart from medicinal value.

2. STATEMENT OF THE PROBLEM

Though the herbs are available at vicinity, the knowledge in utilizing them is slowly humiliating and ignored.

2.1 Scope of the study

Scientific validation could reemphasis the use of herbal remedies to cure skin infections

2.2 Limitations of the study

- The study location was carried out in three Kebeles only.

3. RESULTS AND DISCUSSION

3.1 Ethno botany

Natural products have long been providing important lead compounds to cure infectious diseases (André, 2008). Over many centuries local communities throughout Ethiopia have attempted to combat diseases through a range of religious and secular traditional practices many of which are based on herbal treatments (Abebe, 1993). Ethno botanical survey identified skin infections prevalent in the study area. It also indicated how natives of Jimma utilise medicinal plants overcome such infections. Generally they use plants available in their home garden or at their vicinity for self...
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Skin infections prevalent in the study area

Medicinal plants are not only important to the millions of people for whom traditional medicine is the only opportunity for health care and to those who use plants for various purposes in their daily lives (Abiad, 2007). In current study, nine different skin infections/conditions namely dermatophytosis, eczema, itching, ringworm, skin cancer, skin tumour, spider disease, tissue parasite and wounds were reported in the study area. The part of the plant used, symptom of the disease, recipes and mode of administration were recorded (Table 2). Nineteen species of medicinal plants identified were used in twenty two recipes reported by

Table 1 Medicinal plants used to treat skin infection in the selected kebeles of Jimma –Ethiopia

<table>
<thead>
<tr>
<th>S.No</th>
<th>Local Name</th>
<th>Botanical Name</th>
<th>Family</th>
<th>Division</th>
<th>Habit</th>
<th>Category</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Anchubi (A)</td>
<td>Ocimum urticifolium L.</td>
<td>Lamiaceae</td>
<td>Dicot</td>
<td>Herb</td>
<td>Bee flora</td>
<td>Wild</td>
</tr>
<tr>
<td>2.</td>
<td>Aramawulo (O)</td>
<td>Gloriosa superba L.</td>
<td>Liliaceae</td>
<td>Monocot</td>
<td>Climber</td>
<td>Bee flora</td>
<td>Wild</td>
</tr>
<tr>
<td>3.</td>
<td>Arashadaye (A)</td>
<td>Sphaeranthus suaveolens DC.</td>
<td>Compositae</td>
<td>Dicot</td>
<td>Herb</td>
<td>Weed</td>
<td>Home garden</td>
</tr>
<tr>
<td>4.</td>
<td>Atafariz (A)</td>
<td>Datura stramonium L.</td>
<td>Solanaceae</td>
<td>Dicot</td>
<td>Herb</td>
<td>Weed</td>
<td>Waste ground</td>
</tr>
<tr>
<td>5.</td>
<td>Avocado (E)</td>
<td>Persia americana Mill.</td>
<td>Lauraceae</td>
<td>Dicot</td>
<td>Tree</td>
<td>Beverage</td>
<td>Home garden</td>
</tr>
<tr>
<td>6.</td>
<td>Birbira (A)</td>
<td>Millettia ferrugia (Hochst)</td>
<td>Papilionaceae</td>
<td>Dicot</td>
<td>Tree</td>
<td>Bee flora</td>
<td>Wild</td>
</tr>
<tr>
<td>8.</td>
<td>Damakse</td>
<td>Ocimum lamifolium Hochst.ex.A.Benth</td>
<td>Lamiaceae</td>
<td>Dicot</td>
<td>Herb</td>
<td>Bee flora</td>
<td>Home garden</td>
</tr>
<tr>
<td>9.</td>
<td>Gumpath (A)</td>
<td>Thalictrum rhyncocarpum Qu-Dill &amp; Rich</td>
<td>Ranunculaceae</td>
<td>Dicot</td>
<td>Herb</td>
<td>Weed</td>
<td>Wild</td>
</tr>
<tr>
<td>10.</td>
<td>Gortob (A)</td>
<td>Plantago lanceolata L.</td>
<td>Plantaginaceae</td>
<td>Dicot</td>
<td>Herb</td>
<td>Weed</td>
<td>Home garden</td>
</tr>
<tr>
<td>11.</td>
<td>Indahula (A)</td>
<td>Kalanchoe densiflora Rolfe</td>
<td>Crassulaceae</td>
<td>Dicot</td>
<td>Herb</td>
<td>Bee flora</td>
<td>Wild</td>
</tr>
<tr>
<td>12.</td>
<td>Indode (O)</td>
<td>Phytolaccaceae</td>
<td>Phytolaccaceae</td>
<td>Dicot</td>
<td>Climber</td>
<td>Hedge</td>
<td>Home garden</td>
</tr>
<tr>
<td>13.</td>
<td>K'elewa (A)</td>
<td>Maesa lanceolata Forsk</td>
<td>Myrsinaceae</td>
<td>Dicot</td>
<td>Tree</td>
<td>Charcoal</td>
<td>Wild</td>
</tr>
<tr>
<td>17.</td>
<td>Papaya (O)</td>
<td>Carica papaya L.</td>
<td>Caricaceae</td>
<td>Dicot</td>
<td>Tree</td>
<td>Beverage</td>
<td>Home garden</td>
</tr>
<tr>
<td>18.</td>
<td>Sensel (A)</td>
<td>Justicia schimperiana Hochst.</td>
<td>Acanthaceae</td>
<td>Dicot</td>
<td>Shrub</td>
<td>Hedge</td>
<td>Home garden</td>
</tr>
<tr>
<td>19.</td>
<td>Togo</td>
<td>Dicliptera laxata</td>
<td>Acanthaceae</td>
<td>Dicot</td>
<td>Herb</td>
<td>Bee flora</td>
<td>Home garden</td>
</tr>
</tbody>
</table>

