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An ethnopharmacological survey and *in vitro* confirmation of ethnopharmacological use of medicinal plants used for wound healing in Bosomtwi-Atwima-Kwanwoma area, Ghana

Christian Agyare[a,c], Alex Asase[b], Matthias Lechtenberg[c], Michael Niehues[c], Alexandra Deters[c], Andreas Hensel[c,*]

[a] *Department of Pharmaceutics, Faculty of Pharmacy and Pharmaceutical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*
[b] *Department of Botany, University of Ghana, Legon, Ghana*
[c] *University of Münster, Institute for Pharmaceutical Biology and Phytochemistry, Hittorfstraße 56, D-48149 Münster, Germany*

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ABSTRACT

Aims of the study: Wounds represent a major health burden and drain on healthcare resources in the world including Ghana and Africa. The majority of the people of Ghana and Africa still patronize traditional medicine for their health needs including various forms of wounds. The aim of this study is the identification of medicinal plants, type of wounds, dosage forms and collection methods used traditionally in treating wounds in the Bosomtwi-Atwima-Kwanwoma district, Ghana. *In vitro* screening of selected extracts from these plants on cell physiology of human dermal fibroblasts and keratinocytes was to be performed.

Materials and methods: Validated questionnaires were administered to 78 traditional healers in 54 communities of the district. Interviews and structured conversations were used to administer the questionnaires. Selected herbal material dominantly used by the healers was collected, identified and aqueous and ethanolic extracts were investigated *in vitro* on influence on cell physiology of keratinocytes and dermal fibroblasts (MTT-, BrdU-, LDH-assay). Antioxidant activities of ethanolic extracts were determined by free radical scavenging activity. Antiadhesive activity against *Helicobacter pylori* on human stomach cells was investigated for extracts reported to be used for stomach ulcer treatment.

Results: The ethnopharmacological survey revealed 104 plants species belonging to 47 families. The detailed use of these plants is documented. Aqueous extracts of *Phyllanthus muellerianus, Pycnanthus angolensis* and *Combretum smeathmanni* influenced the mitochondrial activity and proliferation of dermal fibroblasts and keratinocytes significantly. Ethanolic extracts of selected plants exhibited strong antioxidant activities comparable to α-tocopherol. For *Spathodea campanulata*, *Hoslundia opposita* and *Pycnanthus angolensis*, which were reported by the healers to be used also for wound healing in case of stomach ulcers, strong antiadhesive activity against *Helicobacter pylori* was demonstrated, while the extracts did not exhibit any direct cytotoxicity against the bacterium.

Conclusions: Traditional use of many wound-healing plants from Ghana can be well rationalized by the *in vitro* investigation of aqueous extracts. E.g. extracts of *Phyllanthus muellerianus, Pycnanthus angolensis* and *Combretum smeathmanni* exhibited significant influence on the cell viability and proliferation of keratinocytes and dermal fibroblasts.

1. Introduction

Wounds have a tremendous impact on the healthcare economy. Chronic wounds represent a major health burden and drain on healthcare resources in the developed countries (Harding et al., 2002; JanBen, 2006). It is estimated that 70 to 80% of patients in Africa, and also in Ghana are treated by traditional healers and herbal practitioners (Diallo et al., 1996; Nyika, 2007). People in Africa rely on traditional medicine for their health needs, including management of wounds because of the high cost of orthodox medicines, inadequate health facilities and healthcare professionals, coupled with a lack of training of health workers on skin disorders and diseases (Mahé et al., 2006). Traditional medicines and medicinal plants used for management of skin disorders and as wound healing agents (Inngjerdingen et al., 2004; Ram et al., 2004; Njoroge and Bussmann, 2007) are easily available and afford-

* Corresponding author. Tel.: +49 251 8333380; fax: +49 251 8338341.
E-mail address: ahensel@uni-muenster.de (A. Hensel).

