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Wound Healing Agents of Animal Origin: A review

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Abstract

Present paper deals with compilation of an informative data on animal and animal products as wound healing agents. The tribals were interviewed and the frequent meetings were also conducted to cross check the uses. It is found that nine species of animals used as wound healer by local tribal communities from Satpuda Hill ranges of Khandesh region. They used such products in both domestic animals as well as in Human. Most of them are used topically along with some oral substances. Among animals surveyed, non-chordate contributes major group healing agents as compared to chordates. We conclude that, utility of ethnozoological drugs such as animal products would be evaluate as a medicine for wound healing process.

Keywords: *Wound Healing Agents, Animal Drugs, Non-chordates, Chordates*

I. INTRODUCTION

Use of plants and animals is not only as food and fodder but also as medicines. Ethnobotanical drugs are well known as compared to ethnozoological drugs. Phytochemists and pharmacologists from all the over world obtained several patents for herbal drugs developed on the basis of the indigenous knowledge systems of different ethnic groups. Ancient literature is rich in traditional medicinal knowledge. Mainly medicinal plants are reported but few animals are also included. The ethnomedicozoological research still plays its evident scientific role in stimulating further pharmacological studies. Possey (1978), Weidner (1985) and Dufour (1987) have made very relevant contribution in ethnozoology. In India, Chopra (1982), Nadkarni (1990), Khan (1992; 1994) have done some outstanding documentation on ethnozoological or medicinal animals. Leadership in this area have been provided by Joseph (1982-84), Maiti (1984), Tikadar et al., (1985), Azami (1990), Poullins and Robbins (1992) and Sharma (1987) highlighted the importance of ethnozoological drugs of invertebrates and vertebrates' origin as medicine. Literature regarding ethnozoology, animal and animal products as wound healing agents is scanty and much neglected. To throw light on proper utilization as wound healing agents of animal origin is the aim of present study.

Recent aspects about wound healing

Restoration of damaged tissue, wound or fracture is an important process, which plays vital role in survival of life. It is imminent for the basis of all surgical manipulations. Healing process is a complex process, which follow a definite pattern of cellular and molecular events. It follows regeneration, proliferation, granulation, epithelization, contraction, differentiation and synthesis or secretion of different substances (Figure 2). Healing process endeavor to restore the tissue continuity either by contraction process. It is established that, the rate of healing process is enhanced by providing best environment along with important molecular precursors and or essential substances, viz. chondroitin sulphate, eugenol, Vitamin C, Vitamin E, Zinc, Glucosamine, etc. (Udupa et.al, 1995) Besides these basic measures, certain plants, animals and animal products which possess antiseptic, astringents, anti-inflammatory, antimicrobial and bio-stimulator property are also used to enhance the rate of tissue healing.

II. Materials and Methods

Geographical distribution of various tahsils of District Jalgaon is given in Figure 1. An attempt has been made for the evaluation of ethnozoological survey of Jalgaon District (Maharashtra). Out of Fifteen tahsils four are entirely located near and at the base of Satpuda Hill ranges and 60% of the population is Tribal. The Chopda tahsil of the Jalgaon district has Pawara tribe communities while Yawal, Raver and Muktainager have Pawra, Bhil, Tadavi and Adivasi communities. They are known for their folkloric life style. We visited frequently to the various places viz, the tribal villages of Chopda, Yawal, Raver and Muktainager tahsils of the Jalgaon District during the period 2007-2010. The tribals were interviewed and the frequent meetings were also conducted to cross check the uses. The compilation of the data is prepared on accounting [1] Folkloric reputation and [2] Textual books (Chopra, 1982; Nadkarni, 1990; Poullins and Robbins, 1992); [3] Information from local vaidyas (interviewed); [4] References and cross references and [5] Using internet web browsing.

