3.3.1 Number of research papers published per teacher in the Journals as notified on UGC CARE list during the academic year 2020-21.

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Total number of research papers published per teacher in the Journals notified on UGC website for year 2020-21.

Summary sheet

Sr. No.	Title of paper	Name of the author/s	Department of the teacher	Calendar Year of publication	ISSN number
1	Isolation and identification of an antioxidant constituent from Satyrium nepalense (Himalayan Orchid)	Monika Kawra, Sarla Saklani and Versha Parcha	Pharmaceutical Chemistry & Chemistry	2021	0972-0626
2	Evaluation of anti-microbial potential of structurally modified derivatives of lead compound berberine isolated from roots of berberis aristata	Versha Parcha, Diveya J. Singh, Deepak Kumar and Jaswinder K. Saini	Pharmaceutical Chemistry & Chemistry	2021	0019-462X
3	Antibacterial activity and phytochemical characterisation of Saussurea gossypiphora D. Don.	Abhay Prakash Mishra, Sarla Saklani, Versha Parcha, Manisha Nigam & Henrique D. M. Coutinho	Pharmaceutical Chemistry & Chemistry	2021	0302-8933
4	Awareness and effects of text neck syndrome in physiotherapy Students in dehradun	Deptee Warikoo , Yashwant Laxme	Physiotherapy	2021	2277 - 8160
5	Comparative Study between Pilates Exercises and Yoga in Young Adults with Non Specific Low Back Pain	Rajesh Kumar Modak, DR. Vivek Chauhan	Physiotherapy	2021	2249-7781
6	Nature and Pattern Of Neck and Shoulder Pain In Home Economist At Jhansi (U.P.)	Dr. Parul Singhal, DR. Vivek Chauhan	Physiotherapy	2021	2250 - 1991
7	Prevalence of Upperlimb Musculoskeletal Pain among Hostel Housekeeper's	Akanksha, Dr. Vivek Chauhan	Physiotherapy	2021	2249-7781

Sr. No.	Title of paper	Name of the author/s	Department of the teacher	Calendar Year of publication	ISSN number
8	Prevalence of Musculoskeletal Pain in Office Going Population of Gangtok	Tashi Ongmit Lepcha, Dr. Vivek Chauhan	Physiotherapy	2021	2249-7781
9	Wild Medicinal Plants and Agriculture Crop in the part of Doon Valley, Uttarakhand, India	Ganesh Datt Bhatt, Deepali Rana And Mahesh Singh	Zoology	2021	0019-4816
10	Teratological evidences in fish fauna with reference to water quality of Doon Valley of Uttarakhand	Deepali Rana, Shashi K Gupta, Rahul Rana	Zoology	2021	2454-1117
11	Using six parameter genetic model genetic analysis of micronutrients in cowpea [Vigna unguiculata (L.)Walp.]	Pallavi and Alankar Singh	Agriculture	2020	2349-8242
12	Ananlysis of heterotic response for zinc and iron content in cowpea (Vigna unguiculata (L). Walp)	Pallavi, Alankar Singh and YV Singh	Agriculture	2020	2349-8242
13	Diallel analysis for combining ability in cowpea (Vigna unguiculata (L.) Walp).	Pallavi, Alankar Singh and Sumit Chaudhary	Agriculture	2020	2349-8242
14	Study of nature and magnitude of heterotic response in cowpea (Vigna unguiculata (L). Walp) for yield and its attributing components.	Pallavi, Alankar Singh and Sumit Chaudhary	Agriculture	2020	2349-8234
15	Feeding effect of different level of fenugreek powder and vitamin E on carcass quality of broilers	Shiwanshu Tiwari, DS Sahu, Manoj Kumar Bansala, Balveer Singh, Nazim Ali, Rajbir Singh and Rajkumar	Agriculture	2020	2349-8528

Sr. No.	Title of paper	Name of the author/s	Department of the teacher	Calendar Year of publication	ISSN number
16	Impact of selenium and zinc supplementation on semen attributes of Murrah buffalo bulls	Harendra Singh Chauhan, Rajkumar, Shalu Kumar, Manoj Kumar Bansala, Amit Kumar, DS Sahu and BG Desai	Agriculture	2020	2349-6800
17	Application of Methyl Methacrylate Polymer in dentistry	D. K. Awasthi and Gyenendra Awasthi	Biochemistry	2020	2349-8870
18	Application of Gold Nanoparticle in Medical Field	D. K. Awasthi, Gyanendra Awasthi and Kritika Verma	Biochemistry	2020	2455-3301
19	Climate change, infrared energy, orbital variation and their impacts	D. K. Awasthi and Gyanendra Awasthi	Biochemistry	2020	2455-3301
20	Phytochemical Analysis and Evaluation of Anti-inflammatory Activityof Bignonia venusta(Ker Gawl.) Miers Flower Extracts	Vidit Tyagi , Umar Farooq, Gyanendra Awasthi	Biochemistry	2020	0973-3507
21	Autocoids :A Brief Review	D.K Awasthi, Gynendra Awasthi	Biochemistry	2020	2455-3301
22	Lipid Profiling in Mathura Population	Rashmi, Gynendra Awasthi, D. K. Awasthi	Biochemistry	2020	2455-3301
23	Invitro investigation of anti-cancer potential of Spilanthes acmella	Shivsharan Singh, Satish K Verma, Santosh K Singh	Biochemistry	2020	0975-1459
24	Purification, Isolation and Characterization of Thermophilic esterase from Rhodococcus sp. LKE-021	Lekha Singh, Gaurav Sharma, Gyanendra Awasthi, Lokendra Kumar, Mohammad Irfan Ali and Sarmad Moin	Biochemistry	2020	0973-7510
25	Small-scale phyco-mitigation of raw urban wastewater integrated with biodiesel production and its utilization for aquaculture	Neha Arora, Krishna Kumar Jaiswal, Vinod Kumar, M.S.Vlaskin, Manisha Nanda, Vikas Pruthi, PK Chauhan	Biotechnology	2020	0960-8524
26	Microalgae fuel cell for wastewater treatment: Recent	Krishna Kumar Jaiswal, Vinod Kumar, M.S.Vlaskin, Nishesh	Biotechnology	2020	2214-

Sr. No.	Title of paper	Name of the author/s	Department of the teacher	Calendar Year of publication	ISSN number
	advances and challenges	Sharma, Indra Rautela, Manisha Nanda, Neha Arora, Ajay Singh, P.K.Chauhan			7144
27	Sustainability of Ageratum conyzoides (billy goat weed) for bioethanol and recycling of residues for gaseous fuel production	Shivam Pandey, Vinod Kumar, Mikhail S. Vlaskin, Manisha Nanda	Biotechnology	2020	2577-8196
28	Impact of glyphosate herbicide stress on metabolic growth and lipid inducement in Chlorella sorokiniana UUIND6 for biodiesel production	Krishna Kumar Jaiswal, Vinod Kumar, Mikhail S.Vlaskin, Manisha Nanda	Biotechnology	2020	2211-9264
29	Microwave-assisted pretreatment of harmful algal blooms for microbial oil-centered biorefinery approach	Vinod Kumar, Neha Arora, Shivam Pandey, Krishna Kumar Jaiswal, Manisha Nanda, M. S. Vlaskin & P. K. Chauhan	Biotechnology	2020	2190-6815
30	Hydrothermal liquefaction of municipal wastewater sludge and nutrient recovery from the aqueous phase	Vinod Kumar, Krishna Kumar Jaiswal, Mikhail S. Vlaskin, Manisha Nanda, M. K. Tripathi, Prateek Gururani, Sanjay Kumar & Harish Chandra Joshi	Biotechnology	2020	1759-7269
31	Micropropagation and Screening of Phytocompounds Present among in vitro Raised and Wild Plants of Rauvolfia serpentine	Vernika, Rohit Sharma, Ajay Singh, Shalini, Nishesh Sharma	Biotechnology	2020	2228-835X
32	Preliminary Assessment of Vegetation Structure, Biomass and Carbon Stock in Shorea robusta, Tectona grandis and Quercus leucotrichophora Stand in Dehradun District, Uttarakhand,	Tanuja Masiwal, Vikaspal Singh, Anil Kumar Uniyal	Forestry	2020	0970-0420

Sr. No.	Title of paper	Name of the author/s	Department of the teacher	Calendar Year of publication	ISSN number
	India				
33	Study of Land-Use Pattern Under Different Agroforestry System in a Part of Manipur, North- East India	Tuikhang Momsongak Koireng, Vikaspal Singh, Anil Kumar Uniyal, Rashmi and T. Chamoli	Forestry	2020	0971-744
34	HETRP: High Energy Efficient Trustable Routing Protocol for wireless sensor network	Musheer Vaquar, Sanjay Kumar Agarwal	Horticulture	2020	2278-3075
35	Effect of storage conditions on vermicompost quality	Pankaj Kumar, Pawan Sharma, Tilak Ranjan Kumar, H. C. Sharma and R. C. Dubey	Microbiology	2020	0011-3891
36	Taro starch: Isolation, morphology, modification and novel applications concern - A review	Deepika Singla, Ajay Singh, Sanju Bala Dhull, Pradyuman Kumar, Tanu Malik, Pankaj Kumar	Microbiology	2020	0141-8130
37	Recycling of chicken feather protein into Compost by chrysosporium indicum jk14 and their Effect on the growth promotion of zea mays	Jitendra Kumar, Pankaj Kumar, R. K. S. Kushwaha	Microbiology	2020	0972-2025
38	Effect of silver nanoparticles and Bacillus cereus LPR2 on the growth of Zea mays	Pankaj Kumar, Vikas Pahal, Arti Gupta, Ruchi Vadhan, Harish Chandra & Ramesh Chandra Dubey	Microbiology	2020	2045-2322
39	Seed bio-priming with tri-species consortia of phosphate solubilizing rhizobacteria (PSR) and its effect on plant growth promotion	Pankaj Kumar, Abhinav Aeron, Niru Shaw, Ajay Singh, V K Bajpai, Shailja Pant, Ramesh Chandra Dubey	Microbiology	2020	2405-8440
40	Decolorization of Distillery Effluent Waste by Microbial	Gauri Singh, andAshok Kumar Singh	Microbiology	2020	2579-9150

Sr. No.	Title of paper	Name of the author/s	Department of the teacher	Calendar Year of publication	ISSN number
	Consortium				
41	Antidiabetic and Antihypertensive Properties of Chymotrypsin Treated Cow Milk Casein	Santosh Kumar, SumanKumari, Vipan Kumar and Deepak Kumar	Pharmaceutical Chemistry & Chemistry	2020	2319-7692
42	Evaluation of anthelmintic activity of bioactive peptides derived from enzyme treated goat milk Casein	Santosh Kumar, Vipan Kumar, Deepak Kumar, Ashwani Sanghi and Farhath Jan	Pharmaceutical Chemistry & Chemistry	2020	2349-6800
43	Study on Phytoconstituents and Antimicrobial Potential ofSapindus mukorossi Fruit Extract	Versha Parcha , Amita Sati , Shivani Dyani	Pharmaceutical Chemistry & Chemistry	2020	0973-3507
44	Tailoring of Colon Targeting with Sodium Alginate-Assam Bora Rice Starch Based Multi Particulate System Containing Naproxen	Manoj Kumar Sarangi, M.E. Bhanoji Rao, Versha Parcha, Aadesh Upadhyay	Pharmaceutical Chemistry & Chemistry	2020	1521-379X
45	Smart polymers for colon targeted drug delivery systems: a Review	Manoj Kumar Sarangi,M. E. Bhanoji Rao &Versha Parcha	Pharmaceutical Chemistry & Chemistry	2020	0091-4037
46	Preliminary Photochemical screening and Antioxidant activity of five medicinal plants of Garhwal Himalayas: a comparative study	Monika Kawra, Sarla Saklani & Versha Parcha	Pharmaceutical Chemistry & Chemistry	2020	2229-4473
47	Development and Characterization of Colon-targeting 5-Fluorouracil Multiparticulate Beads	M. K. Sarangi, M. E. Bhanoji Rao, Versha Parcha and A. Upadhyay	Pharmaceutical Chemistry & Chemistry	2020	0250-474X
48	Effect of Kinesiophobia on WOMAC, Balance and Range of Motion in Post total Knee Arthroplasty Patients	Deptee Warikoo and Manish Verma	Physiotherapy	2020	2321-3272

Supporting documents

Isolation and identification of an antioxidant constituent from *Satyrium nepalense* (Himalayan Orchid)

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Abstract
Plants are the bio-factories of natural molecules and compounds which are the important source of well-known herbal drugs and formulations. In spite of several known molecules, still there are lot which are yet unexplored. These molecules may have different pharmacological properties.

The present study was performed in order to isolate and identify the novel compound SNP2 from Satyrium nepalense (Himalayan Orchid) for determination of in vitro antioxidant activity via conventional procedures. The results determined SNP2 as Gluconic acid molecule via LC-MS/MS technique. The molecule possessed significant antioxidant activity as determined in the study and thus can be utilized as a promising candidate in category of an antioxidant and nutraceutical agent.

Keywords: Antioxidant activity, *Satyrium nepalense* (Himalayan Orchid), Gluconic acid, Nutraceutical agent.

Introduction

Himalayas are well known for their richest hot spot of biodiversity in the world. The Indian Himalaya Region harbors approximately 8644 plant species belonging to 1748 families. These plant species are known as medicinal plants and maximum species have been reported around up to 1800 m altitudinal range[1]. Natural products, including plants, animals and minerals have been the basis of treatment of diseases from time immemorial. Medicine is next to the three basic needs required by human in order to survive or make their life comfortable. Use of herbal medicine is as old as human race itself. Medicinal plants are one of the most important components of the forests of Himalaya and are well known for their efficacy in coping with various diseases[2].

Uttarakhand, also known as "Dev Bhomi" lies in the western Himalayan region and is famous for its rich variety of herbs, medicinal and aromatic plant species. Garhwal Himalaya is one of the richest floristic zones of India and contains more than 300 species of medicinally important plants[3].

Different medicinal plants from Garhwal region of North West Himalaya were investigated for antimicrobial, antioxidant and anti-inflammatory activities[4-7]. The rural communities in Chamoli, the remote district of Uttarakhand, have their own way of living with in social and cultural moorings. Irrespective of their simplicity and complexity, these communities hold rich traditional knowledge on medicinal plants. The Orchidaceae is a diverse and widespread family of flowering plants, with blooms that are often colourful and fragrant. Beautiful flower orchids are becoming a rarity, losing out to human greed. Orchids are not only important for their aesthetic value but also because they work as ecological indicators. Orchids are mysterious in many ways. These are increasingly being cultivated throughout the world. The incredible shapes and colours of their flowers and their long vase-life have attracted many generations of mankind. 1141 species of orchids in 166 genera are recorded from India[8].

In Uttarakhand, total of 72 genera with 236 species of orchids are recorded[9]. Taking all the monocotyledonous families into account, Orchidaceae is the 2nd largest family after Poaceae in Uttarakhand. Orchids are popular for their healing properties too. *Satyrium nepalense* is a medicinal orchid also known as Salam mishri, usually found at higher altitudes (2400-3000 m) of the Indian Himalayan Region (IHR). It is a terrestrial herb, commonly used by native people of Uttarakhand as folk remedy against various complaints. Decoction of tubers, roots and stems of the plant has been used in various infectious diseases and also as a nutritional supplement since ancient time. It is also used as a food, tonic, in diarrhoea, malaria and dysentery[10].

In the present study antioxidant constituent from the methanolic extract of *Satyrium nepalense* has been isolated and identified. Methanolic extracts of *Satyrium nepalense* exhibit remarkable antioxidant and antibacterial activities among the tested extracts possibly due to the presence of phenolic acids and flavonoids, in particular gallic acid and quercetin as confirmed by LC-MS/MS analysis[11].

Material and Methods

Sample Collection: Tubers of *Satayrium nepalense* were collected from Chamoli district of Uttarakhand at an altitude of 2000-2800 meters and identified by the Botanical Survey of India, Dehradun, Uttarakhand, India.

Extraction procedure: The extraction procedure was utilized with some modifications[12]. The tubers were washed with running water and then with distilled water to remove dust and other contaminants. They were then shade dried at an average temperature. The plant material was coarsely powdered with the help of an electric blender and passed via

EVALUATION OF ANTI-MICROBIAL POTENTIAL OF STRUCTURALLY MODIFIED DERIVATIVES OF LEAD COMPOUND BERBERINE ISOLATED FROM ROOTS OF *BERBERIS ARISTATA*

Versha Parcha[a*], Diveya J. Singh[a], Deepak Kumar[a] and Jaswinder K. Saini[b]

(Received 21 December 2019) (Accepted 21 July 2021)

ABSTRACT

The alkaloid berberine, the chief constituent of *Berberis aristata*, has been reported to have antimicrobial activity associated with it. Structural changes can be made to this lead compound to try to improve its efficacy in terms of antimicrobial activity. In the present study, attempts have been made to evaluate anti-microbial potential of structurally modified derivatives of berberine. The derivatives so synthesized were characterized on the basis of spectral techniques like ^{1}H,^{13}C NMR, UV, IR and MASS and by comparison with standard berberine. Structure-activity relationship studies revealed that methoxyl group is pharmacophore of berberine and is thus needed to be retained in the skeleton. Further incorporation of the electron-withdrawing group has pronounced effect on the antimicrobial activity. Further attempts could be made to extend the series with the incorporation of such electron-withdrawing groups to get potent antimicrobial agents.

Keywords: Berberine, isoquniloline, antimicrobial, structure activity relationship

INTRODUCTION

Rich sources of pharmaceuticals, as well as drug leads, are plants. Plants are in fact natural laboratories where a simple chemical backbone is converted to complex entities and are far better than the synthesized metabolites in biological efficacy. The natural product, due to its sterically more complex structure, exhibits advanced binding properly compared with synthetics. They are known for their drug-likeness and biological friendliness than totally synthetic molecules, making them obvious lead candidates. The initial step in the discovery of a new drug is lead identification, especially from natural sources which may act as important entities in themselves or lead to a pathway on which further work could be done.

Berberine, the chief constituent of *Berberis aristata* has been reported to have antimicrobial activity associated with it. Berberine rich extracts and decoctions from *B. aristata*[1,2] have demonstrated significant antimicrobial activity against a variety of organisms including bacteria[3], viruses[4,5], fungi[6] and protozoans[7]. Moreover, several clinical and preclinical studies have demonstrated the effect of berberine against several disorders like diabetes[7-10], cancer[11,12], nephrological[13], neurological[14], and cardiological[2] problems. It also has hepatoprotective and antioxidant activity[15-17] profile. Structural changes can be made to this lead compound to improve its efficacy. Therefore, in the present study, attempts have been made to evaluate the anti-microbial potential of structurally modified derivatives of berberine.

