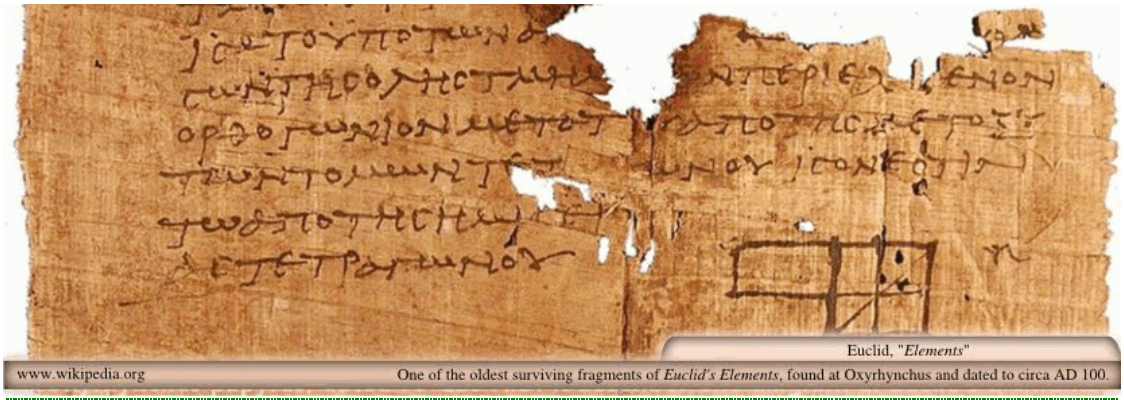
YEAR OF PUBLICATION – 2018

S. No	Name of the teacher	Title of paper
1	Dr. M Shalini	" Implementation of Hindi Word Recognition and Classification System Using Artificial Neural Network"
2	Dr. K. Kusuma Dorcas,	Purification and Characterization of Protease produced by Bacillus subtilis MD2
3	Dr. K. Kusuma Dorcas,	Antimicrobial susceptibility of various natural extracts on coliforms
4	Dr. Uma chitra	*Neophobic tendencies and dietary behavior in a cohort of adolescent girls in Secunderabad*
5	Dr. G. Srilatha	Evaluation of Glycemic, Lipid, Immune-Inflammatory and Oxidative Stress Markers in Various Clinical Stages of Type 2 Diabetic Nephropathy.
6	Dr. G. Srilatha	Collagenase-1 (-1607 1G/2G), Gelatinase-A (-1306 C/T), Stromelysin-1 (-1171 5A/6A) functional promoter polymorphisms in risk prediction of type 2 diabetic nephropathy.
7	K. Vidyalakshmi	Recruitment Process and Staffing Sector: A Big Data Paradigm,

PRINCIPAL
Kasturba Gandhi Degree & P.G. College
For Women, Marredpally,
SECUNDERABAD.

Academic Publications
International Journal of Pure and Applied Mathematics
ISSN 1311-8080 (printed version)
ISSN 1314-3395 (on-line version)



[2018-04-01] **The journal stops consideration of any new submissions.**

Google Scholar: H-Index: 28%u2191; G-Index: 48%u2191; Cites/paper: 7.19%u2191; Cites/year: 338.18%u2191

DOI (Digital Object Identifier) system

Welcome!

International Journal of Pure and Applied Mathematics is a mathematical journal for publishing early, high-impact results in the areas of mathematics and computer science/informatics. The journal also emphasizes mathematical articles devoted to the mathematical treatment of questions arising in physics, chemistry, biology, engineering and all applied sciences.

Although the journal focuses on the original research articles, it also welcomes reviews and short notes.

With the publication of the November 2016 issue, IJPAM has concluded it's **15-th year** of publication of high-quality research articles. Over the past years, we have seen significant growth: The metric factor **"cites per paper" (impact of the journal) has become 7.19** (The IJPAM indexes and impact are calculated using Harzing's Publish or Perish software, based on Google Scholar on 15.10.2017). For this success, we are thankful to our Editorial Board, authors e lly, and readers.

Authors are cordially invited to **submit papers** using our Submission Center.

Manuscripts submitted to this journal will be considered for publication with the understanding that the same work has not been published and is not under consideration for publication elsewhere.

The regular issues of journal are issues with numbers 1, 2, 3, and 4. Only these issues of all volumes will be presented for indexation from all searching/indexing/abstracting services.

For the current status of IJPAM in SCOPUS database, please see scopus.com. [May 29, 2018]

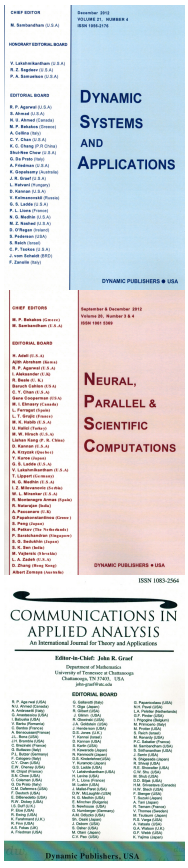
Search

Loading

IJPAM

Academic Publications, Ltd.
Submission Center
Contents
Special Issues
Editorial Board
How to?
Indexing and Abstracting
Instruction for Authors
Publication Ethics
Subscriptions

Books and Monographs



International Journal of Pure and Applied Mathematics
Volume 117 No. 15 2017, 557-565
ISSN: 1311-8080 (printed version); ISSN: 1314-3395 (on-line version)
url: http://www.ijpam.eu
Special Issue

ijpam.eu

IMPLEMENTATION OF HINDI WORD RECOGNITIONAND CLASSIFICATION SYSTEM USING ARTIFICIAL NEURAL NETWORK

M.Shalini[1]
Research Scholar, Dept. of Computer Application, BharathiarUniversity, Coimbatore, Tamil Nadu, India.
shalupk1999@gmail.com

B.Indira[2]
Kasturba Gandhi Degree & PG College for Women, Secunderabad, A.P, India
Research and Development, BharathiarUniversity, Coimbatore, Tamil Nadu, India.
indsneha@rediffmail.com

Abstract : Extensive research has been taken place in the areas of pattern recognition and image processing. Character recognition is one of the important tasks in pattern recognition. A neural network is one of the techniques widely used for character recognition. This paper manages the qualities of Devanagari script particularly Hindi. Line segmentation, word segmentation techniques are used for extracting Hindi text from given image. Algorithms like grey scale algorithm, noise removal , thinning, MSER , Horizontal and Vertical projection algorithms are used in this research. The accuracy of the network pattern is analysed by giving various test pattern to the net.

Keywords : pattern recognition, grey scale algorithm, noise removal, thinning, MSER.