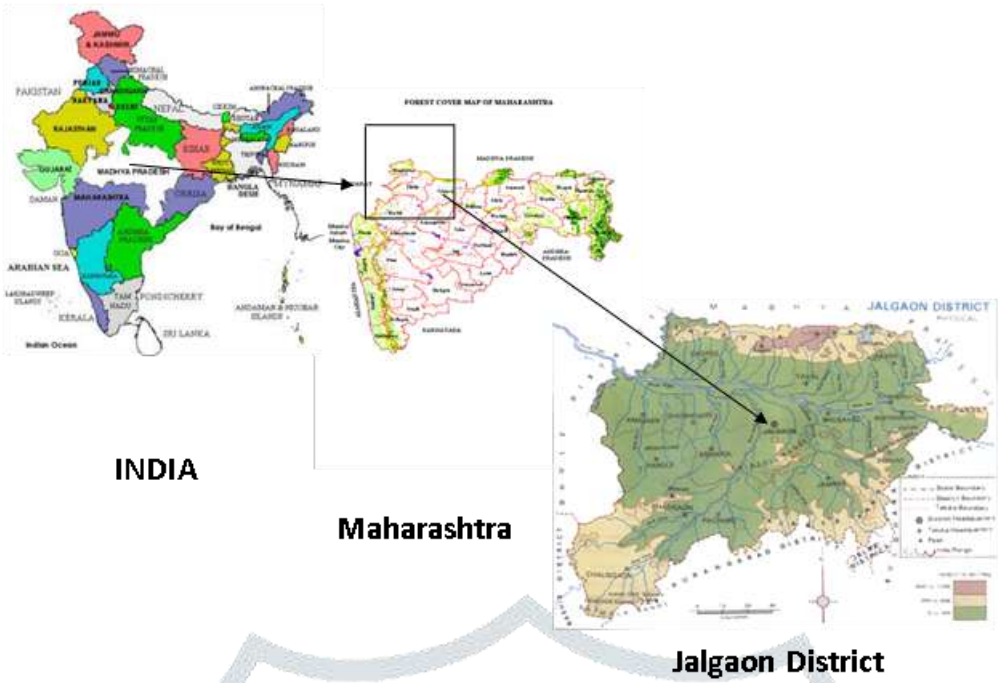


Figure 1 Map of Jalgaon District (Source-http://www.ethnoleaflets.com/leaflets/wound2.ht)

III. Observations and Results

In our laboratory, we have surveyed and reviewed about 124 animals used in various diseases and disorders (Table I). While studying these animal tissue sources, we struck some interesting information from tribal community of Satpuda Hill, as they used divers group of animals in wound healing. They topically used to apply such nine animal species and their products, as no medical facilities are available, since primary health center is located at long distance from their locality. The details about these nine species with their taxonomical name, English name/vernacular name and mode of application are described in Table III. These animals are recorded for topical application on wound healing. Some tissues used for healing the wound are flesh, secretion, milk, hairs, horns, extractives such as cod liver oil, oil preparations, active ingredients like enzymes and factors, saliva, whole animals, animal products viz. honey, ash, blood plasma cow-dung, urine, eggs, etc. Their mode of application varies from region to region. On reviewing taxonomical position of animals, it shows that Arthropoda have the dominating role over other non-chordates. Mammals follow this over other chordates. Products such as Lanolin, Factor VIII, Enzymes, honey are very useful. Substances used in wound healing as accessory chemicals are given in Figure 2. Review of literature showed a little work has been done on animals for wound healing as standard drugs. Body cells and tissues are continuity threatened by the damage caused by free radicals and reactive oxygen. The well-known property of almost each category listed in table II have the capacity to act as antioxidant. A more systematic investigation of these animals may lead to invention of novel and eco-friendly natural product. The aim of present study to promote effective drug or a cream which will result with high therapeutic value, primarily and oral concomitant feeding of drug for better healing effect. Chemical analysis of these animals may lead to development of some potential drugs with high therapeutic index. Tribal medicines used by them are also effective for domestic animals. The recent studies on wound healing activity claim that these substances promote significant healing activity.

Table I List of animals used in various diseases and disorders.