MATERIALS AND METHODS

Isolation of berberine from roots of *B. aristata* and synthetic modification[18] was carried out to study SAR (Fig. 1). All the compounds were subjected to spectral analysis. The IR spectra were recorded on Bruker, alpha E ATR FTIR spectrophotometer. NMR and ^{13}C NMR spectra were recorded at 400 MHZ by using $CDCl_3$ as solvent and mass spectra were scanned on Brucker micro TOF-QII, ESI mass spectrophotometer. ^{1}H NMR and ^{13}C NMR shift were reported as parts per million (ppm) downfield from TMS (Me_4Si). The purity of synthesized compounds was determined by thin-layer chromatography (TLC) on Merck silica gel 60 F_{254} percolated sheet in chloroform/methanol mixture and spots were develop

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ORIGINAL PAPER

Antibacterial activity and phytochemical characterisation of *Saussurea gossypiphora* D. Don.

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Abstract
The study demonstrates that *S. gossypiphora* contain number of secondary metabolites such as steroids, tannins, flavonoids, phenolics, carbohydrates, saponins, and amino acids. Methanolic extract (MESG) of the plant contained highest quantity of phenolics, flavonoids and has greater antioxidant, anti-inflammatory and antibacterial activity in comparison to other extracts. Moreover, acute toxicity studies revealed that none of the extracts produced any toxic symptoms and mortality when administered orally to mice at a dose of 2000 mg/kg b. w. Furthermore, in MESG, the SG-4 fraction exhibited the highest antibacterial activity than other isolated fractions against all tested bacterial strains in a dose-dependent manner. SG-4 fraction showed significant anti-inflammatory effect (60.91%) as evident by maximum inhibition of Carrageenan-induced paw oedema in rat model. The HPTLC analysis confirmed the presence of apigenin and luteolin in the SG-4 fraction of methanolic extract. A noticeable number of mineral elements were also found to be present in *S. gossypiphora*. Conclusively, our study reveals that *Saussurea gossypiphora* contains plethora of bioactive compounds that contributes to its antioxidant, anti-inflammatory and antibacterial activity. Apigenin and luteolin possibly being one of them. Besides, the presence of ample minerals hints is utilisation as nutritionally valuable herb.

Keywords *Saussurea* · Antioxidant · Anti-inflammatory and antibacterial activity · HPLC · HPTLC

Introduction

Saussurea (Asteraceae) is an important genus containing approximately 410 species which are widely distributed throughout the world. Species belonging to the *Saussurea* genus grow under range of temperate to arctic climates. It has been reported to found in Asia, Europe and North America, though the highest number of species found in the Himalayas and in Central Asia (Butola and Samant 2010). Plants belonging to this species possess medicinal properties thus consequently economic value as well. Moreover, they are also used for religious ceremonies. Particularly, these plants represent a rich source of food, flavouring products, rubber, oil, insecticides, dyes, etc. and many species are even grown as ornamental plants. Phytochemical and bio-activity studies carried out on several species of *Saussurea*

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Original Research Paper | Clinical Science

AWARENESS AND EFFECTS OF TEXT NECK SYNDROME IN PHYSIOTHERAPY STUDENTS IN DEHRADUN

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Dr. Yashwant Laxme (MPT), Assistant Professor, Department of Physiotherapy, Dolphin PG Institute of Biomedical & Natural Sciences, Dehradun, UK.

ABSTRACT **Background:** Text neck is a repeated stress injury and pain sustained from excessive watching or texting on handheld devices for long periods of time. This study was designed to guide us through occurrence, awareness and consequences of text neck syndrome in physiotherapy students.

Method: The study design was an observational study with a sample size of 258 healthy physiotherapy students of the age group 18-24 years. Students were asked to fill the questionnaires of Awareness of text neck syndrome (ATNS), NDI, SPADI and Headache. The questionnaire collected the awareness of Text Neck Syndrome and its affects in the selected sample. CVA was obtained and recorded photographically and was measured using Coral Draw X7 software.

Conclusion: The study demonstrated a low level of awareness of text neck syndrome amongst young physiotherapy students in Dehradun. The study also depicted that daily mobile phone use for more than 2 hours resulted in mild pain and disability in the neck and shoulder along with forward head posture. In addition the result depicted that subjects using phone more than 6 hours were at higher risk of Text neck Syndrome.

KEYWORDS : Text neck syndrome, Forward Head Posture, Neck Disability Index, shoulder pain and disability Index

INTRODUCTION

The neck or cervical spine is a coordinated network of nerves, bones, joint, and muscles directed by the brain and the spinal cord. Additionally, irritation along the nerve pathways can cause pain into the shoulder, arm and hand. "Text neck" is the term used to describe the neck pain and damage sustained from looking down at the cell phone, tablets or other wireless device too frequently and for too long.[1]

A recent systematic review done in Honk Kong suggests that prevalence of musculoskeletal problems with mobile phone usage are high ranging from17.3% to 67.8% for neck complaints. [2]The term "Text neck" was coined by Dr. Dean L. Fishman, a US chiropractor. The term of 'Text neck or another phrase turtle neck posture can be described as a repeated stress injury and pain sustained from excessive watching or texting on handheld devices for long periods of time'.[3] A recent study done in Thailand shows that text neck syndrome has become a global epidemic affecting a large number of population of almost all ages who use mobile phones. [2] Text neck syndrome is a growing health concern and can affect large number of population all over the world.[1]

Warikoo and Mittal depicted that the mobile phone has rapidly become an established part of daily life.[4] While this new information and communication technology is convenient and popular, during its adoption, various social issues have arisen, including excessive use or even dependence. The Smartphone has become a necessity for most people. Smart phones are used for both communication and entertainment purposes.

In the last 20 years world wide mobile phone subscriptions have grown. In spite of some knowledge on unfavorable health effects, the usage of cell phone has increased dramatically, especially since the time they have become more affordable and available all over the world.[3] The use of cellular phones has skyrocketed in recent years, with more than 929.37 million subscribers in India as of May, 2012.[4]

There has been controversy about the hazards related to cell phone use, which have been reported to include headache, sleep disturbance, lack of concentration, impairment of short term memory dizziness, heating of the ear, burning skin, brain tumors and hypertension.[5] It is expected to develop Forward Head Posture which is a common cervical abnormality that predisposes population to pathological ailments such as headaches, neck pain, vertebral bodies' disorders, length of soft-tissue and altered strength.[6]

Physiotherapy students are the future health care professionals. Any musculoskeletal disorder will decrease their professional efficiency. Therefore it was a need to find whether this group of population has awareness about this syndrome. In addition the study elicited the effect of high mobile usage on neck and shoulder disability.

MATERIALS AND METHODS

This is an "observational study" with a sample size of 258 subjects. Method of sampling used was "Purposive Sampling". This study was performed on the students of Physiotherapy Program from various colleges of Dehradun, India. The data was collected after Ethics Committee approval and informed consent was taken from all the subjects before collecting the data.

Study Design - Survey study

INCLUSION CRITERIA

- Physiotherapy Students
- Age group - 18 -24
- Gender – Both male and female
- Individuals using mobile phones from 1year or more
- Individuals spending 2 hour or more than 2 hours per day using mobile phones

EXCLUSION CRITERIA

- Abnormal neurological findings
- Radiculopathy
- Vertebrobasilar insufficiency
- Congenital cervical abnormalities
- Recent surgery around neck and arm
- Any open wound around neck

Ethical approval was obtained from the institutional ethical committeeand each subject signed an informed consent approved by the committee

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Comparative Study between Pilates Exercises and Yoga in Young Adults with Non Specific Low Back Pain.

Rajesh Kumar Modak, DR. Vivek Chauhan (Pt)

Dissertation submitted to the h.n.b. garhwal university,srinagar, garhwal, uttarakhand. In partial fulfillment of the requirements for the degree of master in physiotherapy
In musculoskeletal physiotherapy under the guidance of associate professor at dibns
Department of physiotherapy dolphin pg institute of biomedical & natural sciences dehradun, uttarakhand.
H.n.b. garhwal university, srinagar, garhwal, uttarakhand.

Date Of Submission: 15-05-2021 Date Of Acceptance: 26-05-2021

CHAPTER - 1

INTRODUCTION

Low back pain is strongly associated with disability, absence from work, and mood changes such as depression and anxiety[1].It was reports that 70-85% of all people have back pain at some time in life that back pain is the most common cause of limitation in activity in those younger than 45 years of age, and that prevalence rates are shown to be from 12% to 35 %[2].

Low back pain can arise from a wide variety of causes, such as unaccustomed activity, trauma, stress or injury to the structural elements of the spine. Acute LBP occurs suddenly, either as a completely new presentation (first time ever) or, after a period of at least 6 months without LBP. Acute LBP is usually defined as pain that is present for less than 6 weeks after onset[3].

Approximately 90% of LBP (both acute and chronic) is considered non-specific. Non-specific LBP, also known as ordinary or "simple backache", and "common" or "garden variety low back pain", is mechanical low back pain of musculoskeletal origin in which symptoms vary with physical activities[4]. Non-specific LBP may be related to mechanical strain or dysfunction, although it often develops spontaneously, and can be painful and disabling, however the severity or intensity of the pain tells the clinician very little about the source of pain[5]. Nonspecific Low Back Pain is often further subdivided based on duration of symptoms to acute LBP if it lasts up to 6 weeks; or sub-acute pain is identified as lasting 6 weeks to 3 months; or chronic low back pain if it lasts for longer than 12 weeks[6].

Pilatesis an exercise method that was first taught as "Contrology" by Joseph Pilates at his studio in New York during the late 1920s. The exercise system that Joseph Pilates developed merged the theories and movement styles of gymnastics, martial arts, yoga and dance. Modern Pilates focuses on maintaining a 'neutral spine', pelvic and spinal stability, along with activation of transversusabdominis and pelvic floor muscles in combination with controlled breathing[2].

The primary goal of the Pilates exercises is alignment as well as core control. This is taught by incorporating five principles of alignment to be addressed for each exercise performed. This includes breathing patterns to more deeply engage the deep local musculature, rib placement, scapular girdle placement and engagement, and cervical spine and pelvic alignment. An important element of the Pilates method is being able to expand the ribs laterally, which helps you to draw in your abdomen, at the same time relaxing the upper body. While accentuating the axial arrangement of the body, the method ensures the optimum conditions for the respiratory system and helps to stabilize the backbone. Unlike other exercises based on passive breathing, the Pilates breathing method involves active respiration. It activates outer intercostal muscles and abdominal muscles. The most efficient muscle participating in breathing out, and thus in increasing the pressure in the abdominal cavity is the transverse abdominal muscle[7].

Pilates exercises mainly involve isometric contractions (i.e. contraction without joint movement) of the core muscles, which make up the muscular center responsible for the stabilization of the body, both while it is moving or at rest. Pilates became popular as a treatment for low back pain long after Joseph Pilates died. Traditional Pilates exercises follow six basic principles: centering(i.e. tightening the 'powerhouse' (trunk muscles),concentration (i.e.cognitive attention while performing the exercises),control (i.e.postural management while performing the

ORIGINAL RESEARCH PAPER

Physiotherapist

NATURE AND PATTERN OF NECK AND SHOULDER PAIN IN HOME ECONOMIST AT JHANSI (U.P.)

KEY WORDS: NECK PAIN SHOULDER PAIN

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ABSTRACT

INTRODUCTION: To indentify the anatomic site, nature, pattern & severity of neck and shoulder pain among housewives, find out incidence of pain, find out recurrence of neck and shoulder pain , to determine which activities are more prone to aggravate the neck and shoulder pain. To survey awareness of neck and shoulder pain among housewives at Jhansi (U.P.) **OBJECTIVE OF STUDY:** To identify nature and pattern of neck and shoulder pain at wives by Random Sampling done in the Jhansi City, UP. **METHODOLOGY:** Housewives completed a questionnaire about their neck and shoulder pain related questions, movement and pain related questions, ADL problems related question. **OUTCOME MEASURES:** Questionnaire form, Neck & Shoulder Assessment **CONCLUSION:** In conclusion, the survey shows that out of 51 women, around 50% housewives suffer from neck and shoulder pain with either a moderate score of 10-20% or a median score of 40-50%.

CHAPTER - 1

INTRODUCTION

In recent years the concept of status of health has been considered more aggressively, and therefore, more attention has been paid to the integration of the different aspects of health quality in health assessment.

"Musculoskeletal disorders" include a wide range of inflammatory and degenerative conditions affecting the muscles, tendons, ligaments, joints, peripheral nerves, and supporting blood vessels. Body regions most commonly involved are the low back, neck, shoulder, forearm, and hand, although recently the lower extremity has received more attention."

It is believed that job is one of the most effective factors on women's quality of life. Women are often responsible for tasks such as dusting, washing bathrooms and toilets, cleaning windows and mirrors and beds that can lead to contact with a variety of physical contact stress and consequently MSDs and but of course taking care of whole family needs.

The previous studies suggest that the prevalence of musculoskeletal pain among women are more common than men. Considering the effect of women's health on the overall family health and with regard to lack of coordination in shared responsibility of men and women in family and considering women's employment as a minor role alongside the major role of housekeeping.

A housewife's main duties are managing the family, caring for and educating her children, cooking and storing food, buying goods, cleaning and maintaining the home, sewing clothes for the family, etc. It is ironical that a woman employed within the home is referred to as a housewife, and outside the home, as a working woman. In both situations, the woman is working but how the woman is referred to, is based on the working place. The duty of the housewife is to take care of the day-to-day chores within the home. Balancing work and family life has become a major issue for women.

According to sociologists, housework or household chores are facilitating factors for creating a comfortable environment for family members, taking care of and rearing children, and providing the family's necessary requirements and needs. House- keeping is quite different from other occupations because it is a non-paid job that is done in isolation. Household chores are not usually regulated by national laws, and are repetitive and endless. Definition based on anatomical location The International Association for the Study of Pain (IASP) in its classification of chronic pain defines cervical spinal pain as pain perceived anywhere in the posterior region of the cervical spine, from the superior nuchal line to the first thoracic spinous process.

Acute neck pain usually lasts less than 7 days, sub-acute neck pain lasts more than 7 days but less than 3 months, and chronic neck pain has a duration of 3 months or more.

Neck pain was more prevalent among women and prevalence peaked in middle age. Shoulder pain is the third most common musculoskeletal disorder experienced by the general population and accounts for approximately 16% of all musculoskeletal complaints. Shoulder pain is believed to have a multi-factorial etiology, as several risk factors contribute to its development. Most studies have demonstrated that age is a considerable risk factor for shoulder pain.

In this thesis the term non-specific neck pain is used , Non-specific neck pain does not include trauma related neck pain, cervical radiculopathy or detailed pathoanatomic origin to the neck pain. The term idiopathic neck pain is sometime used, meaning that there is no obvious origin for the pain.

Women seem to be particularly at risk with a higher prevalence of upper limb and shoulder MSDs than men. women seem to be particularly at risk with a higher prevalence of upper limb and shoulder MSDs than men shoulder, including calcifications, bursitis, acromio-clavicular arthritis, rotator cuff tears, sub-acromial impingement, of which 8 (2.6%) on the dominant side, 4 (1.3%) on the non-dominant side and 14 (4.6%) bilaterally (Table 6). Both shoulders were normal in two hundred and seventy-six subjects (91.4%). As with the other assessments, the prevalence of anatomical abnormalities tended to increase with age, both for the dominant and the nondominant arm.

Ageing had a statistically significant effect on the prevalence of shoulder MSDs, whether reported or objectively diagnosed, which concurs with existing data on the increase of shoulder tendinopathies with age.

Neck pain is common in rheumatological practice. Assessment of outcome is difficult without objective measures. A Northwick Park neck pain questionnaire using

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Prevalence of Upperlimb Musculoskeletal Pain among Hostel Housekeeper's

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ABSTRACT: Introduction : Work related musculoskeletal disorders of upper limb are one of the most common occupational disorders around the world. The pattern of occurrence of WRMSDs and its relation with ergonomic intervention among housekeepers has not been widely reported. The aim of is study was to conduct a questionnaire survey for musculoskeletal disorders among the housekeepers .

Methods : A randomized questionnaire survey was conducted among housekeepers. Subjects fulfilling inclusion criteria were taken. Disorders of the arm, shoulder and hand Questionnaires used as outcome measure. 100 subjects from different hostels were taken. After taking the consent, the DASH questionnaire was given to them and the answering procedure was explained to them and they responded accordingly. The participants were divided into two groups group A with age 20-39 and group B with age 40-59. Then using the t-test the disorder were seen according to the age group.

Result and Discussion : All the participants completed the study and used for data analysis. There was significant ($p< 0.05$) decrease in pain in neck at activity in Group A compared to Group B. Thus, Group A showed more significant effect of ergonomic improvement than Group B. Hence, ergonomic intervention showed beneficial effect to reduce musculoskeletal disorders in housekeepers.

Conclusion : From this study it can be concluded that exercise with ergonomic intervention are effective in relieving upper extremity work related musculoskeletaldisorders.

Key words : upper extremity work related musculoskeletal disorders, disabilities of arm, shoulder and hand.

I. CHAPTER 1
INTRODUCTION

Housekeeping are the upper limb musculoskeletal disorders are the most common health problem in the workplace accounting for considerable economic loss [1–7]. Musculoskeletal pain are impairments of body structuressuch as tendons, muscles, joints, ligaments, nerves, bones, or a localized blood circulation system caused or aggravated by the work [7–10]. While and upper limb musculoskeletal disorders are defined as conditions which affect the soft tissues (tendons, muscles, joints, ligaments, and nerves) of the and upper limbs [9,11–13].

Housekeeping is a physically demanding job that in- cludes many tasks and housekeepers suffer from exposure to many high-risk factors for and upper limb MSDs [14]. Many of the tasks are repetitive in naturesuch as bed making, buffing and vacuuming, emptying garbage, tidying, dusting, and cleaning floors. Moreover, housekeepers are engaged in push-pull task that result biomechanical strain factors such as joint torque, com- pressive and shear forces, and their influencing variables like specific muscle activity, body positioning, the direction ofexertion,andworkspaceenvironment[13,15].

Adverse events due to and upper limb represent a major source of disability globally and have a significant socio-economic impact [2, 19, 20]. Moreover, employees with and upper limb MSDs experience physical and mental suffering and temporary or permanent limitations in their professional activities [21]. Many factors can be associated with and upper limbMSDs. Different studies conducted showed that repeated lifting of heavy objects, prolonged bending of the overstretching, low little job control, and low supervisor support are significantly associated factors with and upper limb MSDs [16, 22, 23]. Furthermoreand upper limb MSDs were not only

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Prevalence of Musculoskeletal Pain in Office Going Population of Gangtok

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ABSTRACT: Background and purpose: Musculoskeletal system disorders are common among office workers worldwide. They are common causes of severe long-term pain and physical disability. Musculoskeletal disorders (MSDs) are defined as "regional impairments of the muscles, tendons, nerves and joints. The aim of this study was to investigate musculoskeletal disorders (MSDs) and work absenteeism in working adults with acute and chronic musculoskeletal pain following soft tissue insult.

Materials and Methodology: It was a cross sectional study conducted among the office goingpopulation
of Gangtok. A total of 30 office employees were selected which included 15 males and 15 females. Data were collected using a orebro musculoskeletal pain questionnaire.