Introduction: Artificial Intelligence giving machines the human like abilities, has one of the most challenging areas in computer science in last few decades. Due to the growth of technology in India, it becomes important to devise ways so that people can communicate with computer in Indian languages. One of the major tasks of Artificial Intelligence (AI), giving machines the human like abilities, has one of the most challenging areas in computer science in last few decades. Due to the growth of technology in India, it becomes important to devise ways so that people can communicate with computer in Indian languages. One of the major tasks of Artificial Intelligence is to make the machines to see, interpret and the ability to read text. Lot of research work has been done in this field, but still the problem is not solved in its full complexity. A good text recognizer has many commercial and practical applications. Artificial Intelligence techniques are widely used in Pattern Recognition field. The patterns to be classified are usually groups of measurements or observations defining points in an appropriate multidimensional space. A complete pattern recognition system consists of a sensor that gathers the observations to be classified or described.

The Pattern Recognition approaches can be classified as Statistical, Syntactic (or structural), Neural Networks and Hybrid. Statistical pattern recognition is based on statistical characterizations of patterns, assuming that the patterns are generated by a probabilistic system. Structural pattern recognition is based on the structural interrelationships of features.

Neural pattern recognition employs the neural computing paradigm that has emerged with neural networks. A brief introduction about neural networks is presented in the following sections.

ARTIFICIAL NEURAL NETWORKS

An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements called neurons, working in unison to solve specific problems. ANN's, like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process. Learning in biological systems involves the neurons. The aim of introducing ANN's is to mimic the behaviour of brain. Neural Networks with their remarkable ability to derive meaning from complicated or imprecise data can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer techniques. A trained neural network can be thought of as an "expert" in the category of information it has been given to analyse. This expert can then be used to provide projections given new situations of interest and answer "what if" questions.

Back Propagation Algorithm

In order to train a neural network to perform some task, we must adjust the weights of each unit in such a way that the error between the desired output and actual output is reduced. This process requires that the neural network compute the error derivative of the weights (EW). In other words, it must calculate how the error changes as each weight is increased or decreased slightly. The back propagation algorithm is the most widely used method for determining the weights. The back-propagation algorithm is easiest to understand if all the units in the network are linear. The algorithm computes each weight by first computing the rate at which the error changes as the activity level of a unit is changed (EA). For output units, the EA is simply the difference between the actual and the desired output. To compute the EA for a hidden unit in the layer just before the output layer, we first identify all the weights between that hidden unit and the output units to which it is connected. We then multiply those weights by the EAs of those output units and add the products. This sum equals the EA for the chosen hidden unit. After calculating all the EAs in the hidden layer just before the output layer, we can compute in like the EAs for other layers, moving from layer to layer in direction opposite to the way activities propagate through the network. This is what gives back propagation its name. Once the EA has been computed for a unit, it is straight forward to compute the EW for each incoming connection of the unit. The EW is the product of the EA and the activity through the incoming connection [1].

Feed Forward Neural Network

A single artificial neuron can be interconnected in many different ways leading to a variety of Neural Networks with different architectures, learning rules and abilities. The most important

ones are Feed Forward Neural Networks (FFNN), Adaptive Resonance Theory (ART), Hopfield Nets, Radical Basis Functions(RBF), Boltzman Machines, and Cascade-Correlation.

Feed Forward Neural Networks (FFNN) is a very simple way to organize the neurons in several layers as shown in figure. This architecture is called a feed forward net, since neurons of one layer are only connected with neurons of the succeeding layer, without any recurrent connections. These networks consist of one input layer, one or two hidden layers and one output layer. With such net, input data are mapped from the n-dimensional input space to an m-dimensional output space.

This paper describes and discusses the classification and recognition of printed Hindi document using Artificial Neural Networks. Some of the related works are given in section II, Methodology in section III, Testing and Results are discussed in section IV.

Related Works

Major research activities have been carried out on the recognition of characters in foreign languages. Significant contribution is made in the recognition of characters in Chinese, Arabic, English and Japanese languages.

In [CHW02], the author proposed a Neural Network based application to optical symbol recognition. They say that node heads could be easily recognized by using a set of Fuzzy rules extract from the parameters of trained Neural Networks and also showed that only 12 features are sufficient to achieve a high recognition rate.

In [Ban99], the author designed a Devnagari text recognition system by integrating knowledge sources, features of characters such as horizontal zero crossing, moments, aspect ratios, pixel density in nine zones, number, and position of vertex points, with structural descriptions of characters. These were used to recognize characters

Character Recognition for Devanagari Script - C h i t r a k s h a r i k a
This paper [47] gives an efficient way to convert optically scanned images of printed materials into computer process able data files. The technical attributes include Recognizing Hindi, Marathi & Nepali., Scanning images via TWAIN interface, Auto Image segmentation, de-skewing, detection of text, table & pictures, Image editing features, Embedded spell checker for Hindi and text & scanned images in different formats. The system is implemented using ANSI C and hence portable to any platform. The performance rate of accuracy is 96.8% [47].
Dr. P.S. Deshpande et.al, proposed a novel approach on character encoding and regular expressions for shape recognition in their paper [2]. The method is independent of the specific aspect of individual shapes, such as thickness of line, size of character and shapes. In this, features are extracted in the form of regular expression. They achieved an accuracy of 90%.

A Devanagari text recognition system was designed by VeenaBansali [3] in her research work by integrating knowledge sources, features of characters such as horizontal zero crossings, moments, aspect ratios, position of vertex points and pixel density, with structural description of characters.

AditiGoyal, KartikayKhandelwal, PiyushKeshri [4], in their paper discussed about various image pre-processing, feature extraction and classification algorithms, to design high performance OCR software for handwritten Hindi alphabets. Image preprocessing included Median filtering, Background removal, Threshold and sparsity removal. In feature selection and extraction, histograms of oriented gradients were used. This provides a flexible feature and helps to deal with high bias and high variance issues. The basic back-propagation algorithm is used to determine the weight matrix. Features were tested on a reduced training set using naïve Bayes and support vector machines. They observed that SVM gave better results than naïve bayes. The performance obtained with handwritten letters is 98 %.

Methodology

One of the most important tasks in pattern recognition process is character recognition. Artificial neural networks is one of the techniques widely used for document recognition. The different phases involves:

- Data Collection
- Image Acquisition
- Image Digitization
- Image Preprocessing
- Word Segmentation
- Feature Extraction
- Word Classification
- Storing the recognized document in a text file
- Display the recognized document

Data Collection: Data in the form of Hindi Text document with different font styles are collected for testing.

Image Acqusition: The first step in any document recognition task is to acquire a digital image. The grey level images of Hindi document is obtained through Scanner.

Image preprocessing: the digital image thus obtained is preprocesed, the various steps in preprocessing are

- Extraction of intensive values from grey level Hindi document
- Noise Elimination
- Binarization
- Size Normalization
- Thinning

Extraction of grey level image
The intensity values of each grey level image is extracted and stored in a matrix form.
Noise Elimination
Smoothing can be used to reduce fine textured noise in an image. The simple way to eliminate noise is by
using average filters or median filters.

Binarization

The next preprocessing technique is conversion of grey level to binary image (generally referred as threshold).

There are two approaches for conversion of grey level image to binary. They are Global threshold and Locally

adaptive threshold.