Sr. No.	Name of Animal	Diseases and Disorder
1.	*Achatina fulica*	Shell is used for preparing medicated oil
2.	*Achatina stellatus*	In chronic diarrhea
3.	*Acipenser huso / A. stellatus*	Isinglass is manufactured, nutritious, demulcent. Given in chronic diarrhea.
4.	*Acriodotheres ginginianus*	Cardiac stimulant, beneficial in vitiated wind and cough.
5.	*Adeps lanae*	Used as an emollient base for medicated creams and ointments, to soften and soothe the skin and to improve the absorption of a drug through the skin.
6.	*Agama agilis*	Ash used as nerve tonic, stimulant, aphrodisiac, in spermatorrhea.
7.	*Agkistrodon rhodostoma*	From venom extract antivenin to treat the snake bite. Ancrod is extracted pharmaceutically from enzymes in *A. rhodostoma* and given in orthodox medicine to discourage the formation of blood clots that may cause stroke or heart attack.
8.	*Agkistrodon acutus*	From venom extract antivenin to treat the snake bite. Used to treat spasms, cramps and facial paralysis. Flesh is used to strengthen eyesight, ease muscular pains and improve intelligence and venom is prescribed as a slow acting but long-lasting painkiller to relieve chronic pain such as sciatica.
9.	*Alectoris graea*	Flesh- astringent, generative of strength, stomachic. Given in high

Sr. No.	Name of Animal	Diseases and Disorder
		fever, ambrein.
10.	*Ambra grasea*	In weakness, epilepsy, spasms and nervous debility, cholera, plague and infectious disease
11.	*Anabas scandens*	Flesh- astringent, demulcent, easily digestible, cardiac stimulant, slight bilious and alleviative of wind.
12.	*Anser indica*	Flesh and eggs beneficial in cough, heart disease and ulcers. Flesh is stimulant, difficult to digest, nutrient, phlegmatic, corrective of voice alleviates 'vayu'
13.	*Antigona antigone*	Flesh is beneficial in diarrhea
14.	*Antelope cervicapra*	Flesh is antigen of stomachic, useful in fever, ulcer, phthisis, pile, jaundice and cough
15.	*Apis – mellifera, indica, florea, dorsata,*	Honey – energy source, in digestion, constipation, asthma, chronic cold, troublesome cough and throat, rickets, malnutrition, scurvy, ulcer, scalds and wound healing, diabetic,
16.	*Ardeola gravii*	Flesh used in fever, phthisis, cough, edema, loss of appetite, swoon and stone in the bladder.
17.	*Arlus arius*	Flesh is difficult to digest improve memory, wind and phlegm.
18.	*Athene brama indica*	Flesh stimulant, produces 'vayu'. In edema, insanity and loss of semen.
19.	*Aquus asinus*	Milk- cardiac stimulant, useful in wind and phthisis. Ghee- astringent, stimulant, antiphlegm, easily digestible. Flesh- cardiac stimulant. Urine useful in gout.
20.	*Balaena whale*	Demulcent difficult to digest, induces dyspepsia, phlegm and is a cardiac stimulant and carminative
21.	*Barbus sophare*	Demulcent, antiphlegm, alleviative of 'vayu' and beneficial in the diseases of mouth and throat.
22.	*Bezoar serpent stone*	In miscarriage
23.	*Bivalve shell chhip*	To remove hair
24.	*Bombax mori*	Used as styptic, tonic and astringent to check profuse menstruation leucorrhea and chronic diarrhea
25.	*Bos bubalus*	Cardiac stimulant, demulcent, aphrodisiac, phlegmatic and hypnotic
26.	*Bos Taurus*	Fresh cow dung put over on the burnt parts alleviates the pain of burns and wound applied to stops the bleeding and heals the wound
27.	*Bothrops jararaca*	A synthetic teprotide has been used in orthodox medicine to investigate high blood pressure. The venom is used to make an antidote.
28.	*Callichrous pabda*	Flesh is demulcent, cardiac stimulant and carmin.
29.	*Camelus dromodarius*	Milk- easily digestible, stimulant, useful in piles, edema, worm, abdominal tumours, dropsy, phthisis and leprosy.
30.	*Carcharodon carcharius*	Oil is substituent for cod liver oil, richer in iodine and phosphorus than cod liver oil but contain less bromine and Sulphur.
31.	*Calstoreum castor*	Stimulant of exhausted nervous system, antiseptic, useful in hysteria, epilepsy, asthma, muscular tumour and tympanitis, specific influence over uterus
32.	*Catla catla*	Flesh beneficial in disturbance of the three humors.
33.	*Capra aegagrus*	Flesh- nourishing, cardiac stimulant. Milk- sweet, cooling, astringent, beneficial in fever, bile, cough, consumption and dysentery.
34.	*Cateria lacca*	Chronic fever and consumption and applied to chest in remittent fever and used in lumbago, myalgia, epilepsy and hysteria, also applied to nape of neck and spine. If oil applied to the body of pregnant women the fetus grows faster.
35.	*Cera alba*	Beeswax give relief in Scorpion bite and local application for fistula. A paste made up of wax, soap and root of castor oil plant in honey is used for application in ulcers.
36.	*Cervus dama*	Given internally in painful affections of joints, sciatica and lumbago in cardialgia, pleurodynia. Useful in cough, asthma, low fever, phosphaturia.
37.	*Cervus edphus*	Bhasma given as restorative tonic with honey in clusters of respiratory tracts as cough asthma. Local astringent, sedative, internally nerve and blood tonic.
38.	*Cetaceum spermaceti*	Demulcent.