Local languages  A – Amharic  E – English  O – Oromo


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### 3.4 Medicinal plants used to treat skin infections

People of the study area depend on medicinal plants at home garden to manage skin infections which is one of the conservation method and save the harvest in the wild. The ethno botanical survey in selected kebeles (2, 3, and 5 in Jimma) identified nineteen medicinal plants to treat common skin infections in the study area. Eighteen of the medicinal plants were dicots and the remaining one species was monocot which belonged to the family Liliaceae. The families Acanthaceae, Lamiaceae and Lauraceae had 2 species each. The rest of the families Caricaceae, Compositae, Crassulaceae, Euphorbiaceae, Myrsinaceae, Papilionaceae, Phytolaccaceae, Plantaginaceae, Ranunculaceae, Sapindaceae, Solanaceae, and Verbenaceae had one species each. Based on their habit 10.52% of them were climbers, 42.10% herbs, 15.78% shrubs and the rest were trees (31.57%). Forty seven percentages of the medicinal plants were available in the home garden and equal percentage was collected from the wild. In addition to their medicinal properties the identified plants had many non medicinal values in the community. The results of the study revealed that ten plants belonged to honey bee flora; Avocado and Papaya were consumed as fresh fruit and juice; Meea lanceolata was used in charcoal making (Table 1).

### 3.5 Scientific validation

The knowledge and practices of traditional healers and lay community members of Jimma, in treatment of skin infections were discussed below with scientific rationale. The exact terms used by the inhabitants to describe the infections were used in this study.

#### 3.5.1 Dermatophytosis

Dermatophytosis infection might be zoophilic, anthropophilic and geophilic. White fungus growth on the scalp and patchy baldness is common in the study area. To cure such infection (Fig.1), leaf extract of *D.stramonium* or fruits of *P.americana* (Fig.1.1) or fruit pulp of *P.americana* were recommended. (Tadeg,2005) screened *Phytolaccac dodendra* against several fungal strains which are known to cause different types of skin infections. The saponin content of *Phytolaccac dodendra* might be the reason for its effect on dermatophytosis causing fungi.

#### 3.5.2 Fungal infection (Eczema)

Powdery fungus growth on the skin (Fig 2) was not reported as a serious social problem. Contact with infected person was probably the major reason for the spread of infection.
Moreover, deficiency in iodine causes thyroid dysfunction and low thyroid function could be the major reason for eczema. In addition, it reduces the circulation of blood and waste products were not removed completely (Barnes, 1976). Application of fresh leaf extract of *D. angustifolia* was recommended. (Pirzada, 2010) proved the antifungal activity of *D. angustifolia* against dermatophytes insists the folklore claim.