Size Normalization

To make the processing more efficient and robust, size normalization is required. The input to the neural network is an array of fixed size. Hence to make the image suitable to the network, size normalization is required.

Thinning

The final stage in preprocessing is thinning. Image thinning extracts a skeleton of the image without loss of the

topological properties.

The above preprocessing steps are applied to all the Hindi scanned documents. Then these characters are used in further recognition process.

Word Segmentation

Segmentation is one of the most important phases in OCR development. It directly affects the efficiency of any OCR. So a good segmentation technique can increase the performance of OCR. Segmenting text from scanned image helps in optical character recognition. An automated text detection algorithm is used to detect a large number text region and removes non text regions. Maximally stable external regions function is used to detect text regions from the scanned text document. This algorithm works well for text because the consistent color and high contrast of text leads to stable intensity profiles. A simple rule based approach is used to filter non-text regions based on geometric properties. The geometric properties that are food for discriminating between text and non-text regions are aspect ratio, eccentricity, Euler number, extent and solidicity. Text with little stroke width variation is done by estimating the stroke width by using distance transformation and binary thinning operation.

Individual text regions are merged into words or text lines by finding neighboring text regions and then form a bounding box around these regions. This makes the bounding boxes of neighboring text regions overlap such that text regions that are part of the same word or text line form a chain of overlapping bounding boxes. The overlapping bounding boxes can be merged together to form a single bounding box around individual words or text lines. Ocr function is used to recognize the words from Hindi text within each bounding box.

Feature Extraction and classification

The recognized words are stored in a text file and displayed. The recognized words are thus classified into two sub groups based on certain significant features, sub groups are categorized as

- words without matras
- words with matras

A Support Vector Machine(SVM) using the feature extracted by performing Principal Component Analysis is used for classification of words into sub groups.

Testing and Experimental Results

Testing was performed on paragraph of different Hindi documents of different styles and fonts consisting of approximately 30 words. An average accuracy of approximately 95 – 97% is achieved.

Image word	Detected Text	Recognition Accuracy (%)
कल	कल	98
कलश	कलश	90
वकील	वकील	88
पकाना	पकाना	98
कैसे	कैसे	90
कुपित	कुपित	90
आज	आज	96
आजकल	आजकल	96
माता	माता	98
नमस्कार	नमसकार	90

Classification

Table showing the classification of words into two sub groups

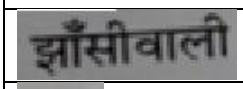
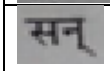
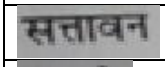
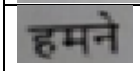
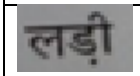
Words without matras	Words with matras
चमक	उठी
वह	में
तलवार	पुरानी
कल	थी
कलश	बुंदेले
पकाना	हरबोलों
आज	कुपित

Results

Training of the system is done by using different dataset or sample and accuracy is measured. Training and testing is done for each word , feature were computed and stored for training the network. Recognition Accuracy of Printed Hindi words is 98%.

Limitations

Poor Recognition rate for words with touching characters and words with similar characters.

Hindi Words	Words which are not recognized correctly
	झाँसीत्रच्चाली
	सन्स
	न्सत्तावन
	हबने
	लही

Conclusion

Document recognition is one of the important applications of pattern recognition. Instead of using only one neural network for recognition and classification we divided the words into two sub-groups based on certain significant features. Support Vector Machine using Principal Component Analysis is used for classification into two different groups. It observed that Recognition accuracy is increased by using the concept of subgrouping using PCA to 95 – 97%.

References

1. Dr. P.S. Deshpande, Mrs.Latesh Malik, Mrs.SandhyaArora ―Characterizing Hand writtenDevanagari Characters using Evolved Regular Expressions‖, 1-4244-0549-1/06, IEEE 2006.
2. VeenaBansali ―Integrating with source in Devanagari text recognition‖, PhD thesis , 1999.
3. AditiGoyal,KartikayKhandelwal, piyushKeshri, ―Optical Character Recognition for Handwritten Hindi‖, Stanford University, CS229 Machine Learning, Fall,2010.
4. Srinivasa Kumar Devireddy, SettipalliAppaRao, Hand written character recognition using Back Propagation Network, journal of theoretical and applied information technology.
5. Naresh Kumar Garg, LakhwinderKaur, M. K Jindal, segmentation of hand written Hindi text, 2010 International journal of Computer Applications (0975 – 8887), volume 1 – No. 4.
6. Raghuraj Singh1, C. S. Yadav2, Prabhat Verma3, Vibhash YAdav4, Optical Character Recognition (OCR) for printed Devnagari Script Using Artificial Neural Networks, International journal of computer science & communication vol. 1, No. 1, January-June 2010, pp. 91-95.
7. Dayashankar Singh, Sanjay Kr. Singh, Dr, (Mrs.) MaitreyeeDutta, Hand Written Character Recognition Using Twelve
8. Directional Feature Input and Neural Network, 2010 International Journal of computer Applications (0975 -8887) volume 1 - No. 3.
9. Surendar, A., Arun, M.”FPGA based multi-level architecture for next generation DNA sequencing”,(2016) Biomedical Research (India), 2016, pp. S75-S79.
10. Surendar, A., Arun, M., Basha, A.M.”Micro sequence identification of bioinformatics data using pattern mining techniques in FPGA hardware implementation”,(2016) Asian Journal of Information Technology, 15 (1), pp. 76-81.
11. Prabu, G., Surendar, A.”Virus detection by using a pattern matching algorithm for network security”,(2015) International Journal of Applied Engineering Research, 10 (10), pp. 9565-9569.

12. Surendar, A., Arun, M., Periasamy, P.S.”Hardware based algorithms for bioinformatics applications - A survey”,(2013) International Journal of Applied Engineering Research, 8 (6), pp. 745-754.

13. RAJESH, M. "A SYSTEMATIC REVIEW OF CLOUD SECURITY CHALLENGES IN HIGHER EDUCATION." The Online Journal of Distance Education and e- Learning 5.4 (2017): 1.

14. Rajesh, M., and J. M. Gnanasekar. "Protected Routing in Wireless Sensor Networks: A study on Aimed at Circulation." Computer Engineering and Intelligent Systems 6.8: 24-26.

15. Rajesh, M., and J. M. Gnanasekar. "Congestion control in heterogeneous WANET using FRCC." Journal of Chemical and Pharmaceutical Sciences ISSN 974 (2015): 2115.

16. Rajesh, M., and J. M. Gnanasekar. "Hop-by-hop Channel-Alert Routing to Congestion Control in Wireless Sensor Networks." Control Theory and Informatics 5.4 (2015): 1-11.

17. Rajesh, M., and J. M. Gnanasekar. "Multiple-Client Information Administration via Forceful Database Prototype Design (FDPD)." IJRESTS 1.1 (2015): 1-6.

18. Rajesh, M. "Control Plan transmit to Congestion Control for AdHoc Networks." Universal Journal of Management & Information Technology (UJMIT) 1 (2016): 8-11.

