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Review

Molecular potentials of Chikadoma as a bacteriocidal agent

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Abstract

For the purpose of avoiding the emergence of untreatable bacterial infections, the search for novel antimicrobial agents from plant sources to combat pathogens has become crucial. This paper reviews the molecular potentials of Chikadoma as a bacteriocidal agent. The documented phytochemical investigations of this versatile medicinal shrub widely cultivated in Nigeria essentially as anornamental plant, have revealed the isolation of pharmacologically active components including stigmastene 3,6-dione, tetrahydroxy flavones-3α- rhamnoside, ursolic acid, and ellagic acid which is phenolic acid. Previous studies indicate that Chikadoma possessesvarieties of pharmacological activities such as antimicrobial, antiemetic, antipyretic, antioxidant and anti-inflammatory properties. This review becomes pertinent as reports have shown that currently despite one-quarter to one-half of pharmaceuticals in the United States of America originating from higher-plants, very few are used as antimicrobials, relying more on bacterial and fungal sources, stating bluntly that since the advent of antibiotics in the 1950s, there has been virtually nonexistence of the use of plant derivativesas antimicrobials; hence the need to explore the potentials of Chikadoma as bacteriocidal agent.

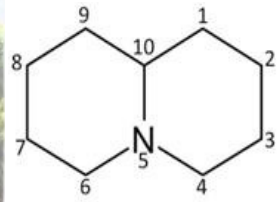
Keywords: Chikadoma, *Lupinusarboreus,* Phenolics and bacteriocidal agent, Yellow bush

INTRODUCTION

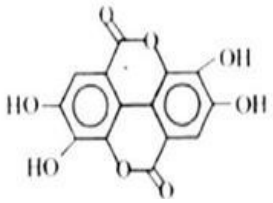
Micro-organisms have untoward effects on the quality and safety of life. Synthetic chemicals are conventionally used against these micro-organisms. In many cases, they develop resistance to commonly used antimicrobial agents. The plausible reason for this high resistance may not be unconnected with worldwide and indiscriminate application in the environment (Anyim *et al.,* 2010; Mukherjee *et al.,* 2002). Also, these antimicrobial agents sometimes cause immune suppression andan allergic reaction. Despite tremendous research being carried out for allergic and immune disorder, it still remains a disease which can be "controlled" and not "treated", since no satisfactory remedy is available in the allopathic system (Ram *et al.,* 2012). Report has it that on the average three antibiotics derived from microorganisms are launched each year and the effective life span of any antibiotic is limited (Cowan, 1999). Hence, there is great interest worldwide for the use of an alternative system of medicine. The search from medicinal plants for novel antimicrobial agents to combat pathogens has become crucial for curbing the emergence of untreatable bacterial infections (Bandow *et al.,* 2003; Pfaller *et al.,* 1998).

Plants have made available an arsenal of chemicals to withstand attack by microbial invasion (Martini *et al.,* 2004). The application of essential oils and plant extracts therefore, are less damaging on the human health and environment (Misra and Pavolvstathis, 1997; Isman, 2000).

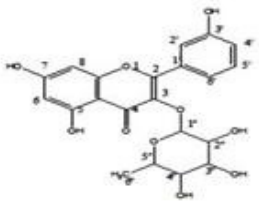
Leaves and bushy shrub of Chikadoma *(Lupinusarboreus)* in Nigeria location.



Quinolizidine



Ellagic Acid



Tetrahydroxyflavone-3-rhamnosideα

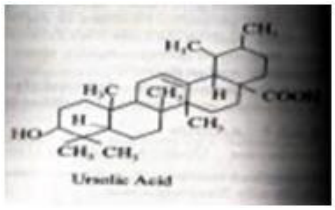


Figure 1. Chemical Structures of some major constituents of Chikadoma *(Lupinusarboreus)*in Nigeria location

Antimicrobial Agents

In its broadest sense, antimicrobial agents are known to treat diseases by attacking microbes. These include antibacterial, antifungal, antiprotozoal and antiviral drugs. Chemotherapy utilizes selective toxicity and biochemical differences that exist between microorganisms and human beings to their advantage. Though relative in most cases as it demands that the concentration should be atatherapeutic dose and to patient factors that can predispose individuals to toxicity, selective toxicity possesses the ability to attack or kill an invading microorganism without causing harm to the host's cell (Katzung, 2001). Antimicrobial agents can be classified based on chemical structure, the spectrum of activity, mechanism of action or degree of effect. For the specific purpose of this review the classification based on spectrum of activity will be emphasized namely:

a. Bacteriostatics: These agents inhibit the reproduction or the development of microorganisms, leaving the body defensive system to destroy them. This implies that their therapeutic effect is dependent on whether ornot the body's immune system is intact. Bacteriostatic agents include tetracyclines and chloramphenicol.

