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Nigerian Folklore Medicinal Plants with Potential Antifertility Activity in Males: A Scientific Appraisal

Linus Chia Saalu

Abstract: In spite of the many achievements in health care delivery in the current century as evidenced by the rapid progress and expansion of orthodox medicine, people in Nigeria like in most of the developing countries lack regular access to essential medicines. For these people, faith in and popularity of traditional methods have not decreased because modern medicine is unlikely to be a tenable treatment alternative primarily because of its high cost. The cost of modern medicine is constantly increasing with improvements in modern health technology and in many cases is inappropriate to the immediate needs of people in developing and underdeveloped countries. On the other hand, medicinal herbs are widely available and affordable, even in remote areas. In addition, consumers believe that herbal medicines are safe because they are “Natural”. The constant resort to medical herbalism has however, thrown up certain health challenges arising from the side and unwanted effects of these herbs on the human anatomy and physiology. One such health condition is male infertility or sub-fertility as a result of the effect of medicinal herbs on the male reproductive organs. This review attempts to document those Nigerian medicinal plants that possess the potentials to reduce male fertility particularly as demonstrated from the results of basic and allied medical sciences research and published in the peer reviewed scientific literature.

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In-vitro Antioxidant and Antimicrobial Activity of *Bougainvillea glabra* Flower

Md. Zahidul Islam, Md. Tanvir Hossain, Foysal Hossen, Mir Salma Akter and Mohammad Arif Mokammel

Abstract: The aim of the present study is to assess the phytochemical nature, antioxidant and antimicrobial activities of methanolic extract of *Bougainvillea glabra* flower. Antioxidants play an important role in protecting cellular damage by reactive oxygen species. The fractions of the flower extract were screened for antioxidant activities using DPPH radical scavenging activity, reducing power assay, total antioxidant capacity and reduction of ferric ions by o-phenanthroline color method. Antimicrobial activities of different solvent fractions were tested against gram positive and gram negative bacterial strains by observing the zone of inhibition using disc diffusion method, where eImipenem ($10 \mu\text{g disc}^{-1}$) was used as the standard. The bacterial strains used in the study were *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli* and *Pseudomonas aeruginosa*. The extracts revealed the presence of phytochemicals. Almost all three fractions exhibited remarkable antioxidant and antimicrobial activity in terms of all the assays tested. Water fraction showed DPPH radical scavenging activity with IC_{50} value of $135.73 \mu\text{g mL}^{-1}$. Not surprisingly, the n-hexane fraction showed excellent antioxidant activity for reduction of ferric ions by o-phenanthroline color method. All three types of fractions showed inhibitory effect against all tested bacteria except *P. aeruginosa*. These findings indicate compounds isolated from carbon tetrachloride and water fractions possess pharmacological properties and potential to develop natural compounds based pharmaceutical products. All fractions of *B. glabra* were found to be the most effective free radical quencher, a potent source of natural antioxidants and antimicrobial agents, thus justifying their traditional use in green therapeutics.

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Md. Zahidul Islam, Md. Tanvir Hossain, Foysal Hossen, Mir Salma Akter and Mohammad Arif Mokammel, 2016. *In-vitro* antioxidant and antimicrobial activity of *Bougainvillea glabra* flower. Res. J. Med. Plant, 10: 228-236. (DOI: 10.3923/rjmp.2016.228.236)

Antimicrobial Activity of Indigowoad (*Isatis indigotica* Fort) and Plains Wild Indigo (*Baptisia bracteata*) Roots

Chiao Ying Huang, Jennifer Yihsin Chang, Gerald L. Riskowski, Wai Kun Chan, Jinn Tsyy Lai and Audrey Chingzu Chang