19. Rajesh, M., and J. M. Gnanasekar. "Consistently neighbor detection for MANET." Communication and Electronics Systems (ICCES), International Conference on. IEEE, 2016.

EM International, Publishers of Quality International Journals

EM International one of the leading publishers of quality journals in Environmental Science and Biotechnology in association with Global Science Publications Aligarh. The organization is publishing high quality scientific research papers, reviews, topical articles and other information for the past forty years.

Three International Journals published by EM International are POLLUTION RESEARCH, ECOLOGY, ENVIRONMENT AND CONSERVATION, and ASIAN JOURNAL OF MICROBIOLOGY, BIOTECHNOLOGY AND ENVIRONMENTAL SCIENCES.

These journals are extensively subscribed by:

- Leading Universities
- Leading Educational Institutions
- Engineering and Technological Institutes
- Government Departments
- Industries' Environment and R&D Departments
- Individual Researchers

All these journals are Registered at COPYRIGHT CLEARANCE CENTRE INCORPORATED(CCC) 222, Rosewood Drive, Suite910, Danver, MA01923, U.S.A.The copyright owner consents that in the U.S.A copies of the articles may be made for personal or internal use of specific clients, on payment of fee. All requests to permission to photocopy should be addressed to the copyright owner (www.copyright.com)

Clarivate Web of Science™ Crossref UGC Care doi

National Academy of Agricultural Sciences

Publisher:

Mrs. Sukhada Rakesh Trivedy
C-101,Prakriti,Balewadi,
Baner, PUNE 411045
India

Regional Operating Office:

C/O EM International, C-101, Prakriti,
Balewadi, Baner, PUNE - 411 045, India
Telephone: 9326712297/8825258822
Email id : sukhada.r.trivedy@gmail.com

Important **Guidelines**

Author Guidelines, Review Policy & Publication Charges

Guidelines for Reviewers

Current **Issues!**

Ecology, Environment & Conservation

Vol 29, April Suppl. Issue, 2023

View Papers

Pollution Research

Vol 42, Issue 1, 2023

View Papers

Asian Jr. of Microbiol. Biotech. Environmental Sciences

Vol. 24, Issue 4, 2022

View Papers

Submit **Manuscript**

Let us help you get published.

Manuscript must be submitted by one of the authors.

Submit Manuscript

Subscribe to Journals Enter Your Email Address GO

Asian Journal of Microbiology, Biotechnology & Environmental Sciences Paper

Vol 20, Issue 1, 2018; Page No.(208-213)

PURIFICATION AND CHARACTERIZATION OF PROTEASE PRODUCED BY BACILLUS SUBTILIS MD2

KUSUMA DORCAS AND PAVAN KUMAR PINDI

Abstract

Bacillus subtilis MD2 (NCBI Accession no KX784212), a soil isolate was grown in casein agar and later shake flask method was used for protease production. The enzyme was purified using ammonium sulphate precipitation followed by dialysis and further concentrated using ion exchange chromatography. The SDS PAGE revealed molecular weight of the protease to be 32 kDa. The specific activity of purified enzyme was found to be 2.21 U/mg and 1.90 fold purity. The enzyme yield was 41.52% from crude protein. The optimum pH was 8.0, while the optimum temperature was 37 °C. The enzyme showed maximum activity with 1.2 % casein as substrate. It also showed increase in activity with 0.1M Fe2+, while its activity was inhibited by EDTA. 1mM of Mg2+ metal ion showed maximum protease activity.

ISSN –2321-3043 ANNQUEST

ST. ANN'S COLLEGE FOR WOMEN

Latest Update News

Welcome to St. Ann's Journal Online:

Annquest is an online journal initiated by St.Ann's College for Women Mehdipatnam, Hyderabad that provides publication of articles in all disciplines of pure and applied sciences, social sciences and humanities. The journal manifests our vision to stimulate intellectual activity, to build the collective knowledge base and to provide the portal to record and disseminate the thoughts and perspective of scholars and academicians.

Editorial Board Members

Annquest Journal

Editorial Members and Their Details 2020-21

S.No	Name	Contact No.	Mail. ID	Department/Organization
1	Dr.Sr.P.Amrutha	8008161972	mailto:amrutha_nov5@rediffmail.com	Principal St.Anns college for women, Mehdipatnam,Hyderabad
2	Dr.V.Venogopal Rao	99850 65518	rao5749@gmail.com	Department of Genetics , St.Anns college for women, Mehdipatnam,Hyderabad
3	Dr.Tabassum	9059307869	Tabassum5550@gmail.com	DL.Department of zoology. Telangana Social Welfare Residential Degree College For Women, Armoor, Nizamabad
4	Mrs.P.V.Neeraja	9490748289	pvneeraja18@gmail.com	Department of Botany, St.Anns College for Women,Mehdipatnam,Hyderabad
5	Dr.Swapna	87900 17061	swapna.nagalingam@gmail.com	Department of Genetics , St.Anns college for women, Mehdipatnam,Hyderabad

6	Mrs.N.Sushma	8790716558	sushmasrinivasreddy87@gmail.com	Department of Biotechnology , St.Anns college for women, Mehdipatnam,Hyderabad
7	Ms.Meeta Joshi	9848841133	jmeeta02@gmail.com	Department of History , St.Anns college for women, Mehdipatnam,Hyderabad
8	Dr.Archana jha	9640170434	jhaarchana18@gmail.com	Department of Hindi , St.Anns college for women, Mehdipatnam,Hyderabad
9	Ms.Prashanthi	73967 60834	shanthikopuri@gmail.com	Department of MCA , St.Anns college for women, Mehdipatnam,Hyderabad

Developed and Maintained by :ST.ANN'S COLLEGE FOR WOMEN

ANNQUEST FEBRUARY 2018
ISSN: 2321-3043
www.stannsannquest.com

Neophobic tendencies and dietary behaviour in a cohort of adolescent girls in Secunderabad

Uma Chitra

Head, Department of Clinical Nutrition & Dietetics, Kasturba Gandhi College for Women, Secunderabad, India, umachitra7@gmail.com

Radhika M S[2]

Scentist D, Division of Community Studies, National Institute of Nutrition, Hyderabad, India

Balakrishna N[4]

Scientist E, Division of Biostatistics, National Institute of Nutrition, Hyderabad, India

Koushik Adhikari[3],

Associate Professor, Dept. of Food Science and Technology, University of Georgia, Griffin, Georgia, USA

ABSTRACT

The aim of this study was to examine the relationship between neophobic tendencies and general dietary patterns and to assess adolescent perceptions about factors influencing their food choices. This cross-sectional study was carried out in a girls' college in Secunderabad. A survey was administered to 1446 girls, aged 15-19 years to collect information on general neophobia, food neophobia, dietary practices, and consumption of energy-dense snacks. There were 274 vegetarians (average food neophobia score [FNS] = 38.8), 371 students who were vegetarians that consumed eggs (FNS=39.2), and 801 were non-vegetarians (FNS=36.6).