Results: The results showed that the highest prevalence rates of MSDs were in the lower back (50%), neck (23.3%), upper back Pain(13.3%) and shoulder painFrom the workstation analysis, the majority of the office workers were at a medium (60%) and high-risk level (20%). Results also revealed a significant association between some of MSDs in the lower back, neck pain and low back pain.

Conclusion: Based on the results of the study, most the office employees of Gangtok had low back pain and neck pain. Moderate and severe neck pain as well as low back pain was found to be more in female than in male.

Key words: Musculoskeletal system disorders,

I. CHAPTER 1

INTRODUCTION

Musculoskeletal disorders (MSDs) are a widespread and increasing occupational health problems in the workplace worldwide. The causes of work-related MSDs are usually multifactorial including physical, ergonomic, and psychosocial factor.

MSDs usually occur in workers who have excessive repetition, awkward postures, and heavy lifting.[7]

MSDs have been common complaints among workers involved in static work or tasks requiring the repetitive motion of the upper limbs and prolonged computer work. Office workers are the one group which may impact on chronic musculoskeletal healthproblems. Office work represents a complex physical work environment, with interactions among the various dimensions of the workstation, equipment and job content. Recent research reviews have confirmed the dose-response association between the number of hours working at a computer workstation and the risk of MSDs which include pain and other symptoms in the shoulder-neck, back and upper limbparticularly.[1-4]

Exposure to occupational computer use can be defined in different ways. Most studies have operationalized exposure to computer use as the average (or cumulative) duration of computer use (or its constituents: mouse and keyboard use) over a certain time period. Other operationalizations include the cumulative number of keystrokes or mouse clicks, variation in computers use between days or weeks, and distribution of usage periods (i.e. number of breaks taken within a certain time period). In this study, exposure to computer use will be measured objectively with a software program, which is installed on the individual workstation. In addition, self-reports will be collected.[6]

Musculoskeletal complaints in the neck and upper extremity and computer work are common in modern society and both show an increasing trend. Several previous reviews have indicated a possible causal relationship between computer work and musculoskeletal complaints in the neck and arm. The epidemiological studies concerning computer use and musculoskeletal

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Documentation of
Wild Medicinal Plants and Agriculture Crop in the part of Doon Valley, Uttarakhand, India

The present study was conduct to document wild medicinal plants and agriculture crop which are growing in and around Selaqui, district Dehradun, Uttarakhand, India. Number of field trips was undertaken for a period of two years from November, 2016 - October, 2018 to enumerate the wild medicinal plants and agriculture crop. The wild medicinal plants were collected from different parts of Selaqui at regular intervals for plant taxonomy. On the basis of field surveys, a total of 129 plant species have been collected, identified and listed. The list comprises of plants belongs to cereals, millets, legumes, root vegetables, stem vegetables, herbage vegetables, fruit vegetables, fruits, fibers, wood, wild medicinal plants and oil crops. The recorded plant species are divided into two groups namely, agriculture-horticulture crop and wild medicinal plants. The botanical names, families along with English and Hindi names have been updated as per existing flora. It was observed that the agriculture and horticulture crops were represented by a total of 77 representatives whereas wild medicinal plants were represented by 52 species. The results showed that family Leguminosae is dominant with the maximum number of species (19) followed by Poaceae (11) and Amaranthaceae (7). The study reveals that these plant species form minor but important food component for the local people and rural communities. The study also focused on the involvement of natural medicinal flora harvest foodstuff to entire foodstuff and dietary safety measures of inhabitant community has been undervalue.

Key words: Agriculture crops, Doon valley, Documentation, Wild medicinal plants.

The study is paying attention on documented natural medicinal flora and agriculture crop.

Introduction

Agriculture biological diversity refers to the human-managed biological diversity for wide-ranging agriculture purpose (Zimmerer, 2010). It's the synergy and relations among living being, land, technology and community system. Agriculture biological diversity biodiversity is regard as the compartment of biological diversity that include the variety and variability of flora, fauna, microbes and *in-situ* and *ex-situ* conservation of genetic wealth connected with agriculture bionetwork (Borokini *et al*., 2010). In sustainable and potency of food, sustenance, physical condition and living safe keeping all over the Globe, agriculture biological take part in a most important responsibility. Moreover, raising a few crops, communities habitually accumulate natural medicinal flora and other vegetation from natural habitat to gather their life requirements (Pandey *et al*., 2016).

Himalayas represent one of the significant mega centres of the biological, distribution more than fifty per cent of the vegetation wealth of the Indian subcontinent (Roy and Kushwaha, 2018). It has been a profound worry and responsiveness about the conservation of the fragile Himalayan ecology (Anon., 2010). The variety, wealth as well as individuality of the vegetation mechanism in various habitat retain reverberation and have maintain the aesthetic surroundings and the substantiality of the Himalayas. However, extreme utilization of forest,

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SHORT COMMUNICATION

Teratological Evidences in Fish Fauna with reference to Water Quality of Doon Valley, Uttarakhand

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Abstract

Fish fauna of Doon Valley (part of District Dehradun) was explored alongwith 15 physical and chemical water quality parameters. Fish and water sampling was done of five major rivers *viz.*, Baldi, Song and Suswa in the Eastern and Tons and Asan in the Western part of Doon Valley. While doing the taxonomical analysis, four teratological evidence were recorded in the fish species. Teratological manifestation with respect to furcated rostral barbel was observed in one female specimen of *Paracanthocobitis botia*, furcated maxillary barbel was seen in one specimen of *Glyptothorax pectinopterus*, forked rostral barbel in *Lepidocephalichthys guntea* and furcated caudal fin in *Heteropneustes fossilis*. The fluctuation pattern in water quality all through 3 different seasons reflected an increment pattern from summer to rainy in the parameters like depth, width, water velocity, CO_2, turbidity and TDS. The declining trend in the values of the aforesaid parameters was noticed beyond rainy months. From rainy to winters, the increment in values was noticed in DO, pH, hardness, alkalinity, BOD, nitrate and phosphate was observed. The parameters which showed increment in values from winters to summers include AT, WT, CO_2. Width, depth and WV have been the chief physical factors with wide range of variations. BOD, Hardness, NO_3, TDS, DO and CO_2 values seemed more important from the quality of water chemistry point of view. Seasonal variation in physical and chemical parameters have also been observed.

Keywords: Doon Valley, Fish Fauna, *Glyptothorax*, *Heteropneustes*, Teratology, Water Quality.

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Introduction

Injury-stricken or congenital deformities are not only common to the human population but also to other animals, including fishes. First figure of teratological fish was published in 1553 when Pierre Belon, a French Naturalist illustrated the head of old male Atlantic salmon with a deformed upper jaw. The second deformed fish to be figured was pug-headed carp illustrated by Guillane Rodenlet in 1555 (Gudger 1936). Dawson (1964, 1966 and 1971) and Dawson and Heal (1976) provided an extensive bibliography of fish anomalies. The said aspect has been found so interesting to the Ichthyologists. Tim and Ray-Jean (1981) examined a total of 18,361 specimens belonging to 34 species and 6 families from the Ohio River for external morphological anomalies like deformities of spinal curvature, fins, mouth, operculum, pug-headedness *etc.* In India, such studies have appeared in literature from time to time (Ovais, 1974; Sundar Singh, 1975; Rahman and Raghavan, 1976; Thakur and Kohli, 1976; Ram, 1976; Shivakumar and Bhat, 1977; Somvanshi and Bapat, 1982; Husain, 1985). Such anomalies are very common in fishes even now. During the recent investigation on fishes of Doon valley, we found such teratological evidence four fish species, which are highlighted in this communication.

Material and Methods

The fish fauna of Doon Valley (part of District Dehradun) was explored and fish sampling was carried out in five major rivers *viz.*, Baldi, Song and Suswa in the East Doon Valley and Tons and Asan in the West Doon Valley. Fish samples were collected using gillnets of varying mesh sizes and sampling was performed with the help of trained fishermen on the sampling sites in the Eastern and Western part of Doon Valley, respectively. Fish samples were preserved in 10% formalin and bought to the laboratory for routine identification, meristic and morphometric analyses using available literature and taxonomic revions (Day, 1878; Jayaram, 1981, 1999; Talwar and Jhingran, 1991; Nelson, 2006; Vishawanath *et al.*, 2007). Field photographs and macrophotogrphy of specimens were taken with the help of Digital Camera. All images and specimens were closely observed and teratological evidences encountered were meticulously recorded.

The estimation of physical and chemical water quality parameters (Air Temperature, Water Temperature, Dissolved Oxygen, Carbon dioxide and pH), was done in the field by taking the help of field water and soil analysis kit. Also, the parameters which could not be analyzed in the field (like Hardness (Calcium + Magnesium), Alkalinity (as bicarbonates), Turbidity, Biological Oxygen Demand, Nitrates as total nitrogen, Phosphates as total phosphorous and Total Dissolved Solids) were analyzed in the laboratory by following standard protocol [APHA, 2005].

Results and Discussion

In the present study four teratological evidences were recorded in the fish species. Teratological manifestation with respect to

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Using six parameter genetic model genetic analysis of micronutrients in cowpea [*Vigna unguiculata* (L.) Walp.]

Pallavi and Alankar Singh

Abstract
Generation Mean Analysis was carried out using six basic generations in 2 different crosses of cowpea for micronutrients i.e. iron and zinc to determine suitable breeding methods. Considering results of gene action, it is apparent that either of the family were found under the control of both fixable (additive, additive x additive) and non-fixable (dominance and epistatic) gene effects coupled with duplicate type of epistasis. Therefore, selection programme aiming to improve such traits in a population should accumulate the fixable additive genes first in early generations. Simultaneously breeding method like modified recurrent selection *i.e.*, alternating pedigree and recurrent selection cycle, diallel selective mating system may be tried for the effective and efficient exploitation non-fixable gene effects.

Keywords: Cowpea, epistasis, micronutients

Introduction
Cowpea is an important legume of the semi-arid tropics. It contains carbohydrate (50-67%), fats (1.9%), fibre (6.35%) and small percentage of the B-vitamins such as folic acid, thiamine, riboflavin and niacin as well as some micronutrients such as iron and zinc. The crop provides a cheap source of protein to humans and nutritious fodder (Singh and Fery, 1997) [8]. In current perspective of intensive and multiple cropping system inclusion of earliness as one component is imperative. The exact genetics of earliness has not been fully demonstrated. In this backdrop, an attempt was made to decipher the genetics and inheritance of earliness and other economic traits in cowpea. Cowpeas are sources of many valuable genes including those for adaptation (Singh, 1983) [7]. It is, therefore necessary to identify promising lines, land races and involve them in crosses with appropriate mating design. Early generation testing and selection have gained momentum in selfpollinated crops as additive genetic variance is more important. Yield augmentation is the prime objective of any breeding programme to cater to the demand for food for exploding population during short period. To realize this clear-cut knowledge about type of gene effect, its magnitude and composition of genetic variance i.e., additive, dominance and epistasis in selection of parent and designing an effective and sound breeding programme. The concept of generation mean analysis was developed by Hayman (1958) [2] for the estimation of genetic components of variation. One of the approaches for GMA involves six generations of a cross, viz., parents (P1, P2), their F1, F2 and backcrosses (BC1 and BC2).

Materials and Methods
Six generations (P1, P2, F1, F2, BC1 and BC2) of three crosses of cowpea, PGCP-63 x Pant Lobia-1, Pant Lobia-3 x Pant Lobia-1 3 were evaluated in a complete randomized block design (RBD) with three replications at G. B. Pant University of Agriculture & Technology, Pantnagar (Uttarakhand), 2016. Standard agronomic practices were followed to establish a good crop stand. A variable numbers of plants (10 for P1, P2, F1, BC1 and BC2 and 50 for F2) were randomly selected from each plot in all replications for recording the observations on different traits. The traits included in this experiment were iron and zinc content in cowpea. The mean data for different characters under study were analyzed as per Compact Family Block Design. Data were subjected to individual scaling test as given by Mather (1949) [4] and Hayman and Mather (1955) [3] to detect the presence or absence of epistasis.

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Ananlysis of heterotic response for zinc and iron content in cowpea (*Vigna unguiculata* (L). Walp)

Pallavi, Alankar Singh and YV Singh

Abstract
The investigation involved was carried out during 2014-2015 at G.B. Pant University of agriculture and Technology, Pantnagar. Pant Lobia-1, Pant Lobia-2, Pant Lobia-3, Pant Lobia-5, PGCP-59, PGCP-63 and PVCP-20 along with their 21 F_1's were evaluated. Crossing between the parental inbred lines was made in half-diallel fashion (without reciprocals) during 2014/15 cropping season.Being a self-pollinated crop, the scope for exploitation of hybrid vigour looking to the biological feasibility and gene action need to be searched out. Pant Lobia-2 and Pant Lobia-5 for iron content and zinc content and Pant Lobia-3 for zinc content found to had best heterobeltiosis and economic heterosis.

Keywords: Cowpea, zinc, iron and heterosis

Introduction
Shull (1914) [4] coined the term 'heterosis' for developmental stimulus resulting from the union of different gametes, while 'hybrid vigour' was referred to the manifestation effect of heterosis (Whaley, 1952) [10]. "Heterosis can be defined as the increased vigour of the F_1 generation of a cross over the better parents" (Hayes *et al.*, 1955) [3]. Because of its high protein (23-25%) and carbohydrate (50-67%), fats (1.9%), fibre (6.35%) and small percentage of the B-vitamins such as folic acid, thiamine, riboflavin and niacin as well as some micronutrients such as iron and zinc, cowpea plays an important role in both human and animal nutrition (Li *et al.*, 2001; Nielsen *et al.*, 1997; Singh *et al.*, 1997) [1, 2, 5]. The haulms are also very nutritious, containing about 15 to 17% protein, which is highly digestible and useful as a fodder for livestock (Singh, 2007; Tarawali *et al.*, 1997a and Tarawali *et al.*, 1997b) [8, 9]. It also has the useful ability to fix atmospheric nitrogen through its root nodules, and grows well in poor soils (Singh *et al.*, 2014) [7]. According to Yadav *et al.*, 1986, cowpea fix 563 kg of atmospheric nitrogen ha^{-1}. Cowpea protein is rich in the amino acids, lysine and tryptophan, compared to cereal grains; however, it is deficient in methionine and cystine when compared to animal protein.

Materials and Methods
The seven parental genotypes were crossed in diallel design to obtain 21 F1 hybrids. The emasculation and pollination were done as per method proposed by Krishnaswamy *et al.*, (1945). was laid out in a randomized block design with three replications during summer 2014/15. The recommended agronomic practices and plant protection measures were adopted for raising a good crop. The data were analysed to compute heterosis (%) over better parent (BP) and standard check (SH) values. Heterosis expressed as the per cent increase or decrease in value of F_1s over mid-parent (heterosis), over better parent (heterobeltiosis) and over the check variety (standard heterosis) was calculated as-

a. $\text{Heterosis } \% = \frac{\overline{F_1} - \overline{MP}}{\overline{MP}} \times 100$

b. $\text{Heterobeltiosis } \% = \frac{\overline{F_1} - \overline{BP}}{\overline{BP}} \times 100$

c. $\text{Standardheterosis } \% = \frac{\overline{F_1} - \overline{BP}}{\overline{BP}} \times 100$

where,
$\overline{F_1}$ = Mean of the F_1
$\overline{MP}$ = mean of two (mid parent) parents of a particular cross

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Diallel analysis for combining ability in cowpea (*Vigna unguiculata* (L.) Walp)

Pallavi, Alankar Singh and Sumit Chaudhary

Abstract
The present investigation involving 7 parents and 21 crosses in diallel design in grown in a randomized block design was carried out during 2014-2015 at G.B. Pant University of agriculture and Technology, Pantnagar. Analysis of variance revealed significant mean squares of general and specific combining abilities for all the traits studied. Pant lobia-2, Pant Lobia-3 and Pant Lobia-5 had good GCA for seed yield per hectare. Pant Lobia-1 was best general combiner for number of pods per plant and 100-seed weight whereas; Pant Lobia-2 for number of pods per plant, seed weight per plant, seed yield per hectare. Pant Lobia-3 for seed yield per hectare, seed weight per plant, and days to pod maturity; Pant Lobia-5 for plant height, seed yield per hectare, 100-seed weight, seed weight per plant ; PGCP-59 and PGCP-63 were for plant height; PVCP-20 for green pod weight per plant and pod length.

Keywords: Cowpea, diallel, gca, sca and yield

Introduction
Cowpea has a number of common names including crowder pea, black eyed pea and southern pea (Verdcourt, 1970) [6] and is generally called beans in Nigeria. The most commonly used designs for combining ability studies are line x tester (L x T) and diallel analysis. Combining ability analysis following line x tester given by Kempthorne (1957) [1] and Imric and Bray (1983) [2] is frequently used for testing the performance of lines in hybrid combinations. It is also useful in characterizing the nature and magnitude of gene action involved in controlling the quantitative traits a high genetic advance. Mishra *et al.* (1987) [3] reported that both general and specific combining ability were important for days to 50% flowering and seed yield with G.C.A. more important for days to 50% flowering and SCA more important for seed yield. Narrow sense heritability 52.7% for days to 50% flowering and 27.9% for seed yield were recorded. Analysis of variance revealed significant mean square due to G.C.A. as well as S.C.A. for all the characters. (Patel *et al.*, 2013) [4].
Diallel cross analysis technique has been found one of the best biometrical techniques for the identification of the lines possessing a built-in genetic potential for superior performance in hybrid combinations. Pal *et al.*, (2007) [5]. These analyses also permit the classification of parental lines in terms of their combining ability in hybrids and throw light on genetic architecture of parents and offsprings for different characters, which is very much essential to formulate a sound breeding programme and for the selection of appropriate breeding methods for the genetic improvement in the traits of economic interest. The practical utility of this technique has not been adequately tested for the genetic improvement in green pod yield of cowpea.

Materials and Methods
The 21 F1's were obtained by crossing 7 genotypes in diallel design during 2014-15 grown in a randomized block design with three replications at Breeder Seed Production Center of G. B. Pant University of Agriculture & Technology, Pantnagar. Each genotype was sown in three rows with row to row spacing (45 cm) and plant to plant (20 cm) respectively. The experiment was conducted under irrigated conditions. Recommended crop production and protection practices were followed to raise a good crop. The observations were recorded on five plants from each replication. The general combining ability (GCA) effects of parents and specific combining ability (SCA) effects of hybrids were worked out as suggested by Kempthorne (1957) [1].

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Study of nature and magnitude of heterotic response in cowpea (*Vigna unguiculata* (L). Walp) for yield and its attributing components

Pallavi, Alankar Singh and Sumit Chaudhary

Abstract
The diallel method of analysis was followed involving seven parental lines for study of heterosis for various yield characters in cowpea. The F1's and their parents were evaluated in randomized block design with three replications. Observation were recorded on number of pods /plant, number of seeds/pod, seed weight per plant, 100 seed weight and seed yield /plant. The best heterotic crosses identified were Pant Lobai-2 x Pant Lobia-1 for number of pods per plant, Pant Lobia-3 x Pant Lobia-2 for number of seeds per pod, Pant Lobia-5 x Pant Lobia-1 for seed weight per plant, Pant Lobai-3 x Pant Lobia-1 for 100-seed weight and Pant Lobia-2 x Pant Lobia-1 for seed yield per hectare.