### 3.5.3 Itching

Itching may be caused by infectious agents or other environmental conditions. To cure itching leaf extract of *O. lamifolium* or *O. urticifolium* or *M. lanceolata* or *D. laxata* was applied on the affected area (Table-2) (Fig 3). (Muhammad et al., 2003) isolated benzoquinones alkaloid with cytotoxic and antioxidant activity from *Maesa lanceolata*. Additionally (Manguro et al., 2011) isolated 8 new triterpene glycosides. Several species and varieties of plants belonging to the genus *Ocimum* have been reported to yield oil of diverse nature, commonly known as basilica oils. Active ingredients such as eugenol, linalool, methyl cinnamate, camphor and thymol were isolated from various species of *Ocimum* (Lemos, 2005) (Adebolu, 2005) and (Matasyoh, 2007). Medicinal plants under lamiaceae family particularly *Ocimum* spp were known for their essential oil content with high therapeutic value. The essential oil present in *O. urticifolium* (Fig. 1.2) and *Ocimum lamifolium* (Fig. 1.3) might have contributed to the curative property against the clinically unidentified skin infections.

### 3.5.4 Ringworm

Whole plant extract of *S. suaveolens* (Fig. 1.4) or sap of *C. macroystychus* or leaf extract of *C. zeylanicum* was applied to cure ring worm and itching. The croton species of plants are used in South America as folk medicine for the treatment of wounds, inflammation and cancer. The genus croton is one of the richest sources of alkaloids with aporphine, proaporphine and morphinandienone skeletons. In addition, flavonoids, lignans, phenols and diterpenes with the clerodane skeleton are also commonly found in this genus. Cinnamon oil has been found particularly efficacious in destroying the organisms responsible for occupational dermatitis (Harold, 1925).

### 3.5.5 Skin cancer

The swollen skin with watery discharge and pain was identified as skin cancer by a traditional healer. The healer prescribes root extract of *Gloriosa superba* to cure skin cancer. Colchicines have been used as cytotoxic drug in the treatment of inoperable carcinoma. The tubers of *Gloriosa superba* contain colchicines, benzoic and salicylic acid, sterols and resinous substances-colchicines, 3-demethyl colchicine, 1,2-dimethyl colchicines, 2,3-dimethyl colchicine, N-formyl, N-deacetyl colchicines, colchicocide, gloriosine, tannins and superbine.
3.5.6 Skin tumour
Ripe and yellow leaves or fallen leaf of *J.chimperana* was rubbed against the skin tumour/wart until cure (Table-2). The phenol content of the leaves reaches maximum level when the matured leaves turn yellow. When the crushed leaves were rubbed on the tumour/warts the phenols were absorbed through the skin and aid in cure. Phytochemical examination of hydroalcoholic extract revealed the presence of alkaloids, saponins, polyphenols and glycosides as a major class of compound in *Justicia shimperiana* leaves (Mekonnen, 2005). *Clerodendrum* genus is rich in steroids, terpenes, flavonoids and anti-inflammatory activity (Lee, 2006).

3.5.7 Spider disease
Reddish patches in the skin were reported as spider disease. The inhabitants of Jimma believe that the contact with spider urine causes the itching and perhaps the disease. The fresh root of *Thalictrum rhyncocarpum* (Fig.1.5) was tied over the affected area after the removal of the outer skin. The plant belongs to the family ranunculaceae and the species under the family are known to produce protoanemonin which is the active principle involved in many of the applications. It was suggested that protoanemonin contained in the plants may be responsible for healing process physiologically not psychologically (Turner,1999). The protoanemonin causes skin irritation and blister in fresh state. Hence identification of the pathogen which causes spider diseases and the confirmation of the active principle in *Thalictrum rhyncocarpum* against the pathogen will be mandatory to standardize the dosage.

3.5.8 Tissue parasite
Local people call the tissue parasite as ‘mujili’. In severe case of infection, it causes irritation and itching. Local people have knowledge in removing the parasite. They remove the adult parasite from upper arms and shoulder with needle. Some of the healers apply the fruit paste of *Milletta ferugina* at the site of parasite entry. The identified iso-flavonoids (Dagne, 1989) and the unidentified compounds might have played a role in expelling the parasite.