Our findings indicate independence of food neophobia and general neophobia scores (r^2=0.037) for this population. The independence of food neophobia from general neophobia may potentially be mediated by cultural factors associated with food neophobia for this population, such as restraint/caution towards foods outside of the regular diet, due to religious beliefs and traditions. Evidence for this is seen in results showing the non-vegetarian group and vegetarian group having lowest and highest food neophobia scores, respectively (36.6 vs. 38.8). Lower food/general neophobia was a significant indicator of greater consumption of meals outside the home. Greater consumption of energy-dense foods (such as pizzas and burgers) was also associated with low food/general neophobia scores.

The findings from this study demonstrate that the vegetarians and ovo-vegetarians were more neophobic than the non-vegetarians. The non-vegetarian group had less neophobic tendencies and was more open to trying new/novel foods and cuisines than the vegetarian and ovo-vegetarian groups.

*Corresponding Author

Journal of Metabolic Syndrome

ISSN: 2167-0943 Open Access

Journal h-index : 2
Journal cite score : 1.79
Journal impact factor : 58.8
Average acceptance to publication time (5-7 days)
Average article processing time (30-45 days)

Editor-in-Chief

About the Journal

The Journal of Metabolic Syndrome (JMS) is an Open Access peer-reviewed journal that publishes original research works in the areas related to the field such as increased blood pressure, a high blood sugar level, excess body fat around the waist and abnormal cholesterol levels that occur together, increasing your risk of heart disease, stroke and diabetes. Most of the disorders associated with metabolic syndrome have no symptoms, although a large waist circumference is a visible sign. If your blood sugar is very high, you might experience signs and symptoms of diabetes including increased thirst and urination, fatigue, and blurred vision.

Journal of Metabolic Syndrome (JMS) is a scholarly publishing journal that aims to publish the most complete and reliable source of information on the discoveries and current developments in the form of original articles, review articles, case reports, short communications, etc. in all areas of the field and making them freely available through online without any restrictions or any other subscriptions to researchers worldwide.

The journal is using Editorial Manager System for quality in peer review process. Editorial Manager is an online manuscript submission, review and tracking systems. Review processing is performed by the editorial board members of Metabolic Syndrome or outside experts; at least two independent reviewer's approval followed by the editor is required for the acceptance of any citable manuscript. Authors may submit manuscripts and track their progress through the system, hopefully to publication. Reviewers can download manuscripts and submit their opinions to the editor. Editors can manage the whole submission/review/revise/publish process.

Submit articles online through manuscript submission, review and editorial tracking system for quality and quick review processing at:https://www.scholarscentral.org/submissions/metabolic-syndrome.html or send as an e-mail attachment to the editorial office at: publisher@hilarispublisher.com .

Rapid Publication Service

Hilaris Publishing is offering wide range of opportunities, options and services for the prospective authors to publish their scholarly contributions.

The journal caters to the demands of the fast publication without compromising on the editorial quality including manuscript peer-review. This flexibility is being provided to ensure earliest author credibility to their respective contributions and this will also ensure timely dissemination of research outcomes for efficient integration, effective translation and reduced redundancy.

Authors have the option to choose between the standard open access publication service which takes its own course of time for complete publication process or can opt for rapid publication service wherein the article is published at the earliest date (Includes multiple subject experts commissioning for securing earliest peer-review comments). The authors can avail this flexibility based on the personal preference, funding agency guidelines or Institutional or organizational requirements.

Regardless of the option, all manuscripts undergo thorough peer-review process, editorial assessment and production process.

Fast Editorial Execution and Review Process (FEE-Review Process)

Authors who are willing to publish their articles under this mode can make a pre-payment of $99 towards express peer-review and editorial decision. First editorial decision in 3 days and final decision with review comments in 5 days from the date of submission. Galley proof generation will be done in next 2 days from acceptance or maximum 5 days (For manuscripts notified for revision by external reviewer).

Manuscripts accepted for publication will be charged regular APC.

Authors retain the copyright of their publication and the final version of the article will be published in both HTML and PDF formats as well as XML formats for transmitting to indexing databases. The editorial team of the Journal will ensure adherence to scientific publication guidelines.

> **h-index**
>
> Articles published in **Journal of Metabolic Syndrome** have been cited by esteemed scholars and scientists all around the world. **Journal of Metabolic Syndrome** has got h-index 2 , which means every article in Journal of Metabolic Syndrome has got 2 average citations.

Recent Articles

Retinol Binding Protein 4: Possible Relation between Insulin Resistance in Type 2 Diabetes and Visceral Obesity

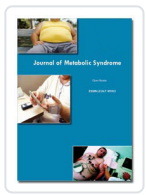
Alyaa Ahmed Elsherbeny, Emad Abdel Mohsen Abdel Hady, Amira Ramadan Elmahdi

Research Article — Abstract PDF

Research Contribution and Achievement

Annie Shergill

Editorial — Abstract PDF



2020 Market Analysis Editorial- Diabetes & Obesity 2020

Dr. Mohamed Zaky

Editorial — Abstract PDF

2020 Awards Editorial- Diabetes & Obesity 2020

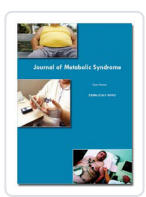
Dr. Mohamed Zaky

Editorial — Abstract PDF

2020 Conference Announcement Editorial- Diabetes & Obesity 2020

Dr. Mohamed Zaky

Editorial — Abstract PDF



Transdermal or Endogenous Testosterone in Men with Androgen Deficiency Syndrome and Type 2 Diabetes Mellitus?

Mitko D Mitkov, Presiyana V Nyagolova

Research Article — Abstract PDF

Relevant Topics

- Articles In^ Metabolomics
- Articles In^ Metabolomics
- Articles On Glucose Metabolism Disorders
- Articles On Glucose Metabolism Disorders
- Articles On Metabolic Syndrome
- Articles On Metabolic Syndr
- Articles-open-access In Metabolomics
- Articles-open-access In Metabolomics
- Atherogenic Dyslipidemia Scientific Journals
- Atherogenic Dyslipidemia Scientific Journals
- Atherogenic Dyslipidemia Top Journals
- Atherogenic Dyslipidemia Top Journals

