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Anti-inflammatory and cicatrizing activity of *Baphia nitida* Lodd. exudates

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Abstract

Baphia nitida exudate (BNE) is used in folk medicine for the treatment inflammation and cicatrisation of wounds in Côte d'Ivoire. BNE was formulated into an ointment and tested at two dose levels for anti-inflammatory and cicatrizing activity against excision wounds created on dorsal areas of rats. Both provide evidence for the ability of BNE to inhibit the inflammatory condition and to accelerate wound cicatrization on the rats. The activity was found to be dose related, and BNE at 2% was found to be best dose for the two tests used. Phenylbutazone cream used as a positive control reference was significantly active in both systems. These results provide a scientific basis for the traditional use of the exudate of *Baphia nitida* as an anti-inflammatory and cicatrizing agent.

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Introduction

Baphia nitida is a shrubby, hard-wooded African tree. Its wood is commonly used to make a red dye. The earliest dyewood (Camwood) was from West Africa. The source of the dye, which is soluble in alkali, is the bark and heart of the tree. Camwood is a red dye-wood imported from tropical West Africa, and obtained from the *Baphia nitida*, a leguminous tree, of the suborder Caesalpinieae and of the Fabaceae family. This wood is of a very fine colour, and is used in turnery for making knife handles and other similar articles. The dye obtained from it is brilliant, but not permanent. It is called sometimes Bar-wood, though this name belongs also to another tree.

Baphia nitida is belonging to Fabaceae family. This plant is very abundant in under wood of the African dense forests (Aké-Assi, 1984; Lebrun and Stork, 1997) and was used for centuries, in Côte d'Ivoire folk medicine. Leaves of plant have been shown to possess diverse pharmacological properties, acting as a sprain, nosebleed, arthritis, rheumatism and asthma (Neuwinger, 1996; Poorter et al., 2004; Ouattara, 2006. *Baphia nitida* provides a red gum, which is very much used in folk medicine for treating various pathologies, including skin disorders, skin, wounds cicatrisation and inflamed and infected umbilical cords (Onwukaeme and Lot, 1991; Onwukaeme, 1995).

The inflammatory phenomenon and the anti-inflammatory drugs treatments are badly defined in traditional medicine. We did not find at the time of our pharmacological investigations any description corresponding only to this process. It was very difficult to us during our ethnobotanic investigations to index plants that fit under this heading. We were thus obliged to call upon plants that use the treatment of certain pathologies, which, the majority of time, are accompanied by an ignition (distorsion, rheumatism, abscess, etc.). This work was completed thanks to the indications of the tradipraticians who use this plant to look after the abscesses and the cheloïdes, which are generally very painful affections. According to various medical literatures, several adverse reactions are known to be associated with the conventional nonsteroidal anti-inflammatory drugs, thereby limiting the widespread application of these agents. Development of newer anti-inflammatory compounds possessing fewer side effects still remains a challenge to the scientific community.

In the present study we were prompted to further value the anti-inflammatory and wound healing activities of exudate of *Baphia nitida* and using as reference, the non-steroidal anti-inflammatory drug, phenylbutazone.

Material and methods

Plant material

Plant material is constituted of the exudate of *Baphia nitida* Lodd. (Fabaceae). It is a shrub of 6 m height. The sheets are oblong round at the base, acuminate, 8 to 12 cm length, 4 to 5 cm of width, more or less pubescent under the ribs. The flowers are white and odorous. The fruits are pods punts long from 6 to 9 and large of 12 mm cm and broad (Aké-Assi, 1984; Lebrun and Stork, 1997). The exudate was taken by wound of the plant located in the enclosure of the University of Cocody (Abidjan-Côte d'Ivoire) and freeze-dried. Thereafter, we achieve an ointment to 1 and 2% with the powder of exudate and a mixture of excipients (lanolin, propylen, glycol, alcohol).

Experimental animal

Wistar rats, weighting 180 ± 20 g and approximately 8 to 10 weeks old, of either sex were used for experimental study. The animals were housed in colony cages at 25 ± 2 °C and relative humidity (50 ± 5%) with 12 h light: 12 h dark cycle. All the animals were acclimatised to laboratory environment for a week before the experiment. Animals were kept in groups of five and had free access to food and water prior to the experiment.

Chemicals

All the drugs used in this study were of pharmaceutical grade. Phenylbutazone was supplied by Sigma Chemicals Company, St. Louis, USA.