Keywords: Heterosis, cowpea and seed yield

Introduction
Cowpea is well adapted crop, cultivated around the world primarily as a pulse, but also as a vegetable (both for the green peas and grain) and cover crop as well as for fodder. Cowpea is considered more tolerant to drought than even soybean and mungbean, due to its deep tap root. Heterosis is usually described in terms of the superiority of F_1 hybrid performance over some measure of parental performance that means definition of heterosis differs depending on the basis of comparison used. Heterosis is defined as improvement of F_1 over the mean of both parents (mid parent heterosis or relative heterosis) (Pickett, 1993, Stuber, 1999) [5, 6]; over the mean of the better parent or heterobeltiosis (Briggs and Knowles, 1967, Jinks, 1983) [1, 3]. These definitions coincide with that of Hayes *et al.*, (1955) [2], who defined heterosis as increased vigour of F_1 over the mean of its parents or over the better parent and this definition is generally accepted. From a commercial point of view, however, heterosis may also be described as the degree of hybrid performance over the best available variety and this is called standard heterosis (Virmani and Edwards, 1983) [7].

Materials and Methods
The present investigation was carried out at the Breeder Seed Production Center of G. B. Pant University of Agriculture & Technology, Pantnagar. The seven cowpea varieties exhibiting genetical diversity in respect of various morphological, development and quantitative characters were sown in crossing block and ploy house during kharif 2014/summer 2015.The emasculation and pollination were done as per method proposed by Krishnaswamy *et al.*, (1945) [4]. The recommended agronomic practices and plant protection measures were adopted for raising a good crop. Observations were recorded on randomly selected five plants chosen at random in each entry for different quantitative traits viz., number of pods/plant, number of seeds/pod,seed weight per plant, 100 seed weight and seed yield per hectare. The data were analysed to compute heterosis (%) over better parent (BP) and standard check (SP) values.

Results and Discussion
In the present investigation, heterosis was explained as per cent increase (positive) or decrease (negative) in the average performance of hybrid over the mid parent (relative heterosis), better parent (heterobeltiosis) and check variety Pant Lobia-1 (economic or standard heterosis). Estimate of heterosis regarding different characters are described in Table 1:

Number of pods per plant
All crosses exhibited the heterobeltiosis in positive direction, the highest value was expressed by Pant Lobia-2 x Pant Lobia-1 (180.00%) followed by PGCP-59 x Pant Lobia-5 (149.14%), PGCP-59 x Pant Lobia-5 (142.24%), Pant Lobia-5 x Pant Lobia-2 (87.08%) and PVCP-20 x

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Feeding effect of different level of fenugreek powder and vitamin E on carcass quality of broilers

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Abstract
Present investigation was appraised to study the effect of feeding fenugreek seed powder and vitamin E on feed consumption, live body weight, body weight gain, feed conversion efficiency, dressing percent, giblet weight and intestinal viscera analyzing experimental data collected from 120 birds of Cobb-400 strain carried out at Poultry Research and Training Centre, Sardar Vallabhbhai Patel University of Agriculture & Technology, Modipuram, Meerut. Birds utilized were selected randomly and divided into four equal groups, each were fed varying diets. For treatments T_1, T_2, T_3 and T_4 dressing percent was computed as 68.02±0.78, 68.56±57, 68.19±0.51 and 68.78±0.55 while giblets (heart, liver and gizzard) has weighed with quantum of 3.33±0.11, 3.55±0.03, 3.45±0.12 and 4.34±0.13 percent, respectively. Similarly, intestinal viscera (%) for all groups were found to be 3.21±0.08, 3.55±0.18, 3.82±0.03 and 4.10±0.05, respectively. Carcass traits considered for the present study were found to have significant difference among them. According to present trial, combined inclusion of fenugreek seed powder and vitamin E as 2.0g and 50mg per kg of feed has adjudged to be better proposition to improve the overall performance.

Keywords: Broiler chicks, carcass, fenugreek powder, vitamin E

Introduction
The world poultry industry has grown consistently since 1940s and the broiler industry has now occupied second place by volume in the world just after pork. Chicken meat represents 29 percent of total meat production from farm animals. Poultry farming in India has transformed itself from backyard venture in to a dynamic agro-industry in few decades and currently possess third and fourth place in egg and broiler production, respectively. Growth promoters are chemical and biological substances added to poultry feed with the aim of improving growth, feed utilization, disease resistance and vitality, regulation of the intestinal micro-flora, reduced morbidity and mortality and in this way realize better production and financial returns. Various types of feed additives such as antibiotics, enzymes, hormones, prebiotics, probiotics, herbal products etc. are used as growth stimulants in poultry production. Fenugreek is an annual legume cultivated across the world, is one of the herbs having multi-functional properties. Husk (seed coat) contains higher amount of polyphenols (103.8 mg of Gallic acid equivalent) and total dietary fiber (77.1%). Seeds are utilized as appetizer and help in digestion; improve growth performance and health status (Abou El-wafa *et al.*, 2003) [1]. Vitamin E is primarily known as an antioxidant in reducing cellular free radical damage but it may also influence the development and maintenance of defense mechanism through multiple functions (Gershwin *et al.*, 1985) [2]. Vitamin E consists of two families of compounds, the tocopherols and tocotrienols, characterised by a 6-chromanol ring and an isoprenoid side chain. The members of each family are designated alpha (α), beta (β), gamma (γ), and delta (δ) according to the position of methyl groups attached to the chroman nucleus. Therefore, 8 stereoisomers of the large vitamin E family are possible but only the RRR-form occurs naturally. Tocopherols and tocotrienols are differentiated by their phenyl "tails" as these are saturated in the tocopherols but unsaturated in the tocotrienols.

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Impact of selenium and zinc supplementation on semen attributes of Murrah buffalo bulls

Harendra Singh Chauhan, Rajkumar, Shalu Kumar, Manoj Kumar Bansala, Amit Kumar, DS Sahu and BG Desai

Abstract
This study determined the impact of selenium and zinc supplementation in the production of spermatozoa and semen quality of Murrah buffaloes. Thirty (30) Murrah buffalo bulls used for semen production at the at Central Research Institute on Buffalo, Sirsa Road, Hisar, Haryana were allotted into three treatment groups. The first treatment (To) with no supplementary selenium and zinc. The second (T_1) and the third (T_2) treatments were given 35 mg/kg dry matter intake of the animal and 35 mg/Kg + 0.20 mg/kg dry matter intake of the animal for the entire duration of the experiment. The buffalo bull fed with rations composed of burseem/green maize/jowar, wheat straw, concentrate (wheat bran, maize, barley and GNC). Semen collection was done bi-weekly using artificial vagina method and the semen volume (ml), sperm concentration (million per ml), sperm concentration (million per ejaculate), gross motility (%) and progressive motility. The results showed that T_2 produced the highest values on semen volume (3. 42 ml), sperm concentration (1205.88±99.66 million/ml), sperm concentration (4124.11±257.20 million/ejaculate), sperm gross motility (81.65±2.29%) and progressive motility (56.65±2.20). Overall results further revealed that the average sperm production and semen quality were improved by supplementation of dietary selenium and zinc and their combination.

Keywords: Murrah bull, zinc, selenium, semen quality

Introduction
Artificial insemination is an effective tool in programs for genetic improvement and a widely used breeding technique in farm animals, especially Indian buffaloes [1]. Semen processing and cryopreservation causes significant damage to the sperm genome, motility apparatus, plasma membrane and acrosomal cap, intracellular enzyme leakage and thus decreases fertility [2, 3]. Semen contains a variety of antioxidants that act as free radical scavengers against reactive oxygen species [4]. Processing and cryopreservation of semen reduces the semen's antioxidant protection capacity; adding antioxidant to the freezing diluent has a protective effect against lipid peroxidation [5, 6].
Selenium supplementation can improve testicular and semen glutathione peroxidase (GSH-Px) activity, protect the membrane system integrity [7] and proliferation of spermatogonial stem cells [8]. Selenium (Se) is also present in the mid piece of spermatozoa and is associated with Cys-rich protein of the mitochondrial sheath [9]. A deficiency of Se causes changes in mid-piece architecture leading to breakage of head and tail of sperms and impaired sperm motility [10]. Zn is an essential nutrient in growth and reproduction, and an indispensable element. Zn assists in the testicular growth and development of seminiferous tubules, spermatogenesis, test steroidogenesis, follicular stimulating hormone (FSH) synthesis and secretion, and luteinizing hormone (LH) [11]. Zn antioxidant property prevents lipid peroxidation and lysosomal membrane stabilisation [12] and thus the fertility increases [13]. The goal of this research is to study the effect of dietary supplementation of Se and Zn on semen quality in Murrah buffalo.

Materials and Methods
Animals and experimental design
The present study was conducted at College of Agriculture, Sardar Vallbhabhai Patel University of Agricultural and Technology, Meerut, (Uttar Pradesh), India on thirty Murrah buffalo bulls (37.28±0.58 months), weighing 349±2.39 kg, reared at Central Research Institute on Buffalo, Sirsa Road, Hisar, Haryana. It is located at 29.14° N latitude and 75.72° E longitudes, 215m above the sea level.

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APPLICATION OF METHYL METHACRYLATE POLYMER IN DENTISTRY

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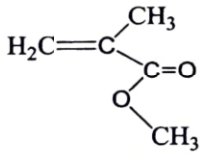
ABSTRACT

Polymer has now become very useful for the treatment of dental problem. A fruitful and vast area of research on dental material is very important. Dental composites consists of a reinforcing filler of small inorganic particles, generally glass or quartz. Such materials are mixed in matrix of organic polymer A recently well known matrix is bis phenol A-glycidal methacrylate(bis-GMA). This is used because its di methacrylate monomer is difunctional, crosslinking and polymerization take place simultaneously, a product is obtained which is very hard material used in occlusive application. Methyl methacrylate(MMA)polymer is commonly used as group of polymers. It contains good mechanical properties like rigidity, wear resistance and strength and also has many useful processing properties as easy to mix, simple to process, cure and shapable. It is biocompatible i.e., non –toxic, non-irritating, tasteless, odourless and resistance to microbial colonization. MMA has aesthetic properties like translucency, transparency. It is chemically resistant in otal part of body. It had acceptable cost. Its density is 0.945g/Ml with 54.3KJ/mol heat of polymerization, colourless, immiscible with water but miscible in organic solvent and flammable in nature.

KEYWORDS: A-glycidal methacrylate (bis-GMA), Methyl methacrylate(MMA), Rigidity, Biocompatible.



Methyl Methacrylate (MM

INTRODUCTION

Polymers now play an indispensable role in dentistry. For dental fillings and prostheses fixed to teeth or other hard tissue, interfacial phenomena again dominate the outcome. Indeed, a clear distinction is difficult to make between mechanical failure and problems of bio compatibility at the interface.

Although mechanical strength and modulus may be tailored for dental polymers, adhesion is one of the most challenging problem area. Bonding to dentin is particularly difficult because acid etching techniques cannot be used. Secondary, carries and prosthetic failures most often occur because of percolation of microorganisms, liquid and other matter into marginal unfilled areas. The development of improved interfacial bonding polymers, such as covalently reactive acrylics will lead to simpler dental procedures (with less etching and grinding) and inhibition of subsequent carries. Additionally opportunities exist for new fissures sealants of act as plaque barrier and minimize harmful deposition of calculus.

A fruitful and extensive area of research on dental materials involves the development of improved composites from which new products appears frequently. These materials, like amalgams, may be formed and cued in the mouth without the need for dental laboratory facilities. Dental composites consist of a reinforcing filler of small inorganic particles, usually glass or quartz. These are embedded in a matrix of organic polymer. A currently popular matrix constituent is bisphenol A-glycidal methacrylate (bis-GMA). Since this dimethacrylate monomer is difunctional, cross-linking and polymerization occur simultaneously, producing a hard durable material required for occlusive applications.

Except for pure gold filling in the teeth, all dental material are multiphase and having composite microstructure involving one or more interfaces The use of antibiotic-containing nanofiber-based polymeric films on dental implants has been investigated to minimize implant loss, especially in periodontally compromised patients. particularly tensile Young's modulus, tensile strength, and flexural strength) compared with

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APPLICATION OF GOLD NANOPARTICLE IN MEDICAL FIELD

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ABSTRACT

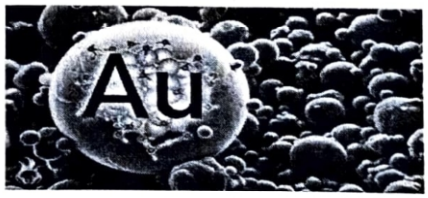
Gold is a Block D, Period 6 element. It is a soft metal that is often alloyed to give it more strength. It is a good conductor of heat and electricity. It is a good reflector of infrared and is chemically inert. The versatile surface chemistry of gold nanoparticles allows them to be coated with small molecules, polymers, and biological recognition molecules, thereby extending their range of application. The morphology of gold nanoparticles is spherical, and they appear as a brown powder. Gold nanoparticles are versatile materials with a broad range of applications in a variety of fields. Researchers have coated gold particles with DNA and injected them into plant embryos or plant cells. This will ensure that some genetic material will enter the cells and transform them. This method enhances plant plastids. The targeted delivery of drugs is one of the most promising and actively developing directions in the medicinal use of GNPs. The options of using GNP conjugated with the following antitumor agents were proposed: paclitaxel, methotrexate, daunorubicine, hemcytabin, 6-mercaptopurine, dodecylcysteine, sulfonamide, 5-fluorouracil, platinum complexes, kahalalide, tamoxifen, herceptin, doxorubicin, prospidin etc. The conjugation was carried out either by simple physical adsorption of the drugs onto GNPs or via the use of alkanethiol linkers. The effect of conjugates was assessed both (chiefly) on in vitro models, using tumor cell cultures, and in vivo, in mice with induced tumors of different natures and localizations (Lewis lung carcinoma, pancreatic adenocarcinoma, etc.).

INTRODUCTION

For centuries gold has captivated mankind and has been considered as a precious metal. Reports state that colloidal gold nanoparticles have been utilized for centuries by artists for their vibrant colors, which are produced by their interaction with visible light. However, only in the 1850s scientists began studying their properties in more detail.

Gold is a Block D, Period 6 element. It is a soft metal that is often alloyed to give it more strength. It is a good conductor of heat and electricity. It is a good reflector of infrared and is chemically inert.

The versatile surface chemistry of gold nanoparticles allows them to be coated with small molecules, polymers, and biological recognition molecules, thereby extending their range of application. The morphology of gold nanoparticles is spherical, and they appear as a brown powder.



Chemical Properties

Chemical symbol	Au
Group	11
Electronic configuration	[Xe] $4f^{142}$ $5d^{10}6s^1$

The chemical properties of gold nanoparticles are outlined -

Physical Properties

The physical properties of gold nanoparticles are given in the following table.

Density	19.30 g/cm^3	0.697 lb/in^3
Molar mass	196.97 g/mol	-

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CLIMATE CHANGE, INFRARED ENERGY, ORBITAL VARIATION AND THEIR IMPACTS

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ABSTRACT

Climate change occurs when changes in earth's climate system result in new weather patterns that last for at least a new decades ,may be for millions of years. come a widespread topic in recent years. This problem that resulted from the emission of greenhouse gases that affected our environment. Therefore, it raises question on whether the problem is caused by human activities or it's just a part of nature's cycle. The climate system receives nearly all of its energy from the sun, with a relatively tiny amount from earth's interior The balance of incoming and outgoing energy ,the passage of the energy through the climate system, determines Earth's Energy Budget. When the incoming energy is greater than the outgoing energy, earth's energy budget is positive and the climate system is warming .if more energy goes out, the energy budget is negative and earth experience cooling .climate can be measured at many geographic scales for example cities, countries, or the entire globe—by such statistics as average temperature, average number of rainy days, and the frequency of droughts .climate change refers to changes in these statics over years, decades, or even centuries. The overwhelming majority of climate scientists agree that human activities, especially the burning of fossil fuels (coal ,oil and gas),are responsible for most of the climate change currently being observed. Scientists have given information for more than century that emissions from the burning of fossil fuel could lead to increase in the Earth's average surface temperature .NASA'S Global surface temperature Record estimate that Earth's average surface temperature has increased by more than1.4^{0}F(0.8^{0}C)over the past 100 years ,with much of this increase taking place over the past 35 years. The green house gases are carbon dioxide(CO_2),Methan (CH_4),Nitrous oxide(N_2O),and water vapour .Human activities---especially burning fossil fuel---are increasing the concentrations of many of these gases, amplifying the natural greenhouse effect .Swedish scientist Svante Areehenius predicted that if human activities increased co_2 levels in the atmosphere, a warming treand would result.Green house gases trap more infrared energy in the atmosphere than occurs naturally .Heat(infrared energy)radiates out ward from the warmed surface of the surface of the Earth.

KEYWORDS: Earth's, Energy Budget., infrared energy, amplifying.

INTRODUCTION

Climate change occurs when changes in earth's climate system result in new weathers patterns that last a few decades, and may be millions of years. Climate system comprises five interactingparts, theatmosphere(air) ,hydrosphere (water), cryosphere(ice and permafrost, biosphere(living things), and lithosphere (earth's crust and upper mantel). , refers to change in entire globe by such statistics as averagetemperatures, averagr number of rainy days,and the frequency of droughts.Human activities,especially the burning of fossile fuel(coal,oil and gas)are responsible for much of the warming and realted changes being observed around the world.Climate scientists agree burning of fossil fuel are resposible formost the climate change.The Climatesystem receives nearly allof its energy from the sun,with relatively tiny amount from the earth's interior .The balance of incoming and out going energy,the passage of the energy through the climate system, determines Earth's Energy Budget. when the incoming energy is greater than the outgoing energy, earth's energy is positive and the climate system is warming. if more energy goes out, the energy budget is negative and earth experience cooling. climate can be measured at many geographic scales for example cities, countries, or the entire globe—by such statistics as average temperature, average number of rainy days, and the frequency of droughts .climate change refers to changes in these statics over years, decades, or even centuries. The overwhelming majority of climate scientists agree that human activities, especially the burning of fossil fuels (coal ,oil and gas),are responsible for most of the climate change currently being observed.The climate change is often used to refer specifically to Anthropogenic climate

Phytochemical Analysis and Evaluation of Anti-inflammatory Activity of *Bignonia venusta* (Ker Gawl.) Miers Flower Extracts

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Abstract-The inflammatory response involves a complex array of enzyme activation, mediator release, fluid extra vasations, cell migration, tissue breakdown and repair which are aimed at host defence and usually activated in disease condition. Currently much interest has been shown in the searching of medicinal plants with anti-inflammatory activity which may lead to the discovery of new therapeutic agent that is not only used to suppress the inflammation but also used in diverse disease conditions where the inflammation response is amplifying in the disease process. In the present study, the selection of *Bignonia venusta* plant for evaluation was based on its traditional usages. Preparation of different extracts from non polar and polar solvent were prepared to study the phytochemical analysis in different extracts and anti inflammatory activities of different extracts. Methanol extract was found to be the richest extract for phytoconstituents and from the comparison with the standard drug aspirin, it was observed that the concentration of 2000 µg/ml of methanol extract showed maximum activity (58.0%) at 560 nm while the other extract from petroleum ether, in comparison with standard drug aspirin shows no activity.