b. Bacteriocidals – Conversely, bacteriocidal antimicrobial agents destroy outrightly, the microorganisms. These agents do not necessarily depend on the immune system. Therefore, they are therapeutically effective even with acompromised immune system. In both situations, plasma bacteriostatic and bacteriocidal concentration must be maintained until the micro-organism is killed by the body defense mechanism and the bacteriocidal effect respectively. However, this classification may seem loose or simplistic recognizing that an agent which has bacteriostatic activity against one organism can exert bactericidal activity against another. Chloramphenicol for example, fits into this explanation being bacteriostatic against gram-negative rods but bacteriocidal against other organisms such as *S. pneumonia* (Katzung, 2001; Ohadoma, 2017).

Natural products with antimicrobial activity

Natural products and their derivatives represent according to literature, more than 60% of the drugs in chemical use, one quarter of which originating from higher plants (Cragg *et al.,* 1997). A wide variety of secondary metabolites such as flavonoids, tannins, alkaloids, terpenoids are rich in plants, which have been found to have antimicrobial properties in *vitro*. This review highlights some of them (Cowan, 1999) *Medicago sativa, Pimentadioica, Aloe barbadenesis, Aloe veramalussy-lvestris, Nerberis vulgaris, Ocimumbasilicum, piper nigrum, Echinaceaeangustifolia, Panaxnotoginseng (ginseng), Cannatis (Hemp), Anacardiuimpulsatilla (cashew) Allium sativum (garlic) Camellia sinensis (green tea), Allium cepa (onion) cassia angustifolia (senna).* The major class of compounds from plants with antimicrobial tendencies is phenolics which include: Simple phenols, phenolic acid, quinones flavonoids, flavones, flavonols, tannins coumarins (Cowan, 1999; Okwu, 2006). Other classes include: terpenoids, essential oil, alkaloids, lectins, polypeptides and polyacetylenes..

Chikadoma

Origin and sources

Chikadoma is commonly planted as an ornamental plant

in Nigeria where it derived its name after a lead researcher Dr. Chika Ohadoma, who extensively pioneered work on the novelty study of the pharmacological utility (Ohadoma, 2018). The English name of Chikadoma is "Yellow bush"; in the USA (Northern California) it is called "Coastal bush" while the taxonomical classification of the Genus and species are *Lupinus* and *arboreus* respectively (Pickart and Miller, 1998; Pliny, 2009). Chikadoma is native to California USA and during the early to mid-1900s it was introduced to many dune systems as a sand stabilizer. In Nigeria the motive was different as the spread of Chikadoma is attributed to aquest for aesthetic garden and environmental beauty where it serves as anornamental flower.Other species of the genus, varieties and forms which contain useful substances in the quantitative contents as well as in their qualitative structures include *L. angustifolius* known as "narrow-leaf lupine". *L. albus* is referred to as "white lupine". This particular species is reputed for the quantity of methionine present in the seed within the limits from 177 to 320mg per 100g representing 0.4 – 0.7% in protein (Kurlovich et al., 1980). *L. mutabilis* is known as "Andean pearl lupine". *L. mutabilis* sweet which are the low alkaloid forms of the species is available by removal of alkaloids via means of soaking and cooking. Another species is *L. luteus* simply known as "yellow lupine", while *L.Chamissionis* is called "blue bush lupine". *L. Polyphyllus* is known as "multifoliate or Washington lupine" (Kurlovich *et al.,* 1980).

Phytochemistry

Chikadoma has a plethora of phytochemicals which vary according to the source and geographical origin. Among the phytochemicals include flavonoids, saponins, glycosides, terpenoids, steroids, resins, proteins, reducing sugar and alkaloids. It is noteworthy to emphasis that quinolizidine alkaloids which are considered Chemotaxonomical markers of the plant genus, irrespective of origin have constantly been present (Ohadoma, 2018). Reported evidence has shown that flavonol glycosides (tetrahydroxy flavones - 3α-rhamnoside), stigmast steroids (stigmastene 3,6-dione), triterpene hydroxyl acid (ursolic acid) and phenolic compounds (ellagic acid) have been isolated from Chikadoma (Ohadoma, 2018).