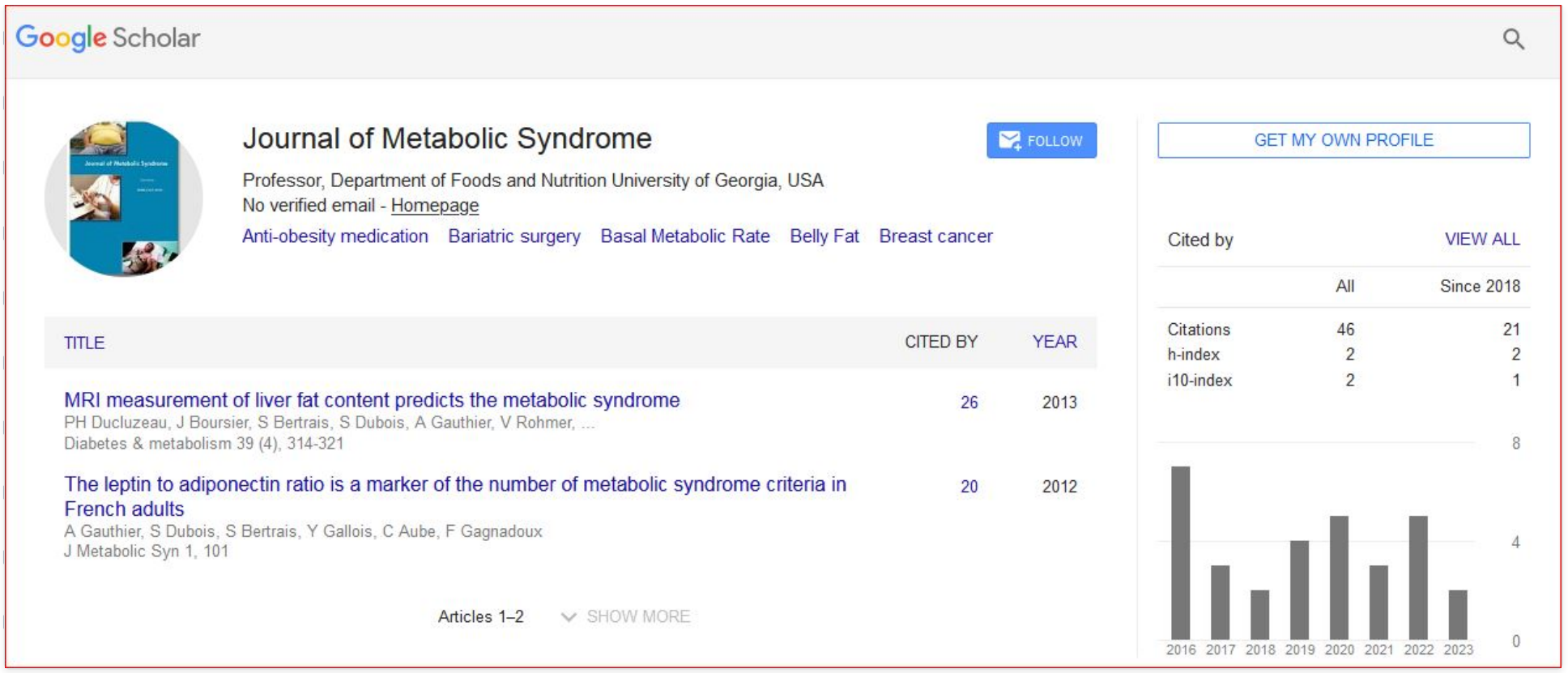
Journal Highlights

- Anti-obesity medication
- Bariatric surgery
- Basal Metabolic Rate
- Belly Fat
- Breast cancer
- Cardiovascular disease
- Diabetes Mellitus
- Diabetes Type 1
- Diabetes Type 2
- Disease management
- Dyslipidemia
- Endocrinology
- Fatty Liver
- Gallstones
- Gastrointestinal Disorders
- Genetic Predisposition
- Gestational diabetes
- HDL Cholesterol
- High Blood Pressure
- Hydrocortisone
- Hyperlipidemia
- Hyperuricemia

Google Scholar citation report

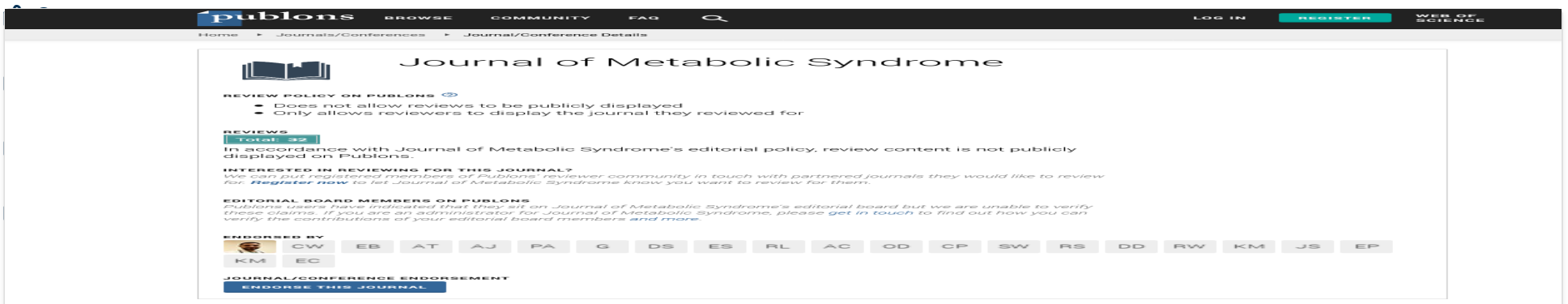
Citations: 46

Journal of Metabolic Syndrome received 46 citations as per Google Scholar report



Schizophrenia

Journal of Metabolic Syndrome peer review process verified at publons



Indexed In

- Index Copernicus
- Google Scholar
- Genamics JournalSeek
- Cosmos IF
- RefSeek
- Hamdard University
- EBSCO A-Z
- OCLC- WorldCat
- Publons
- Geneva Foundation for Medical Education and Research

Related Links

- COVID-19 Special Issues
- Abstracting and Indexing
- Funded Work
- Citations Report
- Table of Contents

Open Access Journals

- Business & Management
- Chemistry
- Clinical Sciences
- Engineering
- Genetics & Molecular Biology
- Immunology & Microbiology
- Medical Sciences
- Neuroscience & Psychology
- Pharmaceutical Sciences
- Science & Technology

Journal of Metabolic Syndrome
ISSN: 2167-0943

Gantala et al., J Metabolic Synd 2018, 7:1
DOI: 10.4172/2167-0943.1000237

Research Article Open Access

Evaluation of Glycemic, Lipid, Immune-Inflammatory and Oxidative Stress Markers in Various Clinical Stages of Type 2 Diabetic Nephropathy

Srilatha Reddy Gantala[1], Ramanjaneyulu Kummari[1], Mohini Ayiengar Tupurani[1], Rajesh Kumar Galimudi[1], Kishore Kumar Gundapaneni[1], Keerthi Kupsal[1], Nivas Shyamala[1], Surekha Rani Hanumanth[1*] and Swarnalatha Guditi[2]

[1]*Department of Genetics, Osmania University, Hyderabad, Telangana State, India*

[2]*Nizam's Institute of Medical Sciences (NIMS), Hyderabad, Telangana State, India*

[*]**Corresponding author:** Dr Surekha Rani H, Assistant Professor, Department of Genetics, Osmania University, Hyderabad-500007, India, Tel: +91-40-2768-2335; E-mail: surekharanih@gmail.com

Received date: February 16, 2018; **Accepted date:** February 27, 2018; **Published date:** March 06, 2018

Abstract

Type 2 Diabetic nephropathy (DN), chronic multifactorial disorder is a devastating complication of DM and a main cause of end stage renal failure. A variety of factors like metabolic, hemodynamic, genetic and multiple pathogenic events contribute to the renal damage in type 2 DN. The present study was designed to assess blood glucose, serum lipid profiles, immune-inflammatory and oxidative stress markers in type 2 DN patients in different stages of the disease and healthy controls. Our study showed that FBS, PPG, HbA1c, TC, TG, LDL-C, ADA, CRP, MDA, NO and DNA damage were significantly high in type 2 DN patients ($p<0.01$) compared to controls. In stage wise comparison also FBS, PPG, HbA1c, LDL-C, CRP, MDA, NO and DNA damage showed significant difference ($p<0.05$). Further, a significant positive correlation was found between PLBS, LDL-C and CRP and oxidative stress markers (MDA, NO, DNA damage) suggesting that monitoring these biochemical parameters at regular intervals may reduce the stage wise progression of type 2 DN and might help in early detection, precise prognosis/therapeutic modalities.