Keywords: Phytochemical Analysis, Anti-inflammatory, *Bignonia venusta*

Introduction

Many species belonging to the Bignoniaceae family, such as *Bignonia venustata,* also known as *Pyrostegia venusta* (Ker Gawl). Miers are known to be of medicinal value[2]. In folk medicine, the aerial parts of *B. venusta* are mainly used as an infusion or decoction.

Traditionally, many diseases like dysentery, immoderate menstrual flow, common diseases of the respiratory system, and for the treatment of genital infections, *Pyrostegia venusta (*Ker Gawl.) Miers is used as a medicine. Diseases like diarrhea, vitiligo and jaundice are controlled by general tonic[3,9]. Tonics made from the stem of *P. venusta* are useful for treating diarrhea, where as flower preparation has been showed to attenuate vomiting[13]. The decoction of aerial parts of *P. venusta* is used for the treatment of cough and flu by local Brazalians. It was shown by Immuno-Modulatory study of the methanol extract of flowers of *P. venusta* that it stimulates the immune system. It ,supports increase in anti inflammatory and

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Review Article

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WJPMR

AUTOCOIDS: A BRIEF REVIEW

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ABSTRACT

Autacoids or "autocoids" are biological factors which act like local hormones, have a brief duration, and act near the site of synthesis. The word autacoid comes from the Greek "Autos" and "Acos". The effects of autacoids are mostly localized but large amounts can be produced and moved into circulation. Autacoids may thus have systemic effect by being transported via circulation. These regulating molecules are also metabolized locally. So the compounds are produced locally, they act locally and are metabolised locally. Autacoids can have many different biological actions including modulation of the activity of smooth muscles, glands, nerves, platelets and other tissues. Some other autacoids are primarily characterized by the effect they have upon different tissues, such as smooth muscle. With respect to vascular smooth muscle, there are both vasoconstrictor and vasodilator autacoids. Vasodilator autacoids can be released during periods of exercise. Their main effect is seen in the skin, allowing for heat loss. These are local hormones and therefore have a paracrine effect. Autacoids are chemical mediators that are synthesized and function in a localized tissue or area and participate in physiologic or pathophysiologic responses to injury. They act only locally and therefore also termed "local hormone." Autacoids normally do not function as the classical blood-borne hormones. Typically, autacoids are short-lived and rapidly degraded. **Autacoid modulators** interfere with the synthesis, inhibit the release or the receptors upon which they act. Autocoids are biological factors synthesized and released locally that play a role in vasoconstriction, vasodilation, and inflammation. These include serotonin,bradykinin, histamine, andeicosanoids. Vertebrates have evolved remarkable mechanisms for the repair and maintenance of their own tissues (i.e., "host" tissues) that simultaneously preclude the invasion and growth of non-host cells and viruses. The front line of host defense relies on the skin, mucosal surfaces, and cornea, where epithelial tissues provide not only the critical physical barrier to a constant exposure to pathogens, but also an interface with commensal microbes.[1,2] Inflammation is a major component of host defense, and a fundamental feature of this vital response is the recruitment of leukocytes to sites of injury.[3,4] Polymorphonuclear leukocytes (PMN) and macrophages in particular are essential for preventing infection and the concomitant threat of life-threatening sepsis. Indeed, in humans, vulnerability to infection is an inevitable consequence of all known genetic or acquired defects in leukocyte function, including defects in adhesion, microbial killing, and phagocytosis; deficiencies in the generation of leukocytes in the bone marrow increase rates of infection and also other illnesses and raise mortality rates.[1] In fact, any injury that compromises the external epithelial barrier triggers a robust inflammatory response.

Acute inflammation and wound healing are intimately linked responses that evolved to remove pathogens and noxious agents and ultimately restore tissue function and homeostasis. Acute wound healing and inflammation are tightly regulated responses that include highly complex programs with overlapping time course, common cell types, and shared chemical mediators.[3-8] Delineation of these two vital injury responses has posed a major challenge, particularly in regard to a definitive role for inflammation and leukocytes in the wound healing response.[5,7,9,10] Pharmacological suppression of the inflammatory response has become a major clinical target, primarily in an effort to control the precarious activation of powerful inflammatory responses that can involve "friendly fire" (e.g., leukocyte-mediated tissue injury), a key problem in inflammatory diseases and chronic wounds. Indeed, elegant studies employing knockout and knockdown approaches provide strong evidence that exacerbated inflammation impairs wound healing see.[5,6,9] Our prevailing paradigm thus suggests that nature tends to err on the site of caution, so that responses to injury can appear overzealous, triggering inflammation and impeding wound healing. On the other hand, several tissues—such as the oral mucosa and the cornea in particular—exhibit differential injury responses that are characterized by rapid wound healing and controlled inflammation, without compromising host defense.[2,9,11,14] A key feature of these privileged tissues

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Research Article
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LIPID PROFILING IN MATHURA POPULATION

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ABSTRACT

Asian populations have experienced spurt in chronic diseases later than the western populations. South Asia especially India where infectious diseases are still highly prevalent, has suffered much more after this transition, as the prevalence, incidence and mortality from coronary artery disease (CAD) among them have been reported to be higher than among the western and other Asians. Coronary artery disease (CAD) is a multifactorial disease resulting from interaction among various hereditary, cultural and environment factors. Population specific studies are rare. The present study reports Lipid (total cholesterol and triglycerides), Lipoprotein (HDL, LDL, VLDL) and their concentrations among Mathura populations and discuss the importance of population surveys covering normal healthy individuals for developing policies for coronary heart diseases (CHD) prevention owing to unique genetic make -up of Indian populations.

KEYWORDS: CAD, HDL, LDL, VLDL, CHD.

INTRODUCTION

In human metabolism, lipids are considered as one of the important dietary constituent. The elevated levels of blood lipids especially cholesterol are the major - factors for heart diseases. Each 1% rise in cholesterol is associated with an approximate 2% increase in coronary heart diseases (CHD). Many epidemiological studies have established that LDLis directly proportional and HDL is inversely proportional to CHD. Hyperlipidaemia and ipoprotenemia are responsible for clinical manifestation of atherosclerosis (Goswami and Bandyopdhyay, 2003). The concentration of blood lipid in an individual or opulation is modulated overwhelmingly by factors such as social, behavioural, physiological and genetics. It is estimated that over 60% of the variability in serum lipids is genetically determined and most of the variation being due to polygenic influences. Interaction between the later and environmental factors is probably the commonest cause of hyperlipidemia in the general population (Thompson, 1990).

CHD is the third largest cause for clinical mortality in India after infectious diseases and uberculosis. Several researchers revealed that the Indians, because of high serum cholesterol lipoprotein (a), Lp(a), insulin resistance syndrome, vitamin E and vitamin C deficiency and genetic make-up are prone to CHD and diabetes(Bhatnagar et al.,1995). Further, Indians are susceptible to atheroma 15–20 years ahead of the west and they develop atheroma even at ower concentration of lipids than western people Swamy et al., 1989). So, there is a need to develop guidelines and standards for lipid and lipoprotein concentration based on Indian populations. But we still depend upon western standards to diagnosis hyperlipidemia in clinical manifestation of atherosclerosis. In spite of Indians greater genetic and cultural diversity only few populations are covered until now and data on lipid variation is very scanty. So, keeping this in view, lipid (TC and TG), lipoprotein (HDL, LDLand VLDL) profiles in Mathura populations is presented.

MATERIAL AND METHODS

A sum total of 200 (Males= 100 and Females 100) individuals aged between 20 and 60 years were selected from Matura. 5 ml intravenous blood was drawn from each individual in the general resting position after overnight fasting in vacutainers. An informed consent was taken from the volunteers. Age, height weight and blood pressure were recorded habits of the subjects were obtained using a questionnaire. The past history of each person along with family history was tracked and no cases of M.I were detected. The sample blood of individuals was tested at the Biochemistry laboratory, Sanskriti University Mathura. Serum total cholesterol levels was determined by enzymatic (CHOD-PAP) colorimetric method (Allain et al., 1974) and triglycerides by enzymatic GPO-PAP) method (Jacobs and VanDenmark, 1960). HDL-cholesterol and LDL-

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In vitro investigation of anti-cancer potential of *Spilanthes acmella*

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Abstract

Aim: The present research work was carried out to identify the phytoconstituents and *in-vitro* anticancer activity of *Spilanthes acmella* extract.

Methods: The whole plant was used for crude extraction. The extraction was carried out by cold percolation as well as hot percolation method (Soxhlet method) both and 70% ethanol was used as extraction solvent. The existence of phytoconstituents was determined by using typical protocols. The anticancer potential activities were determined by sulforhodomine B dye (SRB) assay method. In this experiment, Mitomycin-C (anticancer drug) was used as a positive control.

Results: The qualitative test result of plant extract showed the presence of Protein, Alkaloids, Phenolics and Flavonoids. The plant extract was tested for *in-vitro* anticancer activity against liver cancer (HEP-2) cell line which showed 77±1.90% growth inhibition and colon cancer (HT-29) cell lines which showed 74±1.03% growth inhibition by Sulforhodamine B (SRB) assay. The statistical analysis showed significant results against selected cancer cell lines.

Conclusion: Plant contains bioactive organic compounds viz Protein, Alkaloids, Phenolics and Flavonoids that may possess anti-cancer activities. Finally, it is conclude that the phytoconstituents of this plant compounds can be further used herbal formulations in pharmaceuticals.

Key Words: Anti-cancer, Bioactive, Flavonoids, Mitomycin-C, Phytoconstituents.

INTRODUCTION

Cancer is marked by abnormal growth of cells which leads to the development of tumor and spread by metastasis. According to WHO, cancer is the second leading cause of death worldwide. Treatments for cancer may involve surgery, radiotherapy and chemotherapy and often a combination of two or all three may employed but these type of treatment causes more adverse effect on normal cells [1]. The Study of review/articles before last few decades clearly indicated that herbal products exhibit a variety of therapeutic properties and provide more health security to the patients [2-3]. Plants are rich source of therapeutic bioactive agents, hence extensive research is going on to investigate plant derived non-toxic phytochemical compounds [4]. The medicinal plants have a diverse group of highly valuable and readily available source of bioactive organic compounds, e.g. alkaloids, tannins, essential oils, proteins and flavonoids [5-7]. The traditional system of medicine and knowledge of Ayurveda help in the discovery of new herbal drug leads with high activity and low toxicity for cancer therapy. Initial research focuses on the isolation and purification of bioactive herbal compounds, chemical modification and improving other pharmacological profiles [8]. The evaluation of medicinal plants as a source of anticancer was started in the 1950s, with the discovery of vinblastine and vincristine alkaloids from vinca (*Catharanthus roseus*) plant [9]. In recent time there is a great emphasis has been given towards herbal research on complementary and alternative medicine that deals with the treatment and cure of cancer [10]. Mainly the two plant products like vinblastine and vincristine both are used in combination for the treatment of a variety of cancers, including leukaemias, lymphomas, testicular cancer, breast, lung cancers, and sarcoma [11]. The anticancer activity of the plant *Tectaria cicutaria* extract was tested *in-vitro* using Sulforhodamine B (SRB) assay against some cancer cell lines namely Human Leukemia Cell Line (K-562), Human Nasopharyngeal Cell Line (KB), Human Colon Cell Line (HT-29) and Human Colon Cell Line (Colo-205) which showed significant result [12]. This plant is also known as toothache plant. Its extract contains an active compound know as Spilanthol that used against blood parasites including malaria. The extract have also insecticidal and anti-bacterial activities [13]. The cytotoxic property was also determined by MTT assay, which indicated a potential cytotoxic effect on cancer cell lines such as HeLa and V79 cell lines [14]. The ethanolic extract of Argemon mexicana showed cytotoxic activity using SRB dye assay against lung cancer cell line (A-549), colon cancer cell line (502713), liver cancer cell line (HT-29) and neuroblastoma cancer cell line (IMR-32) [15]. So, Keeping above review literature in mind, our research work was therefore aimed to investigate and evaluate the presence of bioactive herbal compounds and anticancer

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RESEARCH ARTICLE OPEN ACCESS

Purification, Isolation, and Characterization of Esterase from *Rhodococcus sp.* LKE-021

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Abstract

A thermophilic esterase isolated from *Rhodococcus sp.* LKE-021. This enzyme was purified with purification fold 60 from the crude extracts of enzyme and recovery of enzyme obtained approximately 21%. The specific activity of the LKE-021 esteraseis 795.1 U/mg. SDS-PAGE analysis determined the molecular weight of LKE-21 esteraseis around 32,000Da/32KDa. The enzyme activity of LKE-021 esterase exhibited over a wide range of temperature i.e. 30° to 80°C and the enzyme remained stable when incubated on 60° for 2h. This indicates that the isolated LKE-021 esterase is thermostable. The isolated enzyme exhibits activity on various pH ranges from 2.0 to 12.0 and the highest activity observed on 11.0 pH.The LKE-021 esterase was active after proteinase K treatment and shows over 75 % specific activity i.e. 50 U/µg Proteinase K.

Keywords: *Rhodococcus*, isolation & purification, characterization, Polyacrylamide Gel, Extremophiles

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Small-scale phyco-mitigation of raw urban wastewater integrated with biodiesel production and its utilization for aquaculture

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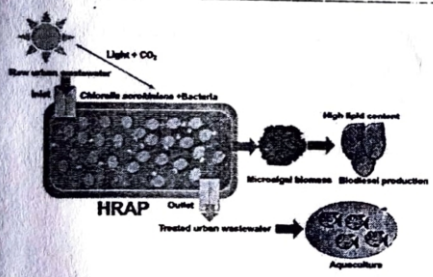
GRAPHICAL ABSTRACT



ARTICLE INFO

Keywords:
HRAP
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ABSTRACT

A low-cost small-scale high-rate algal pond (HRAP) was constructed to investigate the synergistic potential of a novel oleaginous microalga, *Chlorella sorokiniana* for phyco-mitigation, and biodiesel production using raw urban wastewater. An enhanced nutrient removal (97%), total organic carbon (74%), alkalinity (70%) and hardness (75%) from the wastewater was obtained. The microalga dominated in the HRAP as ~90% increase in the dissolved oxygen with high biomass (1.13 g/L) was noted. The microalga biomass showed sufficient lipid content (~31% of dry cell weight) as compared to control (Bold's Basal media). The total lipid profiling of the microalga cultivated in wastewater showed augmentation in the levels of both storage and neutral lipids with good quality fatty acids composition. Moreover, the sucker fishes grew healthy in the treated wastewater with an increase in body weight.

1. Introduction

The 21st century is challenged with grave environmental issues including rapid deterioration of natural resources, ever-increasing greenhouse gasses (GHGs) emissions, generation of hefty amounts of wastewaters and their unsustainable treatment accompanied by the unwarranted discharge of untreated/semi-treated waste effluents into the streams. These problems have been further aggravated by the

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Microalgae fuel cell for wastewater treatment: Recent advances and challenges

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ARTICLE INFO

Keywords:
Microalgae
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ABSTRACT

Electricity generation from wastewater using a microalgae-based microbial fuel cell (MFC) has captured a lot of attention from researchers these days. Microalgae-microbial fuel cell (m-MFC) is a device that can overcome the problem of fossil-fuel depletion and environmental pollution by generating electrical energy from wastewater and sunlight. Sustainable applications of the microalgae-based microbial fuel cells are not only reliable for wastewater treatment and bio-electricity generation but also versatile in the field of bio-hydrogen energy production, eco-friendly solution of desalination, and carbon sequestration. In this review article, we have summarized the mechanism and operational configuration of the microbial fuel cell using an anode chamber, a cathode chamber, and a separation membrane. The technological advancement of photosynthetic microalgae in the microbial fuel cell for energy production and wastewater treatment has been explored. The use of microalgae species such as the anode and cathode is also conferred with the resulting power densities. The challenges and possible solutions of the microalgae-microbial fuel cells in integrated energy production systems with wastewater treatment have been discussed for potential industrialization.

1. Introduction

The upsurge in the global energy needs and the deficiency in the supply of non-renewable energy resources have created a global energy crisis along with a dramatic increase in greenhouse gas emissions and environmental deterioration [1]. The dependency and exploitation of conventional fossil fuels are the main causes of the depletion of natural energy reserves (e.g. coal, oil, etc.), challenging the sustainability of the environment [2]. Therefore, the development and utilization of renewable energy resources have gained momentum in recent years. Several renewable strategies are being considered to achieve a sustainable energy requirement and also to reduce the carbon footprint. In addition, the ever-increasing wastewater generation has become one of the major environmental issues. The rapid increase in wastewater generation from different resources namely domestic, municipal, industrial, and agricultural is not only responsible for water pollution (surface/underground) but also entails a hefty conventional energy cost for its treatment along with the release of greenhouse gases [3]. Indeed, due to the consistent proliferation in industrial and economic growth expansions, it is very difficult to reduce the wastewater generation. The existing conventional wastewater treatment technologies including activated sludge, drip filter, membrane filter, and reverse osmosis (also membrane filter technique) are ineffective in terms of energy requirements [4]. In addition, the biological treatment of wastewater is a slow practice, while chemical processes have environmental concerns. This scenario has called for the development of energy-efficient, cost-effective, and eco-friendly wastewater treatment technologies.

In this regard, microalgae are photosynthetic microorganisms that have an inherent ability to fix environmental as well as anthropogenic CO_2 along with the release of O_2 into the environment, which represents strategic importance to overcome global warming issues (Fig. 1). Microalgae also have the ability to survive under various environmental conditions and can grow in various sources of wastewater (e.g., municipal, industrial, industrial/domestic, and agricultural wastewater

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RESEARCH ARTICLE

WILEY

Sustainability of *Ageratum conyzoides* (billy goat weed) for bioethanol and recycling of residues for gaseous fuel production

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Abstract

Ageratum conyzoides, an herb found throughout the year, is generally considered as a weed: it causes reduction in soil productivity and leads to health hazards for cattle and humans. However, its biomass can easily represent a cost-effective source, which can be used for lignocellulosic biofuel production. The conversion of lignocellulosic biomass to ethanol has drawn much attention in recent times due to abundance of biomass. In the present study, the cellulose and hemicellulose biomass of the leaf and stem of *A. conyzoides* was converted to sugars using acid hydrolysis.146.01 ± 02 mg/g of fermentable sugar was obtained from *A. conyzoides*. The maximum ethanol concentration 11.89 g/L was obtained after 7 days. Scanning electron microscopy was used to characterize the surface morphology after acid hydrolysis of biomass. In the current study, the residues of acid hydrolysis and fermented wastewater was used for biogas production through anaerobic digestion. The yield of biogas from the residues of acid hydrolysis and fermented wastewater was 204 L kg^{-1}VS. The results obtained indicate that *A. conyzoides* may be considered as a promising feedstock for bioethanol and biogas production.