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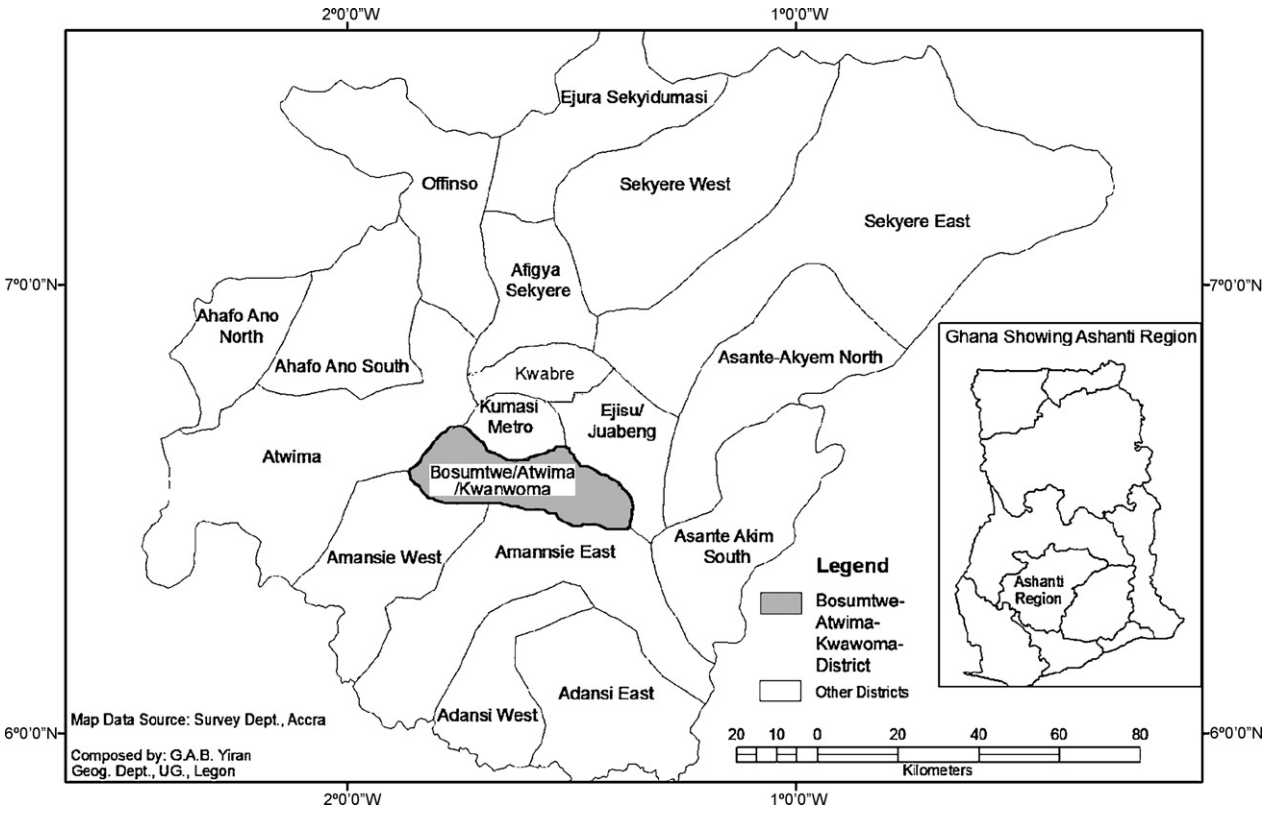

Fig. 1. Geographical description of study area. Map of Ashanti region showing the location of Bosomtwi-Atwima-Kwanwoma District.

able, sometimes free of charge. Most of these medicinal plants have been used for a long time and are assessed to be safer than isolated active compounds (Fabricant and Farnsworth, 2001). Ethnopharmacological investigations on medicinal plants used traditionally for wound-healing have shown that many active extracts and compounds can be identified which stimulate wound healing by induction of skin cell proliferation or differentiation (Deters et al., 2004, 2005a,b; Houghton et al., 2005; Zippel et al., 2009), with additional benefits by potential antioxidant and antimicrobial activities (Mensah et al., 2001; Konning et al., 2004; Jimoh et al., 2007).

Because of the huge reservoir of traditional knowledge on wound-healing plants in Ghana the following study was performed to obtain validated, quantified and reliable data on the use of wound-healing plants in an exactly defined part of the country. The aims of the study were to find out how traditional healers in the Bosomtwi-Atwima-Kwanwoma area of Ghana recognize wounds and how they classify and treat wounds with medicinal plants. It was to be investigated how the respective plants were collected and identified, which part of plants are used, how they are obtained, prepared and applied to wounds and what importance these plants have to the healers beside other non-plant based methods within the management of wounds. Additionally it was to be investigated if under *in vitro* condition with common methods of cell biology, effects associated with skin cell activity and wound healing use can be identified.

2. Material and methods

2.1. Study area and survey

Study area: Bosomtwe-Atwima-Kwanwoma District (Fig. 1), one of the 21 districts in the Ashanti Region of Ghana, 0.15–2.25°W, 5.50–7.46°N. The ethnopharmacological survey was carried out from June to September 2007 in close cooperation with Ghana Federation of Traditional Medicine Healers Association (GHAFTRAM), an umbrella organization including all traditional healers such as herbal practitioners, fetish priests, divine healers, psychic practitioners and traditional medicine practitioners in Ghana. The executives and members of the district branch of GHAFTRAM were contacted prior to the study and informed about the objectives of the investigations. They assisted and cooperated with the survey team. Also non-members of the district branch of GHATRAM participated in the survey. All participants were informed about the survey and personal visits were made to their facilities, centers and homes. In respect to the local tradition, gifts in form of money or local alcoholic drinks were bestowed upon the healers prior to the interviews and administration of questionnaires. Interviews and conversations were used to administer the questionnaires.

Questionnaires were designed in English, translated into the local dialect (Asante-Twi) and administered to 78 traditional healers and herbal practitioners. Interviews were conducted together with a curator/botanist. Voucher specimens of all plants have been deposited in the Ghana Herbarium, Department of Botany, University of Ghana, with defined ID-numbers.

2.2. Plant material and chemicals

Leaves of *Parquetina nigrencens* (Afzel). Bullock., *Phyllanthus muellerianus* (Kuntze.) Exell, *Ficus exasperata* Vahl., *Pupalia lappacea* (L.) Juss., *Hoslundia opposita* Vahl., *Combretum smeathmanni* G. Don., stem bark of *Pycnanthus angolensis* (Welw.) Warb., *Alstonia boonei* Wild. and roots from *Anchomanes difformis* (Bl.) Engl. were collected from Bosomtwi-Atwima-Kwanwoma area and identified by Dr. A. Asase, Department of Botany, University of Ghana. If not stated otherwise all chemicals were purchased by Sigma (Deisenhofen, Germany).