Anti-inflammatory and cicatrizing tests

Excision wounds were created in rats, were used to value the rate anti-inflammatory and cicatrizing tests. All wounds were of full thickness type, extending to the adipose tissue. On shaved dorsal areas, an excision wound of 1.5 cm was executed, in total anaesthesia (cotton soaked with ether) on all sides of the backbone. *Baphia nitida* exudate (BNE) and phenylbutazone (reference) were applied on the abraded skin and then the areas were covered two days, the patches were removed and the skin reactions were evaluated on the basis of designated values showed in Table 1. The same evaluation was performed two days after every bandaging. Bandagings are done during ten days. At every time, the applied ointment quantity is of about 70 mg. Ultimately, five groups of treatment were appearing:

- Group I, rats are dealt with two ointments. On the injury of left, the rats receive the placebo and on the right injury, we applied the ointment of BNE at 1%;
- Group II, rats are dealt with two ointments. On the injury of left, the rats receive the placebo and on the right injury, we applied the ointment of BNE at 2%;
- Group III, rats are dealt with two ointments. On the injury of left, the rats the ointment of BNE at 1%, and on the right injury, we applied the phenylbutazone at 5%;
- Group IV, rats are dealt with two ointments. On the injury of left, the rats the ointment of BNE at 2%, and on the right injury, we applied the phenylbutazone at 5%;
- Group V, Control group, wounds of rats does not receive any product. This group of animals serves to estimate the spontaneous skinning.

The score (Marzulli and Maibach, 1987) is reported in Table 1.

Table 1. Attributed score to value the anti-inflammatory and wound healing activities.

State of inflammation	State of cicatrization	Valutation
No inflammation	No cicatrization	0
Very slight inflammation	Very slight cicatrization	1
Well defined inflammation	Well defined cicatrization	2
Moderate to severe inflammation	Advance cicatrization	3
Severe inflammation	Complete cicatrization	4

Results

After two days contact, the phlogistic process was still evident in all the treated animals. Only a slight reduction of the inflammation could be observed in the rats treated with BNE at 1%. On the contrary, after four days and six days, the oedematous process, which characterizes inflammation, were markedly reduced by phenylbutazone and BNE. The abraded areas seemed less red and the colour plainer. No signs of inflammation were observed, at the end of the experiment, in the rats treated with BNE at 2%, while control showed clear signs of inflammation.

After two days, wound reduction was higher in the group treated with *Baphia nitida* than in the control group and in the animals treated with placebo. With BNE at 1%, wounds heal definitely more quickly than with placebo while its activity is comparable with that of phenylbutazone. BNE at 2% permitted to obtain a faster cicatrizing of wounds than BNE at 1% and phenylbutazone. At the end of the experiment (day 12), a total cicatrization of wounds with BNE at 2% as treatment was observed. Control and placebo have Well defined cicatrization of wounds between 8 and 12 days whereas BNE at 1% has Well defined cicatrization as previously but it causes Advance cicatrisation at day 12 (Table 3).

Table 2. Effects on inflammation of *Baphia nitida*, placebo and phenylbutazone.

Groups of rats		Day 2	Day 4	Day 6	Day 8	Day 10
I	Placebo	1	4	4	3	3
	BN 1%	1	3	3	1	0
II	Placebo	1	4	4	3	3
	BN 2%	0	3	2	1	0
	PB 5%	0	3	2	1	0
III	BN 1%	1	3	3	1	0
	PB 5%	0	3	2	1	0
IV	BN 2%	0	3	2	1	0
Control		1	4	4	3	3

BN, pomade of exudate of *Baphia nitida*; PB, pomade of phenylbutazone; Data are a mean of 6 independent rats. Data are expressed according to the scale reported in Table 1.

Table 3. Effects on cicatrization of *Baphia nitida*, placebo and phenylbutazone.

Groups of rats		Day 2	Day 4	Day 6	Day 8	Day 10
I	Placebo	0	0	1	2	2
	BN 1%	0	1	1	2	3
II	Placebo	0	0	1	2	2
	BN 2%	1	2	3	4	4
	PB 5%	0	1	2	3	3
III	BN 1%	0	1	1	2	3
	PB 5%	0	1	2	3	3
IV	BN 2%	1	2	3	4	4
Control		1	0	0	1	2

BN, pomade of exudate of *Baphia nitida*; PB, pomade of phenylbutazone; Data are a mean of 6 independent rats. Data are expressed according to the scale reported in Table 1.