KEYWORDS

Ageratum conyzoides, bioethanol, biogas, biomass, weed

1 | INTRODUCTION

Ever-increasing demands of energy, emission of greenhouse gases and depletion of fossil fuels have increased the research interest in value of bio-sourced lignocellulosic biomass. Biofuels produced from bio-based materials are in great demand as a renewable source of energy. Production of biomass from weeds comprising of lignocellulosic waste is inexpensive, possess short life, and is easily available. A lignocellulosic material generally consists of three main components, that is, cellulose, hemicellulose, and lignin. Lignin is a polymer of phenolic monomers, while hemicellulose and cellulose are made up of sugar units. Cellulose and hemicellulose can be easily broken into sugar units which can be further used for biofuel production.[1,2] Sugarcane, corn, wheat, rice straw, sweet potato etc. which are mainly consumed as source of food are also a rich source of sugar which can be used for biofuel production. Researchers have now started focusing on weeds

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Impact of glyphosate herbicide stress on metabolic growth and lipid inducement in *Chlorella sorokiniana* UUIND6 for biodiesel production

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ARTICLE INFO

Keywords:
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ABSTRACT

The influence of glyphosate herbicide stress was investigated in the freshwater green microalgae *Chlorella sorokiniana* for metabolic growth and lipid induction. Glyphosate herbicide concentration at 30.10 ppm (IC_{50}) elicited half-maximal inhibition during 96 h of incubation. After 24 days of harvest, *C. sorokiniana* produced 442.18 ± 9.1 mg/L and 427.73 ± 5.0 mg/L dcw of biomass in the control media and glyphosate IC_{50}, respectively. A nominal reduction in biomass production was observed (~ 3.26%) due to stress in metabolic biosynthesis in glyphosate IC_{50} media. However, in contrast to biomass production, glyphosate IC_{50} stress aided in the induction of lipid biosynthesis in microalgae cells. The improvement in lipid synthesis was found to be ~17% higher in glyphosate IC_{50} compared to control. The chemical construction of the biomass, metabolites, and lipids of *C. sorokiniana* was analyzed *via* FTIR spectroscopy. The lipids extracted from *C. sorokiniana* were used for methanolic-H_2SO_4 catalyzed transesterification for the production of biodiesel. The synthesized biodiesel was analyzed by FTIR and ^1H NMR. The conversion efficiency of microalgae lipids into biodiesel was estimated at ~77%. This study insights the use of glyphosate in lipid induction in microalgae to produce renewable and sustainable biofuels for the clean environment.

1. Introduction

Microalgae phytoplankton is a photosynthetic organism that transfigures photonic energy by sequestering atmospheric CO_2 in an aquatic environment into biochemical metabolic products of biomass and releases O_2 as a byproduct [1–3]. The photonic energy fixation efficiency of microalgae biomass is exceedingly greater than any terrestrial plant [4,5]. In recent times, microalgae appear to be one of the highly reliable carbon-neutral renewable fuel applications by exploiting the metabolic components and biomass [6]. Microalgae are well recognized as a tiny reservoir of a plethora of microalgae biofuels, such as biocrude, biodiesel, bioethanol, biohydrogen, biomethane, and bioelectricity [7–9].

The global exploration of renewable transport fuels endorses the prospects of microalgae lipids for transesterification into biodiesel for a sustainable environment [10,11]. Microalgae biodiesel is sulfur-free and performs identically to diesel with reduced emissions of particulates, carbon oxides, hydrocarbons, and sulfur oxides [12]. Numerous species of oleaginous microalgae accumulate a greater amount of metabolic lipids in the form of triacylglycerol, a suitable raw material for transesterification (acid, base, or enzyme-catalyzed) in the generation of biodiesel [13–16]. Furthermore, microalgae are rich in valuable co-products such as edible proteins, antioxidants, polysaccharides, pigments, and long-chain polyunsaturated fatty acids in favor of biopharmaceuticals, bio-cosmetics, and bio-refineries [17,18].

Several species of freshwater microalgae restrain bottlenecks of high lipid constituents in naturalized growth environs. Recent research highlights improving microalgae strains to avoid restrains by understanding the molecular and genetic complexities of cellular metabolism for TAG biosynthesis, metabolic regulation, and subcellular storage to maximize profitability in biofuel production from microalgae [19–25]. However, literature has been reported on the survival strategies of microalgae strains in response to transient physiological stressors to induce the accumulation of cellular lipid content [26]. Various factors are widely considered to improve lipid accumulation under stress conditions, such as nutritional stress, light intensity, temperature, carbon dioxide, salinity stress, and the influence of metals, *etc.* [27]. Also, the chemo-stress conditions (*e.g.* herbicides) have an impact on the improvement of cellular lipids. The lipid components of the microalgae serve as a metabolically active reservoir that the cell can draw in response to the alteration in favorable growth conditions [28–30].

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ORIGINAL ARTICLE

Microwave-assisted pretreatment of harmful algal blooms for microbial oil-centered biorefinery approach

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Abstract
Utilization of harmful algal blooms (HABs) for the cultivation of oleaginous microorganisms can provide dual benefits of mitigating the toxicity from the aquatic reservoirs and generation of copious media for biodiesel production. In the present investigation, microwave-assisted dilute alkali-freeze pretreatment was optimized to develop a low-cost growth medium from HAB dried biomass. The electron micrographs along with the elemental analysis confirmed the efficient breakage of HABs after the microwave-assisted hydrolysis treatment as compared with the acid hydrolysis. Moreover, the sugar analysis revealed ~ 46% higher carbohydrate content in microwave-assisted hydrolysate as compared with acid hydrolysate. The microwave-assisted hydrolysate and conventional dilute acid hydrolysate were then used to cultivate microalga (*Chlorella minutissima*) and yeast (*Trichosporon cutaneum*) for biomass and lipid accumulation and compared to artificial media. Microalga showed ~ 1.3- and 2-fold higher dry cell weight (DCW) and lipid content, respectively, while the yeast growth increased by ~ 27% with lipid content of 30%. The fatty acid profiles and biodiesel properties were also amenable to the international biodiesel standards. Hence, the present study provides a proof-of-concept of utilizing HAB hydrolysate for culturing oleaginous microorganisms for potential biodiesel production.

Keywords Harmful algal blooms · Microalgae · Yeast · Lipid · Biomass

1 Introduction

The unwarranted releases of domestic and industrial wastewaters in the aquatic bodies (both fresh and marine) have led to the formation and outbreak of toxic and harmful algal blooms. Harmful algal blooms (HABs) mainly consist of cyanobacteria and dinoflagellates which form a mat-like structure on the water surface, releasing toxic metabolites that are detrimental to the growth of phytoplankton, zooplankton, and non-blooming algae, thereby reducing the biodiversity [1, 2]. Macroalgal blooms have become a major problem particularly for the freshwater bodies including lakes, streams, rivers, springs, and reservoirs [3]. The presence of HABs in these waters makes them dysfunctional for human consumption, irrigation, and recreational activities [2]. Furthermore, the toxins released by these HABs, bioaccumulate in fishes and shellfishes and can reach to humans consuming them [4]. For instance, hepatotoxins released by *Microcystis* species has caused global concern due to their wide-spreading nature [2]. This requires the control and eradication of HABs from aquatic bodies. Various strategies have been proposed to

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Hydrothermal liquefaction of municipal wastewater sludge and nutrient recovery from the aqueous phase

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ABSTRACT

The hydrothermal liquefaction of municipal sludge was investigated under isothermal conditions (255 °C, 45 min) with TiO_2 as a catalyst. In this study, we used two separation methods (an organic solvent-assisted extraction method and the Soxhlet extraction method) for the production of bio-crude oil. The maximum yield of bio-crude oil was 20.7 wt. % reported with the Soxhlet extraction method. The aqueous phase was examined for TN, TP, COD, and TOC to determine the suitability of this phase for microalgae cultivation. Four strains of oleaginous microalgae were cultivated in the aqueous phase. The results show that the growth of microalgae in the aqueous phase was lower compared to the control medium; this may be due to the high COD value. Microalgae and yeast co-cultivation increases biomass and lipid productivity using nutrients in the aqueous phase.

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KEYWORDS
Hydrothermal liquefaction; sludge; biofuel; aqueous phase; microalgae; yeast

Introduction

Population growth is linked to the increased global demand for energy and the depletion of petroleum sources. Currently, petroleum sources satisfy almost 84% of the world's energy requirements, and petroleum consumption is estimated to increase by 50% in the coming years [1]. The use of biofuels reduces the emissions of particulate matter, CO and total hydrocarbons, thereby making the process biodegradable and less toxic [2–5].

Municipal sludge has a chemical composition of 20–30% proteins, 6–35% lipids and 8–15% carbohydrates [6]. Although sewage sludge contains important organic and inorganic constituents, it is often disposed of as an undesirable substance [7,8]. The increase in population leads to the production of a large amount of municipal sludge. This raises concerns about increasing contamination by metals and pathogenic microorganisms, the risk to human health, and its unpleasant odor [9].

Common municipal sludge disposal methods include landfilling, agricultural use and incineration [6]. In waste treatment plants, an activated sludge process is used in which microorganisms remove micro-pollutants [10]. The activated sludge process is expensive and time consuming; e.g. aerobic digestion takes 20 or more days, and anaerobic digestion takes 20–30 days. The conversion of municipal sludge by hydrothermal liquefaction (HTL) into bio-crude oil can replace non-renewable energy and reduce the volume of waste as well as eliminating pathogens and harmful constituents [11]. Therefore, alternative solutions for municipal sludge disposal become more important. The selection of a municipal sludge management strategy is based on energy requirements which depend mainly on nitrogen, phosphorus and the use of carbon as an energy source [12]. In this study, we have met these two parameters by producing hydrocarbon-rich crude oil and recycling the nutrient-rich aqueous phase through microalgae cultivation.

HTL is a process dependent on temperature (200–400 °C) and pressure (5–15 MPa), in which wet biomass can be converted into liquid fuels [13]. There is no need for an energy-consuming drying step, and the wet feedstock can be used directly [14]. HTL of organic waste leads to the generation of four products: gases, bio-crude oil, bio-char and the aqueous phase [13]. Previous studies have reported that the ideal temperature for maximum bio-oil and bio-char yield is in the range of 300–350 °C [15]. During HTL of bio-solids, low temperatures (250–300 °C) favor the formation of solids, whereas moderate temperatures (300–350 °C) and high temperatures (>350 °C) favor the formation of liquids and gases, respectively [16]. The HTL process based on high temperature (300–500 °C) has been reported in previous studies [17], but limited studies have been reported on HTL conducted at low temperature. Titanium oxide (TiO_2) is the main catalyst used in HTL in industrial and technical research due to its high thermal stability [18]. In this study, low-temperature HTL of municipal sewage sludge was performed and the Soxhlet extraction method was used for the recovery of bio-crude oil. Furthermore, the use of the aqueous phase for the cultivation of microalgae was investigated.

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Natural Sciences

Micropropagation and Screening of Phytocompounds Present among *in vitro* Raised and Wild Plants of *Rauvolfia serpentine*

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Abstract

Rauvolfia serpentina, commonly known as Sarpgandha, is a plant well-known for being utilized for several medicinal purposes. Unrestricted collection from natural stands and overexploitation for medicinal and traditional purposes have rendered it endangered, hence there is necessary requirement for the development of cultivation protocols for mass propagation and sustained utilization of the plant. In the present study, *in vitro* culture of the apical parts of *R. serpentina* on MS (Murashige and Skoog) medium enriched with NAA resulted in development of callus, whereas multiple shoot regeneration along with callus development was achieved on medium combination MS + NAA + Kn and MS + NAA + BAP. MS + 4µM NAA + 4µM BAP was found to be most optimum media composition for regeneration of shoots and callus. Among different media combinations utilized for *in vitro* rooting, a maximum of 82.6 % explants developed in vitro roots on ½ MS + 12µM NAA. Gas chromatography-mass spectrometry (GC-MS) analysis of methanolic extract prepared from leaves of wild and micropropagated plants of *R. serpentina* revealed the presence of 38 and 48 phytocompounds, respectively. 9, 12-Octadecadienoic acid, Methyl linoleate, Methyl stearate, Hexadecanoic acid, methyl ester, Linoleic acid, Ergost-4, 7, and 22-trien-3.alpha.-ol were some of the major compounds found to be present in the leaves of wild plants, and Linoleic acid, methyl ester, Cis-Linoleic Acid Methyl Ester, Methyl elaidate, hexadecanoic acid, and methyl ester were major compounds found to be present in *in vitro* raised plants. Many of the compounds detected have been known to possess 1 or more biological or pharmacological activities.

Keywords: *Rauvolfia serpentine*, Conservation, Apical part, Phytochemical analysis

Introduction

Rauvolfia serpentina (L) Benth. Ex. Kurz is a well known medicinal plant and has been utilized for medicinal purposes in the Ayurvedic system of medicine for a long time [1,2]. *R. serpentina* is commonly known as Sarpgandha and is a perennial evergreen shrub. The plant is found in India, China, Indonesia, Pakistan, Nepal, Malaysia, and Sri Lanka. *R. serpentine* is known to inhabit regions with an annual rainfall of 200 - 250 cm, along with an altitude of 1,000 m. The plant possesses several biological and pharmacological activities including lowering of blood pressure, controlling fever, stimulation of uterine contraction, treating anxiety, insomnia and dyspepsia, and has hypolipidemic, antihypertensive, and antidiabetic activities [3]. The plant is specifically utilized against snake and scorpion bites [1,4-6]. The plant is also reported to possess antifungal and antimicrobial activities [7]. Several bioactive

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Preliminary Assessment of Vegetation Structure, Biomass and Carbon Stock in *Shorea robusta, Tectona grandis* and *Quercus leucotrichophora* Stand in Dehradun District, Uttarakhand, India

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ABSTRACT

A preliminary study was conducted to assess the vegetation structure (density, frequency, abundance, basal area and IVI) biomass and carbon content in *Shorea robusta, Tectona grandis* and *Quercus leucotrichophora* forests. In sal forest site,the total tree density (4.3 ind/ha) are lower but the value of basal area (1418.55) in these forests are higher. In contrast, value of biomass and carbon was recorded 4.62 t/ha and 1.92 t/ha respectively in present study which reveals that production of biomass is comparatively less than reported in other sal forests. For Teak forest, total tree density (4.6 ind/ha), TBA (523.83), total biomass (0.0276 t/ha) and carbon (0.022 t/ha) were also found in lower quantity as compare to earlier studies of Teak forests. Similarly total density (7.2 ind/ha), TBA (1102.397), total biomass (4.068 t/ha) and total carbon stock (1.921 t/ha) in Oak forest site were at lower side. Our findings with respect to vegetation structure analysis, biomass and carbon stock are not similar to earlier result of forests studied in the region, this is might be due to preliminary assessment of biomass and carbon stock of trees in these forest sites, hence, it is concluded that the studied forests were not affected much from nearby humans pressure and variation in climate.

Keywords Vegetation structure, Biomass, Carbon stock, *Shorea robusta, Tectona grandis.*

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INTRODUCTION

Carbon storage is a growing research topic that addresses one important aspect of an overall strategy for carbon management to help mitigate the increasing emission of carbon dioxide, into the atmosphere. Currently, emission of carbon dioxide are increasing globally and are projected to double over the next century. This excess carbon dioxide, enters the global carbon cycle where part remain in the atmosphere, part is taken up by oceans and the terrestrial biosphere. Carbon sequestration in the terrestrial ecosystem can be defined as the net removal of carbon dioxide from the atmosphere into long lived pools

STUDY OF LAND-USE PATTERN UNDER DIFFERENT AGROFORESTRY SYSTEM IN A PART OF MANIPUR, NORTH- EAST INDIA

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ABSTRACT

The survey regions under this study in part of were inhabited by different communities living in harmony with the surrounding environment. Each village under the studied areas adopted different agroforestry land use system having unique traditional practices. The current land use pattern of the studied areas mainly utilized the existing land by adopting an occupation that generates income and profits which includes fish-cum paddy cultivation along with agroforestry tree plantation on the ring bunds in Khoidumpat wetland, plantation of pineapple on the hillock slopes and water reed cultivation on the plain area in Sharam Tangkhul village, pure agriculture and traditional homegardens in Leitanpokpi village. The existing occupation greatly depends on the monsoon rain, soil type and factors.

Keywords: Agroforestry, Homegardens, Landuse and Plantation.

INTRODUCTION

Agroforestry is seen as an alternative paradigm for rural development world-wide that is central on species-rich, low-input agricultural techniques including a diverse array of new indigenous tree crops, rather than on high-input monocultures with only a small set of staple food crops (Leakey 2001). Agroforestry symbolizes a sustainable land-use system, which integrates growing of agricultural crops and timber or fruit tree together on the same piece of the land for maximum production of food, fodder and wood and other products of economic utility. In agroforestry systems, there are ecological and economic interactions between the different existing components (ICRAF 1993). Agroforestry play an important role in lowering vulnerability, increasing resilience of farming systems and protecting households against the adverse climate related risk in addition to promising livelihood security (NRCAF 2013).

India is particularly notable for ethno-forestry practices and indigenous knowledge systems on tree growing. In terms of household income, Central Indian upland rice fields provide an illuminating economics (Viswanath *et al.*, 2000). While most agroforestry systems have great energy for carbon sequestration, home-gardens are unique in this respect. They not only sequester carbon in biomass and soil, but also reduce fossil-fuel burning by promoting wood, fuel production, and conserve agro biodiversity (Kumar *et al.*, 2004).

STUDY AREA

The study was executed in two villages and one wetland area which come under Thoubal and Imphal East Districts of Manipur, North East India. The respective villages under Thoubal District were Khoidumpat Wetland and Sharam Tangkhul village, whereas Leitanpokpi village of Imphal East District. Khoidumpat wetland is a big area of Kakching Sub-Division Thoubal District in habitated by more than hundreds of households. This wetland is known for fish cultivation and production area. Majority of the people residing inside this region were engaged in pisciculture and fish cum paddy practices.