Abstract: Indigowoad Roots (IR) (*Isatis indigotica* Fort) and Plains Wild Indigo Roots (PWIR) (*Baptisia bracteata*) have been shown to be high in phenolic compounds and plants high in phenolic compounds often have beneficial health effects including antimicrobial activity. Indigowoad is a well-known medicinal plant as well as an edible plant root similar to daikon, sweet potatoes, yam, ginseng and carrots. Plains wild indigo roots, leaves and seeds have traditionally been used by native Americans for medicinal purposes and its extracts are consumed to enhance health. The *in vitro* antimicrobial activity of IR and PWIR was determined on five microbes (*Escherichia coli*, *Pseudomonas aeruginosa*, *Legionella pneumophila* sub sp., *Pneumophila*, *Staphylococcus aureus* and *Streptococcus mutans*), as well as general oral cavity bacteria. The IR2 inhibited cell growth of *S. aureus*, *E. coli*, *S. mutans* and *P. aeruginosa*. The PWIR inhibited cell growth of *S. aureus* and *P. aeruginosa*, which are normal skin flora, *E. coli* is a normal intestinal parasite and *S. mutans* causes tooth decay and periodontal disease. The best treatment for oral cavity bacteria was IR2 which reduced bacterial counts by 2.63 ± 0.26 log relative to water treatment. The PWIR reduced them by 0.66 ± 0.21 log.

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Yield and Essential Oil of Sweet Basil Affected by Chemical and Biological Fertilizers

M.A. Mohamed, M.E. Ibrahim, H.E. Wahba and K.A. Khalid

Abstract: Sweet basil has been used as a medicinal plant. This study was carried out to describe detailed growth and chemical investigation of sweet basil essential oil affected by chemical and biological fertilizations. The various fresh and dry weights of herb in general changed under the various NPK fertilization+biological fertilization levels. The highest fresh and dry weights of herb (g plant^{-1} and t ha^{-1}) were recorded with NPK (75%)+biological fertilizers treatment during the second harvest with the values of 721.2, 49.8 and 79.4, 4.4, respectively. The highest essential oil contents (0.4%, 0.7 mL plant^{-1} and 57.9 L ha^{-1}) were recorded at NPK (75%)+biological fertilizers treatment during the first harvest compared with other treatments. The highest amount of linalool and estragole were resulted from the NPK (75%) and NPK (50%)+biological fertilization treatment with the values of 51.2, 27.7; 48.2, 24.1; 54.4, 24.1% during first, second and third harvests, respectively. Essential oil constituents belong to two chemical main classes. Oxygenated Monoterpenes (OM) was the major one, the remaining fractions as Monoterpene Hydrocarbons (MH) formed the minor class. The highest amount of OM were obtained from NPK (75%)+biological fertilization treatment with the values of 89.1, 87.7 and 90.3% during first, second and third harvests, respectively.

How to cite this article:

M.A. Mohamed, M.E. Ibrahim, H.E. Wahba and K.A. Khalid, 2016. Yield and essential oil of sweet basil affected by chemical and biological fertilizers. Res. J. Med. Plant, 10: 246-253. (DOI: 10.3923/rjmp.2016.246.253)

Suppressive and Prophylactic Potentials of Flavonoid-rich Extract of *Adansonia digitata* L. Stem Bark in *Plasmodium berghei*-infected Mice

O. Adeoye Akinwunmi, C. Komolafe Kayode and D. Olatunde Moses

Abstract: Increase in the resistance of malaria parasite to synthetic drugs has led to the increasing search for alternative treatment strategy from plant sources. This study investigated the suppressive and prophylactic potentials of flavonoid-rich extracts of *Adansonia digitata* stem bark in *Plasmodium berghei* infected mice. The albino mice were administered with two different doses (200 and 400 mg kg^{-1} b.wt.) of extract for five consecutive days. About 5 mg kg^{-1} b.wt. day^{-1} dose of artemether-lumefantrine

and 5 mg kg⁻¹ b.wt. day⁻¹ dose of chloroquine were used as reference drugs while the control mice received only the vehicle (5% v/v tween 80). In the prophylactic groups, the mice were pretreated daily for five days before they were challenged with inoculums of 1×10⁷ chloroquine-sensitive *P. berghei* infected erythrocyte intraperitoneally. The results showed a dose dependent chemosuppression in the extract treated groups. The 400 mg kg⁻¹ b.wt., was more effective with respect to the parasite clearance than the 200 mg kg⁻¹ b.wt., dose. The chemosuppression caused by Artemether-Lumefantrine (AL) and chloroquine (CQ) treated groups were significantly (p<0.05) higher than the extract-treated groups. The percentage parasitemia also decreased in this manner. The flavonoid-rich extract of *Adansonia digitata* caused a mutual delay in parasitemia. The Packed Cell Volume (PCV) increased significantly (p<0.05) in the AL and CQ and 400 mg kg⁻¹ b.wt., dose of the extract, respectively when compared with the control. This study showed that flavonoid-rich extract of *Adansonia digitata* stem bark has potent antimalarial property which could be of future importance in malaria management.