Keywords: Type 2 diabetic nephropathy; HbA1c; Lipid profiles; Immune-Inflammatory; Oxidative stress markers; DNA damage

Introduction

Globally the incidence of diabetes mellitus (DM) is increasing in all age-groups and the prevalence was estimated to be 2.8% (175 million people) in 2000 while recent trends show that it might increase to 4.4% (366 million people) in 2030 [1]. Type 2 diabetic nephropathy (DN) can conveniently be categorized into different stages with respect to renal hemodynamic, systemic blood pressure, urinary findings and susceptibility to therapeutic interventions. The glycosylated hemoglobin (HbA1c) levels in most type 2 DN patients were indicative of uncontrolled DM [2].

Prolonged hyperglycemia induces dyslipidemia in type 2 DN. Lipids may induce both glomerular and tubulointerstitial injury through inflammatory mediators, ROS and through hemodynamic changes [3,4]. Immune-inflammatory disturbances in type 2 diabetics have an association with cell mediated responses, inappropriate T-lymphocyte function and low-grade inflammatory status, which further leads to the increased production of oxidative stress associated with type 2 DN. This inflammation and oxidative stress are both deeply inter-related and are known to play an important role in diabetic vascular complications [5].

Type 2 diabetes in India harbors the largest number of diabetics, among which incidence of DN is on rise. In view of the above, the present study has been explored to study the association of blood glucose levels, HbA1c, lipid profiles, immune-inflammatory markers (ADA & CRP), oxidative stress markers (MDA, NO & COMET) and their susceptibility to type 2 DN patients and its progression to end-stage renal disease (ESRD).

Materials and Methods

Study subjects

The present study population consisted of a total of 620 subjects including 310 patients recruited from Department of Nephrology, Nizam Institute of Medical Sciences, Hyderabad, Telangana state, INDIA, with type 2 DN and an equal number of healthy individuals without any systemic disorders from the local population included in the study (medical history & physical examination). Patients undergoing anti-diabetic treatment were enrolled from the department of nephrology between the period from March 2012 to August 2017.

Inclusion criteria: All the type 2 DN patients enrolled for the study had a minimum of 5 years history of type 2 diabetes mellitus with fasting sugar >110 mg/dl and postprandial blood sugar >140 mg/dl respectively and serum creatinine <1.2 mg/dl as defined by clinical presentation by nephrologist will be included in the study.

Exclusion criteria: Patients presenting with systemic inflammatory disease, liver disease, congestive heart failure, malignancy, and AIDS were excluded from the study. Patients on treatment with ACE inhibitors, lipid lowering agents, anti-inflammatory drugs, anti-oxidant and multivitamin supplements were excluded from the study.

According to the pathological classification of Tervaert et al. (2010) based on glomerular lesions and GFR rate the 310 type 2 DN patients were categorized into stages: stage-1: 33 (10.64%), stage-2: 49 (15.8%), stage-3: 112 (36.1%), stage-4: 78 (25.16%), and stage-5: 38 (12.25%). The study protocol was approved by the ethical committee of the institution, written informed consent was obtained from all the subjects.

Covariables

In the present study covariables include gender, age, body mass index (BMI), diabetes, hypertension, serum creatinine, glomerular filtration rate (GFR), hyperlipidemia, urea, diet, smoking and alcohol. The BMI of the subjects was computed by dividing the body weight by square of the height. The blood pressures of subjects were measured with sphygmo-manometer by clinician, hypertension was defined as systolic blood pressure >130 mm/Hg and/or diastolic pressure >80 mm/Hg.

Alkaline Picrate method used for estimation of creatinine in serum. GFR values were calculated by Cockcroft-Gault equation. Ccr= {((140-age) × Weight)/72 × Scr} × 0.85 (if female). Diacetyl Monoxime (DAM) method is used for determination of urea in serum. Smoking and alcoholism were defined as positive for current smokers and alcoholics.

Blood sample collection

From each subject 8ml of blood sample was drawn in the morning after a 12 h fast (from 8 pm to 8 am) and in the afternoon 1 h after lunch; where, 4 ml of the blood sample was collected in EDTA tubes for the determination of glycated hemoglobin and comet assay. 4 ml of blood sample was collected in a clot activator tube and left to clot to obtain serum, which was used for the other biochemical estimations like glucose, lipids, immune-inflammatory and oxidative stress markers.

Estimation of biochemical markers

Fasting blood sugar (FBS) and postprandial blood sugar (PLBS) were analyzed by ERBA kit (Transasia, Germany), glycosylated hemoglobin (HbA1c) was measured by Fluckiger and Winterhalter calorimetric method [6].

Lipid profile (Total cholesterol (TC), Triglyceride (TG), High density lipoprotein cholesterol (HDL-C) were carried out by commercially available kits (ERBA, Transasia, Germany). LDL-C was calculated using the Friedewald's formula: LDL-C = total cholesterol – (HDL – triglycerides/5) mg/dL [7].

Serum adenosine deaminase (ADA) levels were estimated by the method of Giusti and Galanti (1981) [8] and serum circulating levels of C-reactive protein (CRP) were determined by Immunoturbidimetric method using RHELAX-CRP kit (Latex Agglutination slide test for detection of CRP) [TULIP diagnostics (P) LTD., INDIA].

Oxidative stress markers, MDA was measured by thiobarbituric acid (TBA) using Meloni et al., (1992) [9] method. Nitric oxide was estimated using Griess reagent (1:1 mixture of 1% sulphanilamide in 5% H3PO4 and 0.1% N-[1-naphthyl] ethylene diamine) using Lepoivre et al., (1990) [10] method, DNA damage was assessed by Comet assay using Singh et al., [11] and Ahuja (1999) [12] methods.