3.5.9 Wound
There were several types of wounds prevalent and locally called ‘kusil’ and ‘kolla kusil’ meaning untreatable wound. Majority of the inhabitants follow self medication and well aware of the plants used for the treatment of wounds. *Karanchoe densiflora* (Fig.1.6) stem bits/heated leaves were tied with wound to expel the pus from wounds. In Kenya *Karanchoe densiflora* was documented as a remedy for wounds (Bussmann, 2006). Moreover, plants which belong to the family crassulaceae were known for the production of alkaloids and tannins (Stevens, 1995). Leaf extract of *R.nepalensis* (Fig.1.7) was mixed with vaseline or butter and applied to the wounds.Antibacterial (Ghosh, 2003) and antipyretic (Venkatesh, 2004) activity of *Rumex nepalensis* further justify its use in traditional medicine to cure wounds. The facts discussed above provided scientific rationale for the folklore claim. Laboratory investigations in combination with standardization of doses are the need of the hour in international recognition of Ethiopian traditional medicine. Generally the treatments mentioned above were taken as self medication and nearly 50% of the plants were available in the home gardens. One of the frequently cited queries of the traditional healers was that the patients who receive the treatment were careless and do not follow the instructions/doses suggested by the healers and complain on the efficacy. Therefore scientific validation will be mandatory to standardise the doses to avoid side effects.

3.6 Antimicrobial activity of selected plants
Chronic wounds affect a high percentage of the worldwide population and their prevalence is increasing (Hooper,2012). Though modern medicines were available, herbs were used in the treatment of skin infections in the study area. Among nineteen plants reported in the treatment of skin infections especially wounds ten plants were chosen for the current antimicrobial study. Wounds harbour multiple species of microorganisms (Perical, 2010). Microorganisms frequently associated with colonization and infection of wounds, especially *S.aureus* and *S.pyogenes* (Hooper, 2012) were studied. Individual plants are made of mixture of active ingredients in different concentrations. The compounds, which react synergistically with each other, could effectively control the growth of the target organism.

3.6.1 Staphylococcus aureus
Among the ten plants tested, *D.angustifolia* showed highest ZOI of 28.33mm with MIC 12.5µg/ml. In addition to the antimicrobial activity of *D.angustifolia* proved in this research, analgesic, antipyretic (Amabeoku et al., 2001) antimalarial (Mengiste, 2012) and phytochemicals identified by (Udaya Prakash, 2012) justify its use in traditional medicine. *D.stramonium* and *R.nepalensis* also produced higher ZOI than Penicillin antibiotic, the positive control used in this study. *O.lamifolium* showed similar result with the positive control (Fig.5 and 6). *Datura stramonium* seeds contain a poisonous principle called delirants. In addition, lectins which play a role in plant defence mechanism (Peumans, 1995) was found in large quantities in *D.stramonium* might have corollary effect on pathogens causing skin infections in humans. Current study correlated with (Saadabi, 2006) and (Nino, 2006) who found very strong inhibition of *D.stramonium* against *S.aureus*. In contrast, (Taye, 2011) found that *D.stramonium* was not effective against *S.aureus* and *S.pyogenes*.

3.6.2 Streptococcus pyogenes
Very strong antibacterial activity was showed by *D.angustifolia* and *R.nepalensis*, *D.stramonium* and *S.suveolens*. *M.terruginea* was not able to control the growth of *S.pyogenes* and hence did not show any ZOI (Fig.7 and 8). Previous research on wound healing activity (Jha et al., 2011), antibacterial activity of the essential oil (Mwangi et al., 2010) and whole plant extract (Kamali and Mohammed, 2007) of *S.suveolens* against *S.aureus* have proved its efficiency. In addition, (DePooter, 1991) isolated thirty four compounds together with a rare and major natural compound isopinocamphene (33.5%) which could have aided in wide spectrum activity.

4. CONCLUSION
The indigenous traditional knowledge of medicinal plants which developed through interaction of natives of a community with local environments varies with each culture. Documenting the events in each community and further investigation on the medicinal plants to identify the active ingredient is mandatory.
FUTURE ISSUES
Evaluation of the microbial agents against all the microbes associated with skin infections and standardisation of Ethiopian traditional medicine for International recognition.

DISCLOSURE STATEMENT
This research is a self-sponsored study and there is no financial conflict between the co-authors and the Institute where the study was conducted.

ACKNOWLEDGEMENT
The authors thank everyone who helped them to conduct the survey, collection of traditional knowledge and in translation of Amharic language into English. The authors thank Jimma University College of Agriculture and Veterinary medicine for availing the Library, Internet and Laboratory facilities and also thank Mr. Melako Woldfasher, Addis Ababa University, Mr. Kacha Hunde, and Mr. Abathamam in identification of plants.

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