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O. Adeoye Akinwunmi, C. Komolafe Kayode and D. Olatunde Moses, 2016. Suppressive and prophylactic potentials of flavonoid-rich extract of *Adansonia digitata* L. stem bark in *Plasmodium berghei* infected mice. Res. J. Med. Plant, 10: 254-260. (DOI: 10.3923/rjmp.2016.254.260)

Acute Oral Toxicity Testing of Ethyl Acetate Fraction from *Garcinia mangostana* Linn Extract in Sprague-Dawley Rats

F. Rahmayanti, D.F. Suniarti, Z.A. Mas'ud, B.M. Bachtiar, Y.S. Wimardhani and G.P. Subita

Abstract: *Garcinia mangostana*-Linn (GM) or commonly known as Manggis by Indonesian, is a tropical tree native to Southeast Asia. It produces a fruit, whose pericarp contains tricyclic isoprenylated polyphenol or xanthenes. The toxicity's evaluation of the ethyl acetate fraction from GM pericarp extract was needed before therapeutic use. The purpose of this article is to examine the oral acute toxicity test. The acute toxicity test was conducted in female sprague-dawley rats as per standard protocol. One group of rats administered single dose of 8 mg kg⁻¹ b.wt. and the second group with a single dose of 18 mg kg⁻¹ b.wt., of ethyl acetate fraction of GM extract, administrated orally and one control group. Body weight, behavioral changes and mortality were observed for 14 days. Dietary and water intake were also noted. At the end of the study, rats were sacrificed by decapitation. The result of this study showed that the Lethal Dose (LD₅₀) was found to be >15.480 mg kg⁻¹ b.wt. There was a significant weight increase (p<0.05). Neither mortality nor behavioral changes were noted during 14 day study periods. This study demonstrated that there is a wide margin of safety for ethyl acetate of GM extract and there is no significant toxicity effect on the rats. In conclusion, ethyl acetate fraction GM may be considered for the therapeutic use in pharmaceutical formulation.

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Cytotoxicity, Genotoxicity and Antioxidant Activity of Extracts from *Capsicum* spp.

Mônica Rosa Bertão, Milena Cristina Moraes, Darío Abel Palmieri, Luciana Pereira Silva and Regildo Márcio Gonçalves da Silva

Abstract: Extracts of different genotypes of *Capsicum* (*C. annuum* L., *C. baccatum* L., *C. chinense* Jacq., *C. frutescens* L. and *C. praetermissum*) were investigated for total phenolics, flavonoids, capsaicinoids contents and antioxidant activity objectifying to determine the relations between these bioactive compounds and the antioxidant capacity and also examine its cytotoxic and genotoxic potential. *Capsicum praetermissum* showed the highest total antioxidant activity and the highest concentrations of phenolic compounds and flavonoids. For *C. annuum* and *C. frutescens* the antioxidant activity was significant and the levels of phenolic compounds and flavonoids intermediate, while *C. baccatum* demonstrated the lowest antioxidant activity independent of significant levels of these compounds. *Capsicum chinense* showed the lowest level of total phenols and flavonoids despite expressive antioxidant activity. The determination of capsaicinoid content revealed higher levels of capsaicin and dihydrocapsaicin for extracts of *C. praetermissum*, intermediate levels to *C. baccatum*, *C. chinense* and *C. frutescens*, whereas, the *C. annuum*

showed the lowest levels of capsaicinoids, typical of these ornamental genotype. The extracts of *C. praetermissum* and *C. baccatum* exhibited low cytotoxic potential compared to other genotypes. The genotoxic potential was variable between analyzed genotypes, with *C. praetermissum* presenting the lowest rates. All species showed a dose-effect relationship dependent of extract concentration. The results of the present study indicated that *Capsicum* genotypes demonstrated a very high diversity of bioactive compounds that can be explored as agents in the control of complex biological processes related to human nutrition and health.