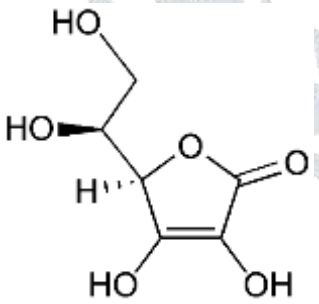
Sr. No.	Name of Animal	Diseases and Disorder
39.	*Clamator jacobinus*	Flesh- cardiac stimulant, nutritious, in epistaxis and phlegm.
40.	*Clarias batrachus*	Flesh- demulcent, used in diarrhea.
41.	*Clupea ilisha*	Flesh- demulcent, bilious, phlegm, carminative.
42.	*Clupeiformes species*	Used for hyperlipidemia, to prevent atherosclerosis, coronary thrombosis. Flesh oil used to lower blood pressure, for psoriasis, eczema and arthritis and to boost the immune system.
43.	*Chelonia turtle*	It is used as alternative, nutrient and demulcent fat is chiefly given in scrofula, rickets, anemia and pulmonary affections.
44.	*Coccus cacti*	Sedative, antiseptic, in neuralgia and whooping cough.
45.	*Columba domestica*	Flesh- demulcent, tonic, cardiac nutritious, in constipation, beneficial in phlegm, bile, vitiated blood and wind, leprosy, prohibited in jaundice.
46.	*Concha ostrea*	Used as calcium supplement, for instance to strengthen the gums and teeth and also for indigestion, high blood pressure, restlessness, insomnia, tinnitus, night sweats and womb disorders and after fevers.
47.	*Corallium rubrum*	As local astringent used in preparation of tooth power, in cough, phthisis, asthma, low fever, urinary disease, spermatorrhea, gleet of gonorrhea, carbuncle, scrofulous affection and nerving tonic in headache, giddiness and vertigo
48.	*Corvus splendens splendens*	Flesh- nutritious, cardiac stimulant, beneficial in ulcer, phthisis and eye disease.
49.	*Crocodilus porosus*	Flesh- demulcent, beneficial in vitiated bile.
50.	*Crocopus phoenicopterus*	Flesh- astringent, easily digestible.
51.	*Crotalus horridus*	Given homeopathically for swelling and pain that is worse for pressure.
52.	*Cyproea moneta*	Used in dyspepsia, jaundice, enlarged spleen, liver, asthma and cough. Ash is given internally in scalding of gonorrhea. “Shula Gaja Kesari” pill mass with the aid of betel leaves.
53.	*Demospongiae*	Applied externally to swollen glands and to eyes to improve eyesight and used for washing wounds and cavities.
54.	*Elephas maximus*	Teeth ash- astringent, in leucorrhea, jaundice, conjunctivitis and sterility in women.
55.	*Equus caballus*	Milk- stimulant, demulcent. Urine- in ringworm and intestinal worm.
56.	*Eudynamis scolopaceus*	Flesh- phlegm, antibilious.
57.	*Fel bovinum purifactum*	Laxative, antispasmodic, cooling, measles, small pox, whooping cough, choleraic symptoms, convulsions, hysteria, jaundice and abortion
58.	*Felis tigris*	Fat used in leprosy, in rheumatism.
59.	*Francolinusn pondicerianus*	Flesh- astringent, demulcent, easily digestible, constipating, cardiac stimulant, improves memory, beneficial in cough, phthisis, fever.
60.	*Gallus bankiva*	Demulcent, laxative, nutritious.
61.	*Gallus domesticus*	Flesh- stimulant, demulcent, cardiac stimulant, nutritious, beneficial in disturbance of the three humours, phthisis, vomiting and remittent fever.
62.	*Gryllotalpa orientalis*	Used for water retention, to ripen boils and abscesses to bursting point and for difficult labor.
63.	*Haliotis gigantea*	Used for fevers. Headache, dizziness, red eyes and blurred vision.
64.	*Halicore dugong*	Dugong oil substitute for cod liver oil.
65.	*Hippocampus kelloggi*	Used as a general tonic and for kidney problems, alcoholic extractions for their hormone stimulating effects.
66.	*Hippocampus covonatus*	Used as a general tonic and for kidney problems, alcoholic extractions for their hormone stimulating effects.
67.	*Hirudinaria granulosa*	Anticoagulant and antiphlegmatic.
68.	*Hirudo medicinalis*	Live leeches used to prevent blood clotting after severe wounding or plastic surgery and for varicose veins. Dried leeches are used to mobilize congealed blood after injury or thrombosis, for amenorrhea, gives for piles and inflammation of the throat and urinary tract.
69.	*Homo sapiens*	Apart from transfusions, the main use of blood preparations is to arrest hemorrhaging. Hormones from urine or placenta are given