Discussion

Conventional nonsteroidal anti-inflammatory drugs are the most commonly prescribed agents used for the management of inflammation and pain, however, toxic manifestation associated with these agents is a matter of concern. As a result, several new approaches are now considered for design and development of superior anti-inflammatory compounds, showing fewer side effects. In the present study, we have evaluated the anti-inflammatory and cicatrisation activities of BNE. After the stimulus of injury to tissues, wound healing, a complex sequence of physiological events occurs and results from the release of some factors by the wounding of tissues (Alison, 1992; Kumar et al. 2008). These events involve the migration, proliferation, adhesion and differentiation of the cells (Raghow, 1984; Tubaro et al., 1987).

For the cicatrization test, after two days, from wound creation, there is a better response in animals treated with BNE at 2% *with* respect to phenylbutazone and BNE at 1%, while the control samples present the worst profile. Wound contraction in specimens from the groups treated, respectively, with *Baphia nitida* was significantly enhanced when compared with controls and animals treated with placebo, in which the wound healing is not complete yet at the end of the experiment. Thus, the reference substance, phenylbutazone, which is not a carrier close to our formulations in the laboratory. Phenylbutazone has a healing time similar to BNE at 1%. This formulation allows faster cicatrization than placebo. This is due to the absence of active components in placebo. BNE at 1% appears to have the same amount of active components that phenylbutazone 5%. Most activity of BNE at 2% on wound cicatrization could be related with its high content of active components. Therefore, it can be hypothized that BNE, contains active components capable of exerting the positive actions on wound healing during the first days after topical application. The rate of wound cicatrization is very similar in animals treated with *B. nitida* at 1% and the anti-inflammatory test. *Baphia nitida*, topically applied, enhanced the anti-inflammatory response, most during the first two days from abrasion and the reduction of the inflammation response is better than for BNE at 2%. These results, confirm the good topical effects of BNE. Tubaro et al. (1987) and Percival (2000) found similar results with *Echinacea*. Instead, it could be possible to suggest that the observed anti-

inflammatory activity of *Baphia nitida* may be attributed to its inhibitory effect on the COX–LOX enzymes, probably influenced in turn by the superior free radical trapping activity of the components present in the extract as reported by Kumar et al. (2008) with *Acanthus ilicifolius*. After ten days, healing is considered complete. There are only traces. The various stages of healing have followed: the debridement of the lesion and sprouting and epithelialization. Initially, the cleansing phase is clear. It lasts three to four days depending rats. It is a waste disposal and necrotic substances highly visible in bandages. Then the wound dries out gradually. The budding phase is not visible, it overlaps with that of epithelialization is a reformation of tissue (Vane and Botting, 1990). It is difficult to define when one begins and another ends. The edges of the wounds and blame themselves gradually bulge exists in the database resolves the As. There is a tendency to bridging and the formation of new crust when you remove the old. New fabrics are formed and there is a very frank retraction of the wound. In wound healing process, glycosaminoglycans are the first components of the extracellular matrix to be synthesized. Therefore, BNE seems to have a lower activity after two days, but a potent effect after eight days. Its wound-healing activity is probably due to the antihyaluronidase activity, since hyaluronic acid plays an important role in early wound healing process and changes in its levels affect cellular proliferation and the deposition of structural matrix (Okasala et al., 1995; Chithra et al., 1998).BNE has to protect type III collagen from damage caused by free radicals. This enzymatic inhibition protects from possible infective processes that cause slower wound healing and it could be in part responsible for the anti-inflammatory and cicatrizing activity of the exudate, topically applied (Bonadeo, 1971; Shrotriya et al., 2007; Achinto and Muniruddin, 2009). Furthermore, interaction of hyaluronic acid with keratinocytes also has an important role in the process of epithelialization [15]. Antihyaluronidase activity of BNE assists deposition of hyaluronan, the backbone of large proteoglycan complexes and in consequence, deposition of extracellular matrix, with maturation and organization of the fibrous tissue, important components for the process of wound repair.

Conclusion

The present study on exudate of *Baphia nitida* has demonstrated that this plant has significant anti-inflammatory and wound healing properties. Our results contribute to the pharmacological support of the use of *Baphia nitida* as anti-inflammatory and cicatrizing in the ethnomedicinal practice. This justifies the traditional use of this plant in the treatment of various types of pains and inflammation, wounds cicatrisation and healing.

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