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Pro-oxidant Activity and Genotoxicity of the *Astronium fraxinifolium* Using Wing SMART and *Allium cepa* Test

Rafael Rozolen Teixeira Zafred, Mário Antônio Spano, Gustavo Rafagnin Martins, Celia Cristina Malagutti Figueiredo, Paulo Cesar Ferreira, Luciana Pereira Silva and Regildo Márcio Gonçalves da Silva

Abstract: *Astronium fraxinifolium* is an arboreal species found throughout the Brazilian Cerrado region and used in folk medicine as antimicrobial, anti-hemorrhagic and healing. Pro-oxidant activity of extracts of *A. fraxinifolium* through Relative Electrophoresis Mobility (REM) of Bovine Serum Albumin (BSA) protein in presence of the extract and Cu^{2+} and also the genotoxic potential through Somatic Mutation and Recombination Test (SMART) and *Allium cepa* tests has been investigated during this study. In the REM, the extracts acting exclusively on BSA resulted in a band formation with higher molecular weight than BSA, probably due to oxidative action of the extracts. In presence of Cu^{2+} and extracts occurred protein fragmentation due to Cu^{2+} oxidative action potentiated by the extracts. In SMART test the frequency of mutant spots increases with the increased concentration of extract *A. fraxinifolium* ($50 \text{ mg mL}^{-1} = 1.40$ and $100 \text{ mg mL}^{-1} = 2.66$). The HB cross shows a decrease in the total of mutant spots frequency for the different treatments ($50 \text{ mg mL}^{-1} = 6.60$ and $100 \text{ mg mL}^{-1} = 3.25$). Evaluation of *A. cepa* test demonstrated the following results (concentration extract = chromosomal abnormalities) $1 \text{ mg mL}^{-1} = 85$, $10 \text{ mg mL}^{-1} = 61$, $50 \text{ mg mL}^{-1} = 53$, $100 \text{ mg mL}^{-1} = 33$ and MMS $10 \text{ mg mL}^{-1} = 50$. Genotoxic and cytotoxic actions can be explained by the actions of tannins present in its composition. But there may be other substances that also act for such results. The genotoxicity in medicinal plants contributes to therapeutic safety warning that although the use of medicinal plants is an inexpensive and non-aggressive method it can cause harmful effects if used incorrectly.

How to cite this article:

Rafael Rozolen Teixeira Zafred, Mário Antônio Spano, Gustavo Rafagnin Martins, Celia Cristina Malagutti Figueiredo, Paulo Cesar Ferreira, Luciana Pereira Silva and Regildo Márcio Gonçalves da Silva, 2016. Pro-oxidant activity and genotoxicity of the *Astronium fraxinifolium* using wing SMART and *Allium cepa* test. Res. J. Med. Plants, 10: 276-285. (DOI: 10.3923/rjmp.2016.276.285)

Cyclooxygenase, 5-Lipoxygenase and Acetylcholinesterase Inhibitory Effects of Fractions Containing, α -Guaiene and Oil Isolated from the Root of *Xylocarpus moluccensis*

Ibrahim M.S. Eldeen, Habsah Mohamed, Wen-Nee Tan, Julius Y.F. Siong, Yosie Andriani and Tengku S. Tengku-Muhammad