Sr. No.	Name of Animal	Diseases and Disorder
		to induce ovulation in women, to treat undescended testes in young men and for infertility treatment. In Chinese medicine, the clear urine of healthy boys under 12 years is given for tuberculosis and chronic cough and dried placenta is taken as a general tonic, especially for blood and energy deficiency, for sterility and for impotence. Bone marrow and organs such as kidney, livers and hearts are used in transplant operations.
70.	*King-fisher*	Flesh- demulcent, useful in epistaxis.
71.	*Kumyss or kumiss*	Dietetic, nourishing and restorative agent given in diabetes in irritability of stomach and obstinate vomiting
72.	*Lacerta agilis*	Nervine tonic stimulant and aphrodisiac in debility, spermatorrhea and seminal weakness.
73.	*Lachesis mutus*	Given as a remedy for headache, epilepsy, palpitations, angina, appendicitis, painful swollen throats, period pains and boils and abscesses.
74.	*Laccifer lacca*	Used as aid to healing, particularly for bleeding gums, excess menstrual bleeding and fainting after childbirth, also in blood, kidney and liver disorders. In orthodox medicine it is commonly used to coat tablets.
75.	*Lepus ruticaudatus*	Flesh- astringent, cardiac stimulant, beneficial in fever, jaundice, diarrhea with fever, phthisis, cough and piles.
76.	*Lobeo rohita*	Flesh- astringent, demulcent, cardiac stimulant, strengthening, slight bilious, beneficial in vitiated wind.
77.	*Lumbricum terrestris*	Used for breathing difficulties, coughs, water retention and fevers, particularly those related to the lungs and as an antidote to poisons.
78.	*Lycosa cubensis*	Given for swelling and abscesses.
79.	*Lytta vesicatoria*	Apply them to the skin to improve circulation for instance for local irritations and to counter infections. Used for kidney stones, absent periods or an enlarged spleen.
80.	*Macacus rhesus*	Flesh- Haematinic, beneficial in eye diseases, phthisis, cough and piles.
81.	*Mel depuratum*	Laxative, nutritive. useful in cough, asthma, fever, dyspepsia,
82.	*Moschus moschiferous*	Eye diseases, phthisis, cough and piles, expectorant, laxative, aphrodisiac, nervous disease, paralysis, epilepsy, hysteria, convulsion, typhoid, coma
83.	*Motacilla maderaspatensis*	Flesh- laxative and beneficial in diseases originated from vitiated phlegm and bile.
84.	*Mus-rattus*	Demulcent, cardiac stimulant, in worms and piles
85.	*Mutilla occidentalis Occidentalis*	Ash – nervine tonic, antispasmodic, paralysis, edema.
86.	*Mylabris cichorit*	Substituent for cantharides.
87.	*Mylabris pustulata*	Internally stimulant, diuretic, externally powerful and valuable counter-irritant, vesicant.
88.	*Mylabris trianthema*	Diuretic.
89.	*Mytilus margritiferus*	Ash- stimulant, tonic and aphrodisiac pearls are laxative, sedative, emetic and nutritive. Mukta bhasma- in cough phthisis and asthma, in nervous disease, chronic headache, epilepsy, leucorrhea, spermatorrhea and impotence.
90.	*Naja Naja*	Venom is a potential source of medicines, including anti-cancer drugs and pain-killers.
91.	*Oleum jacoris*	Liver oil used for eczema and arthritis and given as a vitamin supplement.
92.	*Os draconis*	Used for all nervous ailments, liver problems and abnormally bleeding womb and also apply externally for persistent sores.
93.	*Os sepie*	Antacid, astringent, local sedative, tropical sprue and dysentery
94.	*Ostrea edulis*	Flesh- acrid, demulcent, useful in phthisis, sula and heart diseases.
95.	*Ovis aries*	Flesh- refrigerant.
96.	*Ovis vignei*	Flesh-executive of bile and phlegm. Urine- stimulant, beneficial in leprosy, piles, sula, dropsy, edema and gonorrhea.
97.	*Ovum- Hen's egg*	Egg yolk used as a heart medicine. Egg white used to soothe sore throats and for healing wounds and burns. The shell is taken for