METHODOLOGY

In the present study questionnaire for survey were prepared according to the method given by (Shukla *et al.*, 2013). To execute the survey an initial research on the suitable area was selected through contact with the local people. Once the area was confirmed, a questionnaire was prepared to extract the required field data and information from the farmers in respective areas. In order to identify the current land use practices and the traditional agroforestry practices of Khoidumpat Wetland, Sharam Tangkhul village and Leitanpokpi village, a specific date was fixed to conduct the study in randomly selected houses of the study regions. The questions were mainly focused on the existing pattern of land use and its components under agroforestry systems (tree species and vegetables, wildlife biodiversity), land holding area (average), annual

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HETRP: High Energy Efficient Trustable Routing Protocol for Wireless Sensor Network

Musheer Vaquar, Sanjay Kumar Agarwal

Abstract: ***Wireless sensor network environment based on limited resources technology. Energy is one of the most significant resources in such systems, so ideal utilization of energy is essential. A high energy efficient with trustable routing protocol for Wireless Sensor Networks covered under this paper. The protocol is trustworthy as far as data conveyance at the Base Station. We assumed about portability in sensor nodes and in the base station. The proposed protocol depends on the cluster and hierarchical routing protocols. All clusters comprises of unique cluster head node and two deputy cluster head nodes, and several normal sensor nodes. The cluster head panel model introduced to optimize the re-clustering time and energy prerequisites. As consider the protocol trustworthiness, it lays finest exertion to guarantee a predetermined level of performance at the base station. Contingent upon the network topology, transmit data from cluster head node to base station that done either by direct or indirect i.e. multi-hop way. Also, substitute ways are utilized for data transmission between a cluster head node and the base station. Thorough NS2 simulation results delineate energy efficiency, throughput, and delayed lifetime of sensor nodes affected by the proposed protocol.***

Keywords: ***Wireless sensor networks, Portable sensor nodes, energy efficient routing protocol, trustable routing protocol***

I. INTRODUCTION

Wireless Sensor Network (WSN) encompasses of a few resources obliged sensor nodes (SN) arbitrarily sent over a geographic area. These SNs forward tangible information to a capable Base Station (BS). Depending on the type of application, the BS is located from the sensor area or within the sensor region [1]. Such structures have a wide range of jobs in military and general locations.Some application territories of WSN are as per the following: battle field reconnaissance, target following in combat zones, interruption identification, and post debacle salvage tasks, smart home system, checking and alarming frameworks for stores, wildlife observing frameworks, and numerous wellbeing and security related applications [1,2].

In the previously mentioned applications, the SNs create tangible data from the area of intrigue. The detected information are at last sent toward the BS for further preparing and basic leadership with respect to the control for meeting the aims of the system set up. Contingent upon the application type, the SNs and the BS can be static or portable. In a run of the WSN, the SNs are exceptionally resource constrained [1, 3]. The SNs are modest, expendable, and predictable to go on till their energy depletes available.

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Hence, energy one of the restricted source for a WSN framework, and it should be overseen in an ideal manner. Trusty and effective information conveyance at BS is wanted. Energy efficiency is a significant part of every use of WSN. Routingof information inWSN is basic undertaking, and noteworthy measure of energy can be spared if steering can be done carefully. Routing is an issue connected to the network layer of the protocol pile of WSN [1, 4]. In multi-hop correspondence, the significant issue might be the choice of the transitional nodes in the directed path. The transitional nodes are to be chosen so that the energy necessity is limited. Simultaneously, the dependability of the information driven arrangement must be reliable.

Various hierarchical routing is viewed as energy proficient and adaptable methodology. There are a few various hierarchical routing protocol proposed for WSN [2, 3, 5]. Every one of these protocol assumes about a WSN with static SNs. Postulations protocols are not appropriate to deal with versatility of SNs and BSs. Albeit zone routing [9], Dynamic Source Routing (DSR) [6], Temporally Ordered Routing Algorithm (TORA) [9], Ad hoc On demandDistance Vector (AODV) routing [7] and destination sequenced distance vector (DSDV) routing [8] are some steering routing that exist for portable impromptu systems, these are not appropriate for WSN arrangement [10]. This is along these lines, because of various highlights of WSN and the one of kind constraints WSN experiences. In addition, WSN applications have various arrangements of necessities [10]. Routing in a WSN arrangement in which both the SNs and the BS are portable is a difficult issue.

Current routing protocol revealed in [11, 12, 13] don't assume about the flexibility in SNs and in BS, and accordingly, these are not straightforwardly relevant to a portable WSN. In flexible WSN, the correspondence connections might beoriginates and flop progressively. Subsequently, the routing protocol needs to deal with the network issue likewise in sucha WSN arrangement. Data packets are to be directed mulling over this availability issue.

This paper covers, a routing protocol, which is named as High Energy Efficient Trustable Routing Protocol (HETRP) for WSNs, is proposed. Our significant objective is to accomplish energy efficiency and to give availability to nodes. Portability of nodes is considered while routing choices are made. Target after such routing is that data packetsneed to travel through reasonable path notwithstanding nodes versatility and in nearness of ensuing connection disappointments.

The remaining section of the paper organized as; Section II, in which framework model is portrayed and the formally expressed the problem. Segment III portrays the proposed protocol in detail. A mathematical examination with respect to the legitimacy of the route is exhibited in Section IV. In Section V, simulation results are

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Effect of storage conditions on vermicompost quality

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To study the effects of storage conditions on vermicompost, an experiment was conducted with freshly prepared, un-dried fresh vermicompost (60% moisture), and pre-air dried vermicompost (30% moisture) stored in polythene bags for a period of four weeks under different moisture and aeration conditions. Three different storage conditions were tested by placing fresh and pre-dried vermicompost in: (1) open bags, (2) holed bags and (3) sealed bags. Vermicompost properties were analysed weekly for four weeks after storage. The moisture content declined in both fresh and pre-dried vermicompost, with a maximum decline under open bag condition, followed by holed and sealed bags. In the sealed airtight bags with fresh vermicompost, a rapid decline in total organic carbon, nitrogen and electrical conductivity was observed during the first and second week of storage, possibly due to microbially-triggered volatilization losses. However, such decline was lacking in pre-dried vermicompost. In open and holed bags, the carbon and nitrogen were retained and rather increased during storage, possibly due to ongoing aerobic decomposition and no volatilization losses. The highest nutrient quality was observed under predried holed bag conditions, possibly due to optimal microbial activity releasing nutrients, combined with no volatilization losses. It was concluded that fresh vermicompost must be air-dried before its storage in bags. Storage of air-dried vermicompost under aerobic conditions using open/holed bags appears to be the best option for retaining nutrients and quality of vermicompost.

Keywords: Carbon, electrical conductivity, nitrogen, quality, storage conditions, vermicompost.

VERMICOMPOST is widely used as an organic source of nutrients and carbon due to its high availability of nutrients and also for improving soil aeration, water-holding capacity, buffer capacity, and cation exchange capacity of soils[1,2]. Application of agrochemicals for

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Review

Taro starch: Isolation, morphology, modification and novel applications concern - A review

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ABSTRACT

Tuber and root crops are matured as fundamental food crops universally especially in tropical and subtropical regions. Among them, Taro (*Colocasia esculenta*) considered as 5th chief root crop due to its medicinal, ornamental and food formulation facets. Competitively it holds a considerable amount of starch even more than that to potato, sweet potato, cassava and so on. Taro corms starch (70–80%) contemplate as a cheapest abode for food industries due to its multifarious potentiality in food like stabilizer, emulsifier, fat substitute and as filler agent too. Baby foods, packaging material novelties, geriatric foods with resistant starch incorporation are the recently explored deliverables. Moreover, quality attributes of taro starch increases its behavioral versatility after modification competitively in a much better manner than native starch. This review aims to outline the current awareness about taro starch's molecular pattern, isolation procedures, properties, modifications and novel hit approaches for commercial viability. Gluten-free trait, hypoallergenic features and high digestibility are the additional benefits that widens its application scope to adapt better among pharma and textile in along with food sector.

Contents

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RECYCLING OF CHICKEN FEATHER PROTEIN INTO COMPOST BY *Chrysosporium indicum* JK14 AND THEIR EFFECT ON THE GROWTH PROMOTION OF *Zea mays*

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Original Research Article

ABSTRACT

***Chrysosporium indicum* JK14 was used in the recycling of feather waste into compost. The combination of poultry feathers and sterilized soil was inoculated with fungus *C. indicum* JK14 in different proportions and kept for degradation. *C. indicum* JK14 supported better degradation of feathers in soil and enhanced nutritional value. A pot experiment with this compost showed that the plant length of *Zea mays* was significantly increased by 34.26%, and plant fresh weight was enhanced by 56.52% as compared to control (Only soil no feathers) due to micronutrient released by fungal degradation of feather waste. This approach of feather waste application will not only helpful in eco-friendly growth promotion of various crops but also helpful in controlling environmental pollution that occurs due to the production of tones of feather waste daily globally.**

Keywords: Keratinophilic fungi; keratinase; feather compost; plant growth.

INTRODUCTION

Feathers are rich in keratin protein and are abundant biowaste from the poultry industry and constitute between 8 to 10 percent of chicken [1,2]. Degradation of chicken feather waste from poultry shops can be managed by unconventional sources [3]. At present, the poultry industry treats feather waste by either steam or chemical treatment to produce feather meal [4] and either untreated or treated forms of feather used as fertilizers or disposed of as landfills [5]. Biodegradation of feathers by microorganisms studied by several workers as bacteria [6,7] fungi [8,9] and actinomycetes [10,11] and found as an efficient method for bioconversion of feather waste. Up to 80 percent feathers were metabolized by *Psuedomonas arruginosa* [12]. Chicken feather

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Effect of silver nanoparticles and *Bacillus cereus* LPR2 on the growth of *Zea mays*

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The effect of Plant Growth Promoting Rhizobacteria (*Bacillus* sp.) and silver nanoparticles on *Zea mays* was evaluated. The silver nanoparticles were synthesized from *Tagetes erecta* (Marigold) leaf and flower extracts, whereas PGPR isolated from spinach rhizosphere. The silver nanoparticles (AgNPs) were purified using ultra centrifugation and were characterized using UV–Vis spectroscopy at gradient wavelength and also by High Resolution Transmission Electron microscopy (HRTEM). The average particles size of AgNPs was recorded approximately 60 nm. Almost all potential isolates were able to produce Indole Acetic Acid (IAA), ammonia and Hydrogen cyanide (HCN), solubilized tricalcium phosphate and inhibited the growth of *Macrophomina phaseolina* in vitro but the isolate LPR2 was found the best among all. On the basis of 16S rRNA gene sequence, the isolate LPR2 was characterized as *Bacillus cereus* LPR2. The maize seeds bacterized with LPR2 and AgNPs individually showed a significant increase in germination (87.5%) followed by LPR2 + AgNPs (75%). But the maximum growth of root and shoot of maize plant was observed in seeds coated with LPR2 followed by AgNPs and a combination of both. *Bacillus cereus* LPR2 and silver nanoparticles enhanced the plant growth and LPR2 strongly inhibited the growth of deleterious fungal pathogen. Therefore, LPR2 and AgNPs could be utilized as bioinoculant and growth stimulator, respectively for maize.

The global human population is increasing day by day. As per the report published by the Food and Agriculture Organization[1], there will the immense demand of agriculture and agricultural-based products in the future, resulting in dietary changes. To fulfill the needs of food for all the substantial additional agricultural production of 2.4×10^9 t/year is required. Agriculture is a very important component of the environment and is influenced by an interaction between humans and nature resulting in an alteration in climate and environment. The continuous use of a chemical fertilizers has resulted in the ultimate changes in the pools, soil nutrients, which are important factors for growth promotion because crop yield and quality of food is highly dependent on fertilizers and quality of the agricultural lands[2].

Maize or corn (*Zea mays*) belongs to the family *Poaceae* and genus *Zea* is the most important cereal in the world after wheat and rice. Globally, maize is known as queen of cereals because it has the highest genetic yield potential among the cereals. It possesses a high nutritive value and is important as a coarse grain. Maize is used as a staple food of human, a livestock feed, a raw material for more than 3500 products such as QPM (Quality Protein Maize), infant foods, starch, alcohol, textile and medicinal products, etc[3–6]. The present world production of maize is about 1099.61 million metric tons, which is highest as compared to wheat and rice[7]. It is estimated that corn will be the developing world's largest crop by 2025, and between now and 2050 the demand for maize in the developing world is expected to double[8]. In India, maize is one of the important cereals cultivated throughout the year (current annual production is about 28 million metric tons) for various purposes including grain, fodder, green cobs, sweet corn, baby corn, pop corn in peri-urban areas[9]. Similar to other crops, maize production is also negatively affected by various types of insects and fungal diseases that pose threats to maize yield. Fungal infection caused mainly by *Fusarium graminearum*, *Stenocarpella maydis*, and *Macrophomina phaseolina* are among the principal causes of deterioration and loss of corn grain[10]. The worldwide yield losses due to various diseases in maize crops have been estimated approximately 12–40%[11].

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Research article

Seed bio-priming with tri-species consortia of phosphate solubilizing rhizobacteria (PSR) and its effect on plant growth promotion

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ABSTRACT

Three potential rhizobacteria namely *Burkholderia gladioli* (MTCC 10216), *Pseudomonas* sp. (MTCC 9002) and *Bacillus subtilis* (MTCC 8528) procured from IMTECH, Chandigarh (India) were evaluated individually and as consortia for its phosphate (P) solubilizing ability and effect of growth of fenugreek (*Trigonella foenum graecum* L.) and tomato (*Lycopersicon esculentum* L.). Phosphate solubilizing ability of these strains individually and as consortia was tested on Pikovskayas agar medium, Phosphate solubilizing agar medium and National Botanical Research Institute phosphate agar medium containing six different sources of insoluble inorganic phosphate such as tri-calcium phosphate (TCP), di-calcium phosphate (DCP), zinc phosphate (ZP), ferric phosphate (FP), sodium di-hydrogen phosphate (SP), and aluminum phosphate (AP), and two organic P such as calcium and sodium phytate. The maximum P solubilizing ability was recorded in consortium-4 having all three potential bacterial strains. Phosphate solubilization after 7th day of incubation was 37.9 mg/100 ml of TCP, 40.01 mg/100 ml of DCP, 15.79 mg/100 ml of FP, 43.02 mg/100 ml of SP, no solubilization of ZP and AP, 39.75 mg/100 ml of calcium phytate and 24.01mg/100 ml of sodium phytate. Seed germination and the other plant parameters such as plant height and weight significantly increased in fenugreek and tomato seeds, bio-primed with consortium-4 followed by consortium-3. After bio-priming of seeds in pot assay, the level of phosphorus in soil got increased by 54% in consortium-4 treated soil followed by consortium-3 (47%) over untreated control soil. Based on these findings, consoritium-4 could be recommended as a good bio-inoculant for fenugreek, tomato and other crops in comparison to individual strains and other consortia.

1. Introduction

The present scenario of soil engineering is totally based on synthetic chemicals which are responsible for several problems of human health and ecological disturbance [1]. The application of potential plant growth promoting rhizobacteria (PGPR) as bioinoculants is the only strategy to address these problems [2, 3]. The world population is increasing rapidly, but the sufficient and healthy food is not being produced as per demand [4]. Therefore to address these concerns, we must move towards organic agriculture. The rhizosphere is a zone of predominantly commensal and mutualistic interactions between plant and microbes and influenced by root system [5]. The rhizosphere region is rich in nutrients as compared to the bulk soil due to the accumulation of various root exudates like organic acids, amino acids, sugars, etc. released by the root system affecting biological activities [6].

Phosphorus (P) is an essential element for plant, but normally not available directly for plants because of its non-bioavailability form in soil. Phosphate solubilizing rhizobacteria (PSR) solubilize the insoluble soil P and help in utilization by plants for their various metabolic activities [7]. The insoluble P in soil is available as an inorganic mineral for example, apatite, tri-calcium phosphate (TCP), di-calcium phosphate (DCP), hydroxyapatite, zinc phosphate (ZP), sodium di-hydrogen phosphate (SP), aluminium phosphate (AP), ferric phosphate (FP) and rock phosphate (RP), besides these inorganic phosphate several other organic forms

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DECOLORIZATION OF DISTILLERY EFFLUENT WASTE BY MICROBIAL CONSORTIUM

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ABSTRACT

Aim: The effluent discharged from sugarcane molasses based distilleries causes environmental pollution due to its large volume and dark brown colour. The effluents also acifidys soils and causes harmful effects on agriculture crops. The objective of this work was the decolourization of molasses waste water from Doiwala sugar industry, Dehradun was done using different microbial consortiums. **Methodology and Results:** The microbial strains used in this study were obtained from IMTECH Chandigarh. They were designated as A is *E. coli*, B is *Pseudomonas aeruginosa*, C is *Staphylococcus aureus*, D is *Serratia odorifera*, E is *Proteus vulgaris* and F is *Candida albicans*. A total of six combinations were prepared using these strains i.e A+B, C+D, E+F, A+B+C, D+E+F and A+B+C+D+E+F. These consortiums were subjected to decolorization experiment of molasses waste water from Doiwala Sugar Factory, Dehradun, India at regular time interval by measuring the optical density. It was observed that at 7th day incubation in each case all consortiums showed maximum decolorization after which the percentage of decolorization was stable. It was also observed that the bacterial consortiums showed higher decolorization than the mixture of bacteria and fungi. Consortium C+D showed highest decolorization i.e. 89%. **Conclusion, significance and impact study:** it is recommended that industry should work with this consortium for decolorization of molasses containing wastewater to solve this environmental problem.

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Antidiabetic and Antihypertensive Properties of Chymotrypsin Treated Cow Milk Casein

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ABSTRACT

Milk is known to contain a number of peptides fractions that affect metabolic responses. Casein being the most abundant milk protein, after enzymatic treatment generates peptide fragments which have unique ability to regulate the diabetic and hypertensive metabolic pathways in the biological system. Upon oral administration of bioactive peptides may affect the major body system-namely the cardiovascular, digestive, immune and nervous systems showing multiple biogenic effects such as antimicrobial, Immuno modulatory, antioxidative, antithromboic, antidiabetic and antihypertensive. In the present study, the peptide formulation derived from chymotrypsin treated cow milk casein was functionally studied for their antidiabetic (via α-amylase inhibition) and antihypertensive (via angiotensin converting enzyme inhibition) activity. The peptide content and their biogenic effects varies with the duration of enzymatic treatment thus depicting variable effects. Maximum antidiabetic effect was shown by bioactive derived after 3 hours of enzymatic treatment; while maximum antihypertensive effect was shown by bioactive derived after 6 hours of incubation with chymotrypsin. These metabolic effects of these unique peptide formulations were required to be explored for their targeted use as nutritional supplements for diabetic and hypertensive patients.

Introduction

Milk is a well-balanced source of nutrients which exhibit diverse biological activities influencing digestion, metabolic response to absorbed nutrients growth and development of specific organs and is resistance to disease. Biological activities are mainly due to the peptides and protein in milk (FitzGerald and Meisel,2003;Korhonen and pihlanto,2003). Enzymatic degradation of food stuffs in the gut release short chain peptides sequences

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Evaluation of anthelmintic activity of bioactive peptides derived from enzyme treated goat milk Casein

Santosh Kumar, Vipan Kumar, Deepak Kumar, Ashwani Sanghi and Farhath Jan

Abstract
Goat milk is particularly rich in protein content leading to profound nutritional significance. Majority of biological activities of milk is attributed to the milk protein casein and the bioactive peptides derived from it. Majority of the drugs available in the market to treat parasitic worm infections, have common side effects leading to limitations of their use. The present work was designed with the aim to evaluate the anthelmintic activity of bioactive peptides derived from goat milk casein upon treatment with proteolytic enzymes Trypsin, Chymotrypsin and Pepsin. From goat milk, casein was isolated and treated with different enzymes separately. Bioactive peptides obtained were analysed for their anthelmintic effects using in-vitro method. Albendazole was used as standard for the experimental purpose. As compared to the standard, only peptic and tryptic hydrolysates showed better anthelmintic activity. The data obtained from the present study hence proved that bioactive peptides released by peptic and tryptic digestion of goat milk casein contains significant health effects thereby suggesting their potential use in future as neutraceuticals for the treatment of helmintic infections without having any side effects.