Potential as bacteriocidal and concluding remarks

The pharmacological studies and documentation of Chikadom hitherto are relatively scarce (Lough, 1992; Ohadoma, 2018). Among the findings of available scientific investigations and documentations on Chikadoma is the antimicrobial activity. The crude methanol leaf extract, ethylacetate, n-hexane and methanol fractions of Chikadoma have been shown to exert activity against Clinical isolates of Gram-positive and Gram-negative bacteria (Ohadoma *et al.,* 2014). A lot more still needs to be explored and utilized, hence this review attempts to probe the potential status of the degree of antibacterial effect – whether bacteriocidal or otherwise bacteriostatic. The Gram-positive and Gram-negative bacteria are responsible for a lot of the multi-drug resistant infections in Nigeria (Kesah *et al.,* 2003), asymptomatic genital and urinary tract infections, otitis media including wound infections caused by *Pseudomonasaeruginosa* (Onyeka *et al.,*1995) and *Salmonella* (Akinyemi *et al.,* 2000) and *Staphylococcus aureus* (Akerele *et al.,* 2002), upper respiratory tract infections, and osteomyelitis prevalent in children caused by *Bacillus* and *Streptococcus*, species (Onuba,1992). According to Arshad (2007), the main molecular compounds with antimicrobial activity are phenols, and phenols and phenolic compounds had been extensively used in disinfection and remain the standard with which other bacteriocides are compared(Okwu,2006). In the isolation of the active constituents from ethylacetate fraction of Chikadoma leaf, phenolic acid was identified (Ohadoma and Osuala, 2016) and agreed with physical data (Perez *et al.,* 1990); and did not turn red or pink under influence of light suggesting its purity (Hicks, 1971; Kar, 2007), Phenolics such as tetrahydroxy flavones -3α-rhamnoside which is a flavonol glycoside, flavonoids and tannins have been found in Chikadoma leaves (Ohadoma and Osuala, 2016; Ohadoma, 2018). The mechanism of action thought to be implicated for phenolic toxicity to microorganisms include: (i). enzyme inhibition by the oxidized compounds, possibly through reaction with sulfhydryl groups, and/or. (ii).through more nonspecific interactions with the protein.

Flavonoids are hydroxylatedphenolics. They occur as C_6-C_3 unit linked to an aromatic ring; and are known to be synthesized by plants in response to microbial infection.It should not be absurd that they have been found *invitro* to be effective antimicrobial substances against a wide groups of microorganisms. The mechanism of action probably is due to their ability to complex with extra cellar and soluble proteins and to complex with bacterial cellwalls.

CONCLUSION

This review agree that with the reported antimicrobial activity and the phytochemical constituents of leaf extract and fractions of Chikadoma, the molecular potential as bacteriocidal agent may be utilized to encourage the use of plant derivatives as antimicrobials.

Conflict of Interest

The Authors have not declared any conflict of interest.

REFERENCES

Akerele J, Abhulimen O, Okonofua F. (2002). Prevalence of asymptomtic genital infection among pregnant women in Benin City, Nigeria. Afri J Reprod Health, 6:93-97.

Akinyemi KO, Coker AO, Olukoya DK, Oyefolu AO, Amorighoye EP, Omonigbehin EO.

Anyim C, Nworie O, Onwa NC, Agah MV, Ugwu E.N. (2010). Plasmid profile of *Escherichia coli, Staphylococcus aureus* and *Streptococcus pneumonia* isolated from sputum of paragonimiasis patients in Afikpo South, Ebonyi, Nigeria. Afr. J. Sci. 2(1): 2646 – 2656.

Arshad MS, Batool SA.(2017). Natural antimicrobials, their sources and food safety. DOI:10.5772, https://www.intechopen.com (accessed September 18,2019).

Bandow JE, Br'otz H, Leichert L, Labischinski H, Hecker M.(2003). Proteomic approach to understanding antibiotic action. J. Antimicrob Agents Chemother. 47(3): 948-955.

Cowan MM. (1999).Plant products as antimicrobial agents. Clin Microbial Rev. 12(4):564-582.