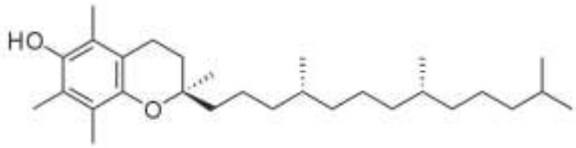
Sr. No.	Name of Animal	Diseases and Disorder
		tuberculosis, inflammation of the stomach lining and scrofula and for skin and eye diseases. Lecithin is taken to break down blood fat deposits and for dementia.
98.	*Palaemon curcinus*	Flesh- cardiac stimulant, constipating, phlegm. Beneficial in obesity, bile and vitiated blood.
99.	*Passer domesticus*	Flesh- palatable, refrigerant, demulcent, cardiac stimulant and aphrodisiac.
100.	*Pavo cristatus*	Flesh used for contracted limbs, grease used medicinally.
101.	*Perdix sylvatica*	Flesh- cardiac stimulant, improve memory and digestion, useful in wind, bile and in epistaxis.
102.	*Perra canaliculata*	Taken for both rheumatoid arthritis and osteoarthritis.
103.	*Phalacrocorax niger*	Flesh- demulcent, alleviative of 'vayu'.
104.	*Pinctada margaritifera*	Ash- stimulant, tonic, aphrodisiac, laxative, sedative, emetic, nutritious.
105.	*Plexaura species*	Prostaglandins extracted from outer layer are given to stimulate many body functions such as contraction of the womb during labor. Coral ash externally applies as a tooth powder, for earache and as a surma for eye disorders.
106.	*Psittacula krameri*	Flesh- easily digestible, refrigerant, cardiac stimulant, constipating, beneficial in cough and phthisis.
107.	*Pteria margaritiferia*	Pearl used for spasms, convulsions, headache and insomnia.
108.	*Rana tigrina*	Flesh- cardiac stimulant, phlegm, slight bilious, alleviated thirst, gonorrhea, phthisis, leprosy, vomiting.
109.	*Rhinoceros unicornis*	Flesh- astringent, difficult to digest, nutritious, cardiac stimulant and alleviative of vomiting and epistaxis.
110.	*Saccobranchus fossilis*	Flesh- demulcent, easily digestible, cardiac stimulant, aphrodisiac, galactagogue, in dropsy, jaundice, bile, phlegm. And wind.
111.	*Saiga tatarica*	Used for fevers, dizziness, blurred vision, headache and convulsions. Deer velvet used as a tonic and to accelerate the healing of wound and ulcers.
112.	*Scilla serrata*	Antibilious, diuretic, laxative, hematinic, cardiac stimulant and alleviative of 'vayu'.
113.	*Scolopendra subspinipes*	It is given internally to counter poisoning and for spasms, convulsions and lockjaw. Applied externally to soften and disperse sores and lumps, including cancers, particularly on the neck.
114.	*Scomberomorus commersonii*	Substitute for cod or shark oil.
115.	*Sepia esculenta*	Cuttlebones used for stomach ulcers and indigestion, abscesses, sores, wound and menstrual problems and for kidney stones, nausea. Externally used for inflammation and skin diseases and as a toothpowder. In homeopathic remedy *Sepia* given for ulcers, warts, incontinence, menopausal and menstrual problems and detached apathy resulting from shock.
116.	*Somniasus microcephalus*	Liver oil taken before and during radiotherapy treatment for cancer to reduce side effects. Also been tested as a treatment for cervical cancer and has been shown to improve well-being following treatment and to lengthen survival. Used as general tonic.
117.	*Taccardia lacca*	Hematemesis, caries.
118.	*Trichogaster fasciatus*	Flesh- astringent, constipating.
119.	*Turbinella rapa*	Anodyne, carminative, digestive, astringent, demulcent, cardiac stimulant, nutritious, phlegmatic, gonorrhea, dysentery, dyspepsia, colic ulcer, eye troubles, ear ache, jaundice,
120.	*Turnix M. tanki*	Flesh- astringent, demulcent, constipating, stomachic. And beneficial in disturbance of the three humors.
121.	*Varanus bengalensis*	aphrodisiac
122.	*Viverra zibetta*	Stimulant, aphrodisiac, antispasmodic
123.	*Whale*	Flesh- demulcent, stimulant, constipating, induces dyspepsia, cardiac stimulant, phlegm.
124.	*Xanchus pyrum*	Flesh- demulcent, cardiac stimulant, nutritious, useful in phthisis, abdominal tumors.