Abstract: This study aimed to investigate inhibitory effects of methanolic root extract of *Xylocarpus moluccensis* against cyclooxygenase, 5-lipoxygenase and acetyl cholinesterase enzymes using *in vitro* models. Based on bioassay guided, the extract yielded two fractions A and B. The fractions were analyzed using Gas Chromatography-Mass Spectrometry (GC-MS). The major component of fraction A was identified to be α -guaiene (98.54%). For fraction B (oil), 15 components were identified. The α -guaiene fraction showed strong activities against, AchE ($\text{IC}_{50} 21 \mu\text{g mL}^{-1}$), 5-lipox ($\text{IC}_{50} 27 \mu\text{g mL}^{-1}$) and COX-1 ($\text{IC}_{50} 43 \mu\text{g mL}^{-1}$). It was weaker against COX-2 with IC_{50} of $84 \mu\text{g mL}^{-1}$. The oil possessed strong activities against 5-lipox and AchE with

IC₅₀ of 33 and 25 µg mL⁻¹, respectively. However, it was weaker against both the COX enzymes (IC₅₀ values ≥ 125 µg mL⁻¹). Indomethacin, zileuton and galanthamine were used as positive controls. Concentration responses of the α-guaiene and oil against the enzymes were obtained using 5 concentrations (25-125 µg mL⁻¹). Means were plotted in a graph with error bars representing 95% confidence intervals. For the α-guaiene, the inhibition response increased significantly with the increase of concentrations from 25-100 µg mL⁻¹ against the four tested enzymes. Both the isolates showed remarkable dual inhibitory effects against 5-lipoxygenase and AchE enzymes. The results indicated the potential therapeutic effects of the plant in the treatment of inflammatory related ailments and cognitive disorders. Further study is needed to verify mechanism of actions and effective doses. The isolation and the biological activities observed contribute to the novelty of this study.

How to cite this article:

Ibrahim M.S. Eldeen, Habsah Mohamed, Wen-Nee Tan, Julius Y.F. Siong, Yosie Andriani and Tengku S. Tengku-Muhammad, 2016. Cyclooxygenase, 5-lipoxygenase and acetylcholinesterase inhibitory effects of fractions containing, α-guaiene and oil isolated from the root of *Xylocarpus moluccensis*. Res. J. Med. Plants, 10: 286-294. (DOI: 10.3923/rjmp.2016.286.294)

Effects of Aqueous-ethanolic Extract of *Nigella sativa* Seeds (Black Cumin) and Vitamin E on Cisplatin-induced Nephrotoxicity in Rat

Somayeh Shafiee, Alireza Ebrahimzadeh, Ziba Rajaei, Nema Mohammadian, Azam Alavinezhad, Shahrzad Havakhah, Sara Hossienian, Samira Shahraki and Abolfazl Khajavi Rad

Abstract: Cisplatin (cis-dichlorodiamineplatinum II) is a potent antineoplastic agent against several types of tumor. Nevertheless, its clinical utility is limited due to its cytotoxic adverse effects that include nephrotoxicity. Several factors including inflammation, oxidative stress, DNA damage and mitochondrial injury are involved in cisplatin-induced cell injury. *Nigella sativa* and vitamin E possess the anti-inflammatory and antioxidant properties. Accordingly, the present study was designed to investigate the protective effects of hydroalcoholic extract of *Nigella sativa* seeds and vitamin E on cisplatin-induced nephrotoxicity. Forty eight male Wistar rats were randomly divided into 8 groups and treated daily with *Nigella sativa* extract (100 or 200 mg kg⁻¹, i.p.) or vitamin E (100 mg kg⁻¹, i.p.) 1 h before single dose cisplatin injection (6 mg kg⁻¹, i.p.) and continued for 5 days. Serum and urinary biochemical parameters were measured on day 0 and 6. Histopathological examination of the kidney and determining the kidney index were performed on day 6. The results showed that serum urea and creatinine concentrations, as well as urine glucose, kidney index and histopathological damage were significantly increased in cisplatin group compared with control group, while Glomerular Filtration Rate (GFR) and urea clearance were significantly reduced. Similar alterations in biochemical factors were observed in groups that received cisplatin together with *Nigella sativa* extract or vitamin E compared to control group. However, treatment with *Nigella sativa* extract or vitamin E could improve histopathological damages due to cisplatin. In conclusion, *Nigella sativa* extract or vitamin E treatment attenuated the histological alterations induced by cisplatin.