Keywords: Bioactive peptides, Anthelmintic, Trypsin, Chymotrypsin, Pepsin, Albendazole, Neutraceuticals

Introduction
Milk is a well-balanced source of nutrients having biological activities that influence various biochemical and physiological processes of the body in a positive manner. Biological effects of the milk are mainly due to its protein content and associated peptides. The benefits of milk in preventing various infections have been recognized for thousands of years. Much of this activity has been attributed to antibodies, but the role of milk sugars and milk proteins as bioactive agents is only recently being recognized. Milk contains various components with physiological functionality [1].

Goat milk has high protein content but lower in fat similar to human milk. It is much beneficial as compared to milk of other animal species because of less allergic nature, naturally homogenized form, easily digestible and rarely causes lactose intolerance. It contains lower amount of alpha casein (mainly responsible for milk allergy) and high in beta casein fraction as compared to cow milk. Beta casein of goat milk is having greater solubilisation than cow milk [2]. The curd of goat milk is also weaker which directly influences the digestibility in the gastrointestinal tract.

Bioactive peptides are the specific protein fragments having positive effect on different body functions and conditions, thereby influencing overall health status [3]. According to their functional properties, bioactive peptides may be classified as antimicrobial, antithrombotic, antihypertensive, opioid agonist, opioid antagonist, immuno modulatory, mineral binding, antioxidative and anti-inflammatory etc. Milk protein casein is one of the richest source of these bioactive peptides [4, 5]. There are several methods to produce bioactive peptides from milk protein casein and the most commonly used approach is by enzymatic digestion using different proteolytic enzymes either alone or in combination. After their release from milk, these peptides acts as modulators of many regulatory biological processes thus exhibiting wide array of biological and physiological effects [6]. The major protein in goat milk is beta casein.

Study on Phytoconstituents and Antimicrobial Potential of *Sapindus mukorossi* Fruit Extract

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Abstract-*Sapindus mukorossi* is well known for its folk medicinal values. The fruit is valued for the saponins (10.1%) present in the pericarp which constitutes up to 56.5% of the drupe known for inhibiting tumour cell growth. Recently many of the pharmacological actions of this plant have been explored which include the antimicrobial molluscicidal and insecticidal actions. The fruits are of considerable importance for their medicinal value for treating several diseases like excessive salivation, pimples, epilepsy, chlorosis, migranes, eczema and psoriasis etc. The powdered seeds are employed in the treatment of dental caries, arthritis, common cold, constipation and nausea. Keeping in view the medicinal importance of the fruit, it was thought worthwhile to carry out systematic study on phytochemical investigation and antimicrobial potential of fruit extract of *Sapindus mukorossi*. Fruit were dried, powdered and extracted with different solvent systems with increasing polarity. The extracts were screened for the antibacterial and antifungal activity. Predominance of antibacterial activity was observed at dose level of 50µg/ml of petroleum ether extract. Maximum zone of inhibition (19mm) &(18mm) was observed against *Salmonella typhii* and *Shigella dysenteria* respectively as compared to standard drug Ampicillin 20µg/ml. Since antibacterial activity was observed in 50µg/ml concentration of petroleum ether extract, it was chosen for exploring its antifungal potential also. Maximum zone of inhibition was observed against Aspergillus sulfurous as compared to standard drug ketoconazole 20µg/ml. From the above study, it could be concluded that *Sapindus mukorossi* petroleum ether fruit extracts(50µg/ml) have good antimicrobial potential and can be explored further to isolate active principles from the same.

Key words: Epilepsy, Phytochemical Screening, Zone of Inhibition, Antimicrobial potential

Introduction

The traditional knowledge and use of medicinal plants for curing of disease has been widely established across the globe. 80% of the world's population in developing countries uses traditional medicine as per WHO guidelines. Furthermore, the traditional knowledge with its holistic and systematic approach supported by experimental base can serve as an innovative and powerful discovery engine for newer, safer and affordable medicines. *Sapindus mukorossi* also known as soap-nut tree belongs to the family sapindaceae widely grown in upper reaches of Indo-Gangetic plains, Shivaliks and sub-Himalayans tracks at altitudes from 200m to 1500m. [1]The fruit is valued for the saponins (10.1%) present in the pericarp which constitutes up to 56.5% of the drupe known for inhibiting tumor cell growth.

RESEARCH ARTICLE

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Tailoring of Colon Targeting with Sodium Alginate-Assam Bora Rice Starch Based Multi Particulate System Containing Naproxen

Manoj Kumar Sarangi, M.E. Bhanoji Rao, Versha Parcha, and Aadesh Upadhyay*

This research is focused on the formulation and optimization of Assam Bora rice starch (ABRS)-alginate beads containing a non-steroidal anti-inflammatory drug (NSAID) such as Naproxen (NA), by an ionotropic gelation technique using 3^2 factorial design for colon targeting against rheumatoid arthritis, inflammatory bowel disease, and colon cancer. The impact of a polymeric blend of sodium alginate (SA) and ABRS on the drug entrapment efficiency (DEE, %), bead size (BS), and percentage cumulative drug release in the first 6 h (Q6, %) is optimized. The DEE (%) of all the developed beads is found to be in between 45.25% and 85.14% with an in vitro drug release of 32.81–42.18% in first 6 h. The optimized batches of beads are coated with Eudragit S100 (ES100) (5%, 10%, and 15% w/v) to facilitate colon targeting in a prominent way. The average size of the developed beads is found to be within the range of 751.61–822.22 μm. The optimized ABRS-alginate beads containing NA show significant drug permeability over a prolonged period on ex vivo permeability through a goat colon. The in vivo roentgenographic study on rats shows the colon targeting of the beads without degradation.

1. Introduction

Colon targeting has proven its advantages against various colonic ailments such as Crohn's disease, ameblasis, colorectal cancer, ulcerative colitis, and also shown a great potential in the peroral delivery of gastrointestinal unstable analeptic peptide macromolecules.[1,2] The colonic region is considered to be very less diversified and less profound in enzymatic activities as compared to the stomach and small intestine and provides a significantly larger surface area for faster absorption.[1] However, the delayed lag time approach at the ileo-cecal site and a fast transit witnessed that a single unit dosage form might not be the perfect dosage form of targeting into the colonic region. Because of their smaller particle size compared to single unit dosage forms, multiparticulate beads have benefits like increased bioavailability, reduced risk of systemic toxicity, reduced risk of local irritation, predictable gastric emptying rate, and retention in the ascending colon for a relatively longer period of time, capable of passing through the GI tract easily leads to less inter and intra subject variability. Moreover, multiparticulate systems are to be more uniformly dispersed in the GI tract and also ensure more uniform drug absorption.[3,4] Several approaches have been explored for targeted-drug release in colonic area such as prodrugs and novel polymers containing azo groups, which forbids the drug release in the upper gastrointestinal region and extended into the colon area.[2,5,6] Scientific investigations of biodegradable polymers and their formulations including single and multiple unit revealed their gastro-resistant and colon targeting potential.[7–10] Natural polymers such as inulin, pectin, guar gum, and Chitosan remain unblemished in the harsh upper gastrointestinal environment and are fermented by more than 400 species of bacteria in colonic microflora.[3] Upon reaching around the colon, polymers undergo enzymatic degradation, microbial assimilation, and digestion of the polymeric chain into low molecular monomers.[11]

A comprehensive colon targeting of drugs via oral administration requires protection against its release as well as absorption in the gut and small intestine, gastrointestinal degradation, and thereby maintains a controlled release of drug molecules in the proximal colon area. This could be acquired with the use of ES100 coating which can safeguard the drug during its transit to the colon. Natural polymers are of more interest for a numerous reasons such as they are capable of modifications, readily available, economical, biocompatible as well as degradable.[12,13]

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Smart polymers for colon targeted drug delivery systems: a review

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ABSTRACT

The colon targeted drug delivery has a number of important implications in the field of pharmacotherapy. Oral colon targeted drug delivery systems have recently gained importance for delivering a variety of therapeutic agents for both local and systemic administration. Targeting of drugs to the colon via oral administration to protect the drug from degradation or release in the stomach and small intestine. It also ensures abrupt or controlled release of the drug in the proximal colon. Various drug delivery systems have been designed that deliver the drug quantitatively to the colon and then trigger the release of the drug. This review will cover different types of polymers which can be used in the formulation of colon targeted drug delivery systems.

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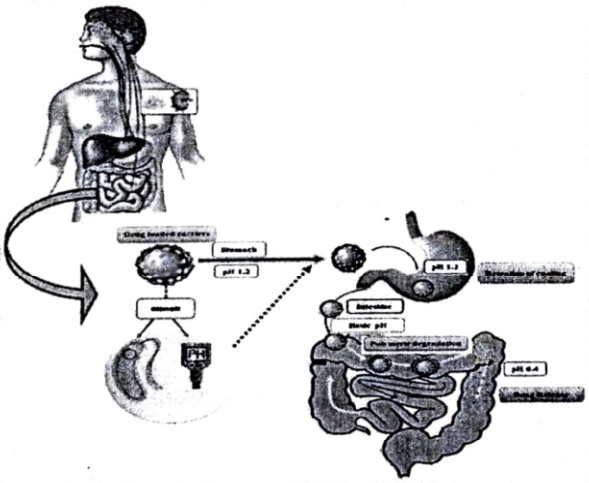
KEYWORDS
Biodegradable polymers; colon targeted delivery; controlled delivery; polysaccharides

GRAPHICAL ABSTRACT



1. Introduction

The colon targeting is more intensified to provide an adequate therapy of colonic diseases, such as irritable bowel syndrome, colon cancer[1], inflammatory bowel disease (IBD), including Crohn's disease and ulcerative colitis[2], have recently been well recognized. The colon, as a site for drug delivery, offers distinct advantages on account of a near neutral pH, a much longer transit time with relatively low proteolytic enzyme activity and a much greater responsiveness to absorption enhancers. These criteria favor this distal part of the gastrointestinal tract (GIT) as a site for the delivery of various drug molecules including proteins and peptides. Colon-specific delivery systems should prevent the release of the drug in the upper-part of the GIT and require a triggering mechanism to affect an abrupt release on reaching the colon. In the past, various primary approaches for colon-specific delivery, such as pro-drugs, pH sensitive polymers, timed release delivery systems, and microbially degraded delivery systems, have achieved limited success. The majority of these systems developed during the past decade were based on pH and time-dependent mechanisms with limited *in-vivo* evaluation. Minor variation in pH between the small intestine and the colon makes

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RESEARCH ARTICLES

Preliminary phytochemical screening and antioxidant activity of five medicinal plants of garhwal himalaya: a comparitive study

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Abstract
The Garhwal Himalayan region is rich in medicinal plants, greatly valued by local inhabitants for health care needs. In this study five different medicinal plants i.e., *Bunium persicum, Dactylorhiza hatagaria, Satyrium nepalense, Urtica diocia*, and *Viscum album* of Garhwal Himalayan region were screened for the presence of major phytochemical compounds and also analyzed for their antioxidant activity. The air-dried plant materials were extracted with methanol using soxhlet extraction method. Phytochemical screenings of each plant parts (methanol extract) were resolute through standard biochemical analysis and their antioxidant activity were examined by DPPH assay. All the extracts showed the presence of carbohydrates except *Urtica diocia. Satyrium nepalense* and *Dactylorhiza hatageria* showed the presence of alkaloids, flavonoids, saponins, and steroids. *Viscum album* and *Urtica diocia* showed the presence of flavonoids and phenols. *Bunium persicum* did not show the presence of saponins and flavonoids. DPPH free radical scavenging activity indicated that the methanol extract of *Satyrium nepalense* possesses the higher antioxidant activity while the lower was found in *Urtica diocia*. IC_{50} value of methanol extracts of *Bunium persicum, Dactylorhiza hatageria, Satyrium nepalense, Urtica diocia* and *Viscum album* were 0.09, 0.21, 0.04, 0.42 and 0.14 mg/ml respectively. However,the result reveals that *Satyrium nepalense* contains potent phytochemicals and thus further studies can be done for its therapeutic uses.

Keywords Phytochemicals · antioxidant · DPPH · *Dactylorhiza hatageria* · *Satyrium nepalense* · Garhwal Himalaya

Introduction

Uttarakhand is located at the foothills of the snow-clad Himalayas, with lush green forests and meadows. Due to its unique geographical location and climate, Garhwal Himalayas have a majestic natural beauty, great wealth of medicinal plants and traditional medicinal knowledge (Prakash 2014). Medicinal plants have been used in almost all cultures as a source of medication for several health conditions and can be a promising alternative for many diseases and conditions. Always, these plants are also valued to flavor foods, giving the food a dual role, i.e., flavor and bioactive compounds (Salehi et al. 2020; Sharifi-Rad et al. 2017a, b).

Furthermore, medicinal plants are low cost and tend to have fewer side effects than synthetic drugs. They comprise a brilliant source of exogenous antioxidants, whose activity ranges from extremely slight to very great (Sharifi-Rad et al. 2016). Indisputably, these natural antioxidants may act as reducing agents, free radical scavengers, singlet oxygen forming and pro-oxidant metals quenchers, localized O_2 concentration reducers, endogenous antioxidant defences boosters, and avoid damage in repair systems, or any combination of the above. Also, they protect against oxidative stress, which in turn helps in maintaining the balance between oxidants and antioxidants levels (Mishra et al. 2018; Sharifi-Rad et al. 2017a, b, 2018).

In the present study we organized a systematic record of preliminary phytochemical screening in selected plants i.e., *Bunium persicum* (Kala zeera-Apicacea), *Dactylorhiza hatagegia* (Hathajadi-Orchidacea), *Viscum album* (Bhangra-Santalaceae), *Urtica diocia* (Kandali-Urtigacia) and

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Research Paper

Development and Characterization of Colon-targeting 5-Fluorouracil Multiparticulate Beads

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Sarangi *et al.*: Colon Targeting Microparticulate System

This investigation is related to the development and optimization of multiparticulate beads of fenugreek seed mucilage-sodium alginate containing 5-flurouracil through ionotropic gelation technique using 3^2 full factorial design generated with Design-Expert® Version11 software. The beads were developed using $CaCl_2$ as the crosslinking agent. The effect of ratio of fenugreek seed mucilage and sodium alginate blend and concentration of $CaCl_2$ on the drug encapsulation efficiency, bead size and percent cumulative drug release in 6 h was optimized by 3^2 factorial design. The beads were also characterized using field emission scanning electron microscopy, Fourier-transform infrared spectroscopy and thermal analysis. The percent drug encapsulation efficiency of all these beads was within the range of 43.91 to 85.39 % with an *in vitro* drug release of 33.92 to 39.23 % in 6 h. The optimized batches of beads were coated with Eudragit S100 (5, 10 and 15 % w/v) to facilitate colon targeting in a prominent way. The *in vitro* drug release from the coated beads (P3) in various colonic fluids followed zero-order pattern with erosion mechanism in 18 h. The average size of these beads was within the range of 895 to 1021 µm. The optimized fenugreek seed mucilage-alginate beads containing 5-flurouracil showed significant drug permeability over a prolonged period in an *ex vivo* permeability study through goat colon. The results indicated successful colon targeting of 5-flurouracil multiparticulate beads developed using polymeric blends containing sodium alginate and fenugreek seed mucilage in an appropriate ratio.

Key words: Fenugreek seed mucilage, sodium alginate, 5-fluorouracil, inotropic gelation, colon targeting

Drugs, those are specifically targeted in the colonic area are highly significant in the treatment of several diseases like ulcerative colitis, Crohn's disease, colorectal cancer and amoebiasis. In addition to the above, the colon-targeted drug delivery systems (CTDDS) posses a high impact in the development of oral delivery of therapeutic peptides and proteins, which are found to be unstable in the upper parts of the gastrointestinal tract. It has been observed that the colonic area is found to be having low intensity along with low diversity of several enzymatic activities in comparison to the stomach and small intestine[1]. Several approaches have been developed for targeting the drug release into the colonic area[2]. Polysaccharides like inulin, chitosan, pectin, and guar gum have already been proven their impact in colon-specific drug delivery[3-6]. The polysaccharides remain unaffected in the virulent environment of the stomach as well as small intestine and get degraded by polysaccharidases on arrival in the colonic area[7]. pH-sensitive polymers dissolved at or above pH 7.0, are mostly used for colon targeting. However, as per Ashford *et al.* such type of polymers are unsuitable for developing CTDDS because of their low site specificity[8]. Thus the delayed arrival at the ileocecal junction and quick transit indicates that targeting colon with a single unit may not be a suitable approach for developing a colon-targeted drug delivery system. Over the past few decades, a maximum focus has been intensified for developing hydrogel beads from polysaccharides through ionotropic gelation technique,

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Effect of Kinesiophobia on WOMAC, Balance and Range of Motion in Post Total Knee Arthroplasty Patients

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Abstract

According to recent researches fear of pain and even more avoidance of movement are strongly correlated both with the acute postoperative pain perception and recovery after surgery up to 1 year, thus presenting a relevant clinical impact on the outcome after TKA. This placed a need to identify the presence of fear of fall in post TKA patients and to check whether kinesiophobia might effect a person's final outcomes in balance, function and range of motion post TKA. In the present study the effect of kinesiophobia in post TKA patients was evaluated. In addition its impact on kinesiophobia, balance, range of motion and physical functions in post TKA patients was assessed. The results showed that fear of fall has a significant severe effect on balance of the subjects with bilateral group than the moderately affected unilateral group which leads to more functional limitations having high WOMAC scores which is an indicator of functional abilities. Fall risk had no effect on knee ROM in either of the groups. Overall this study came to a conclusion that kinesiophobia positively effects balance and function in post TKA patients.

Keywords
Kinesiophobia, Proprioception, Fear of fall.

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INTRODUCTION:

Osteoarthritis (OA) is a common chronic condition resulting in pain, fatigue, functional limitations, locomotor disability, increased health care utilization and high economic costs to society.[1,3] Osteoarthritis (OA) affects the joint by causing focal areas of loss of articular cartilage within the synovial joints and it is associated with bone hypertrophy and capsular thickening.[6] The knee is the most commonly affected weight-bearing joint. Knee osteoarthritis (OA) is a major public health concern worldwide and one of the foremost causes of chronic disability in older adults as it reduces physical function and diminishes quality of life.[5,2] Impaired proprioception also has been reported for the patients suffering from knee osteoarthritis leading to degeneration of the knee.[7] The prevalence of OA increases with age and if pharmacological and conservative treatments do not releases symptoms joint replacement is recommended.[9,7] Surgery, particularly total knee replacement, can be of great value as it is efficacious, improves quality of life, as well as reduces pain and improves function.[10,8] However, the modern TKA is considered a successful intervention with 90% of patients at long-term follow up reporting reduced pain and improved functional ability. Despite these improvements, patients continue to exhibit long-term functional deficits and to report difficulties with lower limb function during activities of daily living