Table II Accessory components involved in wound healing process

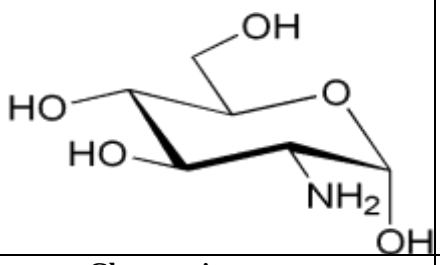
Sr. No	Supplementary substances	Mode of action	References
1	Glucosamine	The amino sugars include D-glucosamine. A constituent of Hyaluronic acid. Several antibiotics contain amine sugars believed to be important for their antibiotic activity	Mayes and Murray, 1992. (Ch.15, pp-154)
2	Chondroitin sulphate	Are located at site of calcification in endochondral bone and are also found in cartilage. They are also located inside certain neurons and may provide an endoskeleton structure, helping to maintain their shape.	Murray and Keeley, 1992. (Ch.57,pp-704-706)
3	Hyaluronic acid	It is especially high in concentration in embryonic tissue. It is thought to play an important role in permitting cell migration during morphogenesis and wound repair.	Murray and Keeley, 1992. (Ch.5, pp-706)
4	Hydroxyproline	Hydroxyproline confer rigidity on the collagen molecule, hydroxyproline is formed by the post translational hydroxylation of peptide bound proline residues catalysed by the enzyme Prolyl hydroxylase, whose cofactors are ascorbic acid and α-ketoglutarate.	Kamath et al., 2003.
5	Lysyl oxidase	Collagen fibers are further stabilizes by the formation of covalent cross links, both within and between the triple helical units. These cross-links form through the action of lysyl oxidase.	Udupa et al., 1995.
6	Vitamin C	It acts as a cofactor for the synthesis precursor Prolyl and Lysyl hydroxylase of collagen fiber.	Murray and Keeley, 1992. (Ch.57,pp-698)
7	Vitamin E	The main function of Vit. E is as a chain breaking, free radical trapping.	Mayes, 1992. (Ch.53, pp-647)
8	Zinc	Function as prosthetic groups in enzymes.	Patel, 2005.
9	Copper	Function as prosthetic groups and cofactor in enzymes	Rand and Murray, 1992. (Ch. 59 , pp-743)
10	Eugenol	Acts as antioxidants.	Farahpour et al., 2012.
11	Curcumin	Acts as antioxidants	Jagetia and Rajanikant, 2004.