Cragg GM, Newmann DJ, Snader KM. (1997).Natural products in drug discovery and development. J Nat. Prod, 60(1):52-60.

Hicks J. (1971).Comprehensive Chemistry. Revised 2nd ed., London: Macmillan Press. p. 785-791.

Isman MB. (2000). Plant essential oils for pest and disease management. Crop Prot. 19:603-608.

Kar A.(2007).Pharmacognosy and Pharmacobiotechnology. 2nded; New Delhi: New Age Publishers, p.751-752.

Katzung BG.(2001).Basic & Clinical Pharmacology, 8th ed. N.Y: McGraw-Hill, p. 753.

Kesah C, Ben-Redger S, Odugbemi TO, Boye SC, Dosso M, Ndinya-Axhola JO.(2003). Prevalence of methicillin resistant *S. aureus* in eight African Hospitals Matta. Clin Microbiol Infect, 9:153-156.

Kurlovich BS, Kartuzova LT, Heinanem J, Benker I.I, Chmeleva ZV, Bernatskaya ML.(1980).Major physiological and Biochemical features of lupine. A collection of the N.I. Vavilov Institute of Plant Industry, Lough B.J. Isolation and characterization of developing seed of *L. arboreus*. J. Pharmacol, 12(1): 22-26.

Martini ND, Katerere DRP, Eloff JN.(2004).Biological activity of five antibacterial flavonoids from *Combretumerythrophyttum* (Combretaceae). J. Ethnopharmacol. 93:207-212.

Misra G, Pavolvstathis SG.(1997).Biodegradation Kinetics of monoterpenes in liquid soil-slurry systems. Appl. Microbial. Biotechnol. 7:572-577.

Mukherjee PK, Saritha GS, Suresh B. (2002).Antimicrobial Potential of two different Hypericum species available in India. Phytother Res. 16: 692-695.

Ohadoma SC, Nnatuanya IN, Amazu Lu, Okolo CE.(2014). Antimicrobial activity of the leaf extract and fractions of *L. arboreus*. J Med Plants Res. 8(8):386-39.

Ohadoma SC, Osuala FN. (2016). Isolation of the active constituent from ethylacetate fraction of *Lupinusarboreus* leaf. World J. Pharm & Pharm Sci. 5(9):1995-2001.

Ohadoma SC. (2018). Scientific basis for the therapeutic use of *Lupinusarboreus*. Euro J. Pharm Med. Res. 5(3): 30-34.

Ohadoma, SC.(2017). Clinical & Natural product Pharmacology made easy. 2nd ed. Nigeria: Reverend Publishers, p.410-411.

Okwu DE.(2006). The potentials of *Ocimumgratissimum, Pengluriaextensa* and *Tetrapleureatetraptera* as spice and flavouring agents. J. ChemSoc Nigeria, 31(1):38-42.

Onuba O. (1992).Coping with Osteomylitis. Afr. Health Sci, 1:66-77.

Onyeka CA, Onyeka IC, Okeke GN. (1995).Prevalence of bacterial otitis media in primary school children in Enugu suburb, Enugu state, Nigeria. West Afr. J Med, 14:78-81.

Perez C, Paul M, Bazerque P. (1990). Antibiotic assay by agar-well diffusion method. ActaBiol et Med Exp. 25:113-155.

Pfaller MA, Jones RN, Doem GV, Kugler K.(1998). Bacterial pathogens isolated from patients with blood stream infection: frequencies of occurrence and antimicrobial susceptibility patterns from the sentry antimicrobial surveillance program (United States and Canada, 1997). J. Antimicrob. Agents Chemother. 42(7): 1762-1770.

Pickart AJ, Miller LD. (1998).Yellow bush lupine invasion in Northern California coastal dunes. Ecological impacts and manual restoration techniques. ResterEcol, 6:59-68.

Pliny IO. (2009). The family of lupines. A collection of Miller Institute for Basic Research. Miller Publishers USA.

Prevalence of multiple drug resistance *Salmonella typhii* among clinically diagnosed typhoid fever patients in Lagos, Nigeria. Z. Nature Forsch C., 2:11-14. (2000).

Ram HN, Sriwastava NK, Makhija IK, Shraeedhara CS.(2012). Anti-inflammatory activity of Ajmodadichurna extract against acute inflammation in rats. J. Ayurveda integr Med. 3:33-37.