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Analyses of *Ramalina farinaceae* Extract Anti-proliferative Activities in Culture of Mammalian Cells and Splenocytes

Damian C. Odimegwu, Vincent C. Okore and Charles O. Esimone

Abstract: Preliminary investigations of *Ramalina farinaceae* (RF) plant extract sourced from Southeast, Nigeria for later possible antiviral usage lead to the identification of anti-proliferative activities against some mammalian cell lines and mouse splenocytes. The extract/cell systems were incubated for 1-2 days followed by analysis of cell viability status using an MTT-based assay. Measurement of released interferon gamma cytokine was undertaken as a proliferative activation marker for immune cells derived from mouse spleen. The preliminary data showed anti-proliferative cytotoxic activities with TC₅₀ = 103.1, 61.57 and

65.24 $\mu\text{g mL}^{-1}$ for vero, Tsa201 and A293 cells, respectively, when tested in a concentration-dependent manner. Extract-stimulated mouse splenocytes showed no proliferative activation status contrary to INF-g release recorded for lipopolysaccharide (LPS) stimulated mouse splenocytes. *Ramalina farinacea* extract in the present study appear to down-regulate cell proliferation indicating possible utility in counteracting cell hyperplasia. It could however, equally still be utilized in other cellular systems when adequately tailored at lower concentrations in specific given settings to meet the contingent need.

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Influence of Different Sampling Site and Storage Duration on Volatile Components of Korean Green Tea

Ok Ja Choi, Hyun Sook Jung and Kyeong Won Yun

Abstract: The purpose of the study was to analyse the volatile components of tea leaves and green tea depending on sampling site and storage duration. Volatile components of fresh tea leaves and green tea of Suncheon and Namwon were detected by headspace-GC/MS. The mean annual rainfall and air temperature of Suncheon is higher than that of Namwon. A total of 57 different constituents were identified and qualitative and quantitative differences were observed among the samples. Fresh tea leaves and green tea of Namwon contained more components than that of Suncheon. Composition of volatile component of green tea was changed by the storage duration, namely the longer storage duration, the smaller was the number of volatile components. Percentage of some volatile components in the green tea was decreased with storage duration, the content of some components have gone with storage duration.

How to cite this article:

Ok Ja Choi, Hyun Sook Jung and Kyeong Won Yun, 2016. Influence of different sampling site and storage duration on volatile components of Korean green tea. Res. J. Med. Plants, 10: 309-313. (DOI: 10.3923/rjmp.2016.309.313)

Antioxidant Properties of Leaf, Twig and Calli Extracts of *Neolamarckia cadamba* (Roxb.) Bosser in Sri Lanka

A.M. DonPaul, S.R. Weerakoon and S. Somaratne

Abstract: *Neolamarckia cadamba* (Roxb.) Bosser poses a threat of extinction due to felling for timber, large-scale sample collections for herbal formulations in traditional medicine and research purposes. Use of calli as the source of secondary metabolites instead of destructive sampling conserves *N. cadamba* for future generations. Objectives of the present study were to evaluate antioxidant activity of natural extracts of leaf and twigs of *N. cadamba*, through optimization of calli induction of leaf and internode explants and a comparison of calli and plant extracts for their antioxidant activity. Calli were induced from tender leaves and internodes using two out of ten NAA and BAP hormone combinations; NAA 5.0 mg L^{-1} : BAP 0.5 mg L^{-1} and NAA 2.5 mg L^{-1} : BAP 3.0 mg L^{-1} . Methanolic crude extracts of mature leaves, twigs and calli were obtained and the extracts were screened for antioxidant activity using *in vitro* assays; Total Phenol Content (TPC) assay, DPPH assays and plasmid DNA nicking assay. The TPC was highest in twigs than leaves of natural plant and call extracts which in turn indicated increase antioxidant activity. Calli obtained from leaves and internodes are of important as a potential source of bioactive compounds showing the capability of scavenge the diverse free radicals in different systems and as potential therapeutic agents for treating radical-related pathogenic cell damages. Further studies focusing the enhancement of production of secondary metabolites in calli of *N. cadamba* exposing to different stress conditions is a prerequisite to produce important bioactive compounds in higher concentrations.

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