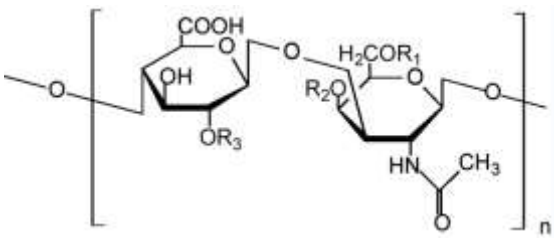
Vitamin C



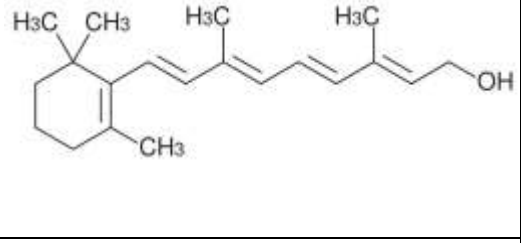
Vitamin E



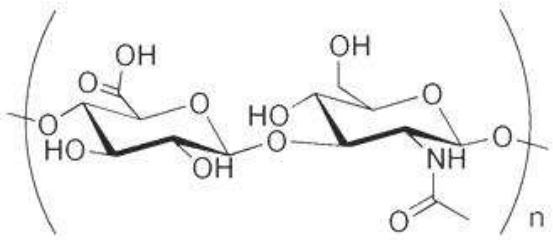
Glucosamine



Chondroitin sulphate



Vitamin A



Hyaluronic acid

Figure 2 Some accessory wound healing agents

Table III List of animal and animal products used in wound healing.

Sr. No.	Phylum	Zoological name (English name/vernacular name)	Mode of usage / Parts used
1.	*Annilida*	*Hirudo medicinalis* (Leech/Jaluka)	Live leeches and extracted enzymes given to prevent blood clotting after wounding or surgery.
2.	*Arthropoda*	*Scolopendra subspinipes* (Centipede/Gom)	Applied externally for carbuncles, sores and lumps.
3.		*Gryllotalpa orientalis* (Mole cricket/Ratkeeda)	Used for ripening the boils and abscesses.
4.		Maggot (Ali)	Accelerate the healing of wounds and Ulcers.
5.		*Apis mellifera* (Honey bee/Madhmashi) and product-Honey(Madha).	Honey used externally for wound healing.
6.	Aves	Ovum (Hen's egg)	Long been used for healing wounds and burns.
7.	*Mammals*	*Sus scrofa* (Pig/Dukkar)	Pig's pancreas, gives us clotting factor VIII to prevent bleeding.
8.		*Adeps larvae* (Sheep/Mendhi)	Refined wool fat or Lanolin improves skin penetration of other ingredients.
9.		*Saiga tatarica* (Antelope/Harin)	Accelerate the healing of wounds and Ulcers.

IV. Conclusive Remarks

Use of such animals and animal products for wound healing should not be neglected. The Satpuda Hill of Khandesh Region is rich source of such products. Research on this aspect should take cognition after taking permission from ethical committee. The formulation of such products offers proper utility of indigenous sources as medicines as per Pharmacopeias.

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