Statistical analysis

All statistical analyses were performed with online statistical software tools such as Open Epi version 3.03. Differences in demographic, clinical, and biochemical variables were statistically analyzed by one-way ANOVA in type 2 DN patients and healthy controls. All p-values ≤ 0.05 were considered statistically significant. All numeric values are expressed as the mean ± SD. Pearson's correlation coefficient (r) was used to quantify continuous variables such as hyperglycemia (fasting and postprandial), HbA1c, lipid profiles, ADA, CRP with oxidative stress markers using SPSS statistical software (version 20).

Results

The distribution of baseline demographic and biochemical data in healthy individuals (310) and type 2 DN patients (310) are represented in (Table 1 and Figure 1) and among type 2 DN stages are depicted in (Table 2 and Figure 2). With respect to age no significant difference observed between controls and type 2 DN patients (Table 1) however the mean age of patients in stage 4 and 5 was high when compared to patients in stages 1, 2 and 3 but no significant difference observed among the type 2 DN clinical stages (Table 2). The number of males was more than that of females in the patient population. Mixed diet, habit of smoking and alcohol consumption were also higher in-patient population (Figure 1).

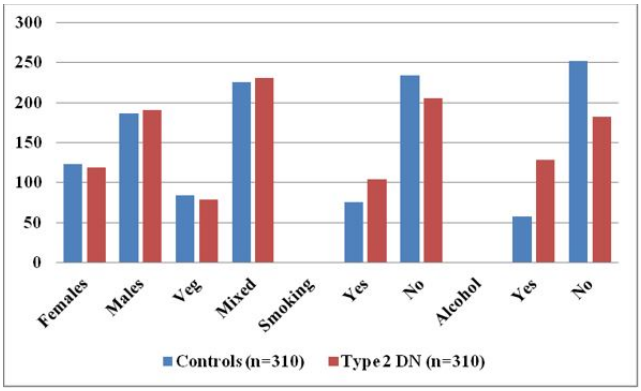


Figure 1: Demographic data in controls and type 2 DN patients.

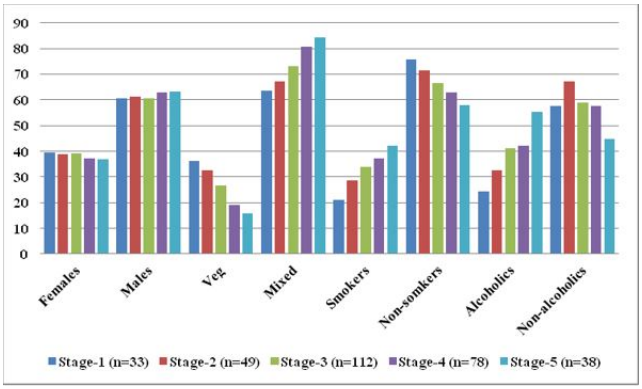


Figure 2: Demographic data of patients among type 2 DN stages.

Variables	Controls (N=310)	Type 2 DN (N=310)	p-value
Age (years)	52.84 ± 7.99	56.92 ± 8.77	0.1
Systolic BP (mmHg)	121.23 ± 7.37	136.5 ± 13.99	0.01*
Diastolic BP (mmHg)	80.88 ± 7.02	86.32 ± 14.66	0.01*

HBA1c	5.12 ± 2.65	10.66 ± 5.78	0.01*
Serum Creatinine (mg/dL)	0.91 ± 0.24	2.04 ± 0.38	0.01*
Urea (mmol/24h)	18.16 ± 4.63	96.17 ± 7.17	0.01*
*Significant at p<0.01			

Table 1: Baseline and biochemical parameters in controls and type 2 DN patients.

Parameter	Stage- 1 (N=33)	Stage- 2 (N=49)	Stage- 3 (N=112)	Stage- 4 (N=78)	Stage- 5 (N=38)	p-value
Age (years)	54.30 ± 8.99	54.69 ± 8.84	56.59 ± 8.84	59.11 ± 7	59.92 ± 10.20	0.72
BMI (kg/m^2)	25.44 ± 3.16	25.80 ± 4.21	25.82 ± 4.72	26.48 ± 3.81	25.33 ± 4.10	0.61
Systolic BP (mmHg)	134.24 ± 10.79	135.12 ± 12.19	135.20 ± 14.83	138.28 ± 15.88	139.69 ± 16.29	0.04*
Diastolic BP (mmHg)	83.48 ± 12.77	84.12 ± 14.18	86.55 ± 14.96	87.92 ± 15.12	89.53 ± 16.30	0.02*
HbA1c (%)	9.83 ± 4.24	9.93 ± 5.28	10.62 ± 5.92	10.80 ± 6.53	12.14 ± 6.94	0.03*
Serum Creatinine (mg/dL)	1.26 ± 0.21	1.37 ± 0.26	1.9 ± 0.34	2.5 ± 0.48	3.22 ± 0.62	0.01*
Urea (mmol/24h)	80.95 ± 4.91	90.23 ± 5.82	98.64 ± 7.82	100.41 ± 8.55	110.62 ± 8.75	0.01*
*Significant at p<0.01						

Table 2: Baseline and biochemical parameters in different stages of type 2 DN.

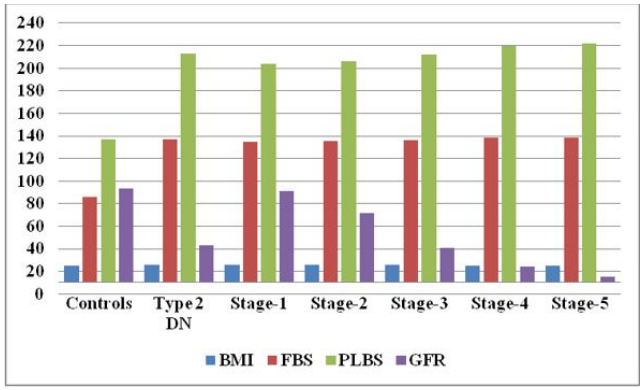


Figure 3: Clinical parameters in the study population.

The distribution of clinical parameters BMI, FBS, PLBS and GFR in the study population are represented in Figure 3. There was no significant difference with respect to BMI among the study subjects. Glycemic parameters FBS and PLBS levels were higher in patient and showed a gradual increase in different stages of type 2 DN compared to controls (p<0.01). Serum creatinine and GFR are commonly used parameters to indicate renal dysfunction [13]. The GFR values showed decreasing trend among type 2 DN stages suggesting the reduced kidney function from stage-1 to stage-5 (Figure 3).

Lipid profiles of the study subjects are represented in Figure 4. Our results revealed that TC, TG, LDL levels were significantly higher in type 2 DN stages compared to controls (p<0.01), whereas LDL levels were significantly increased in type 2 DN stages from stage-1 to stage 5 compared to controls (p<0.01). The mean SBP and DBP values were significantly high in type 2 DN compared to controls (p<0.01) (Table 1) and there was a progressive increase in SBP and DBP values from stage 1 to stage 5 which was also found to be significant at (p<0.04) and (p<0.02). Mean HbA1c levels of type 2 DN found to be more than that of controls which was found significant at (p<0.01) (Table 1). The mean HbA1c levels of patients also increased from stage 1 to stage 5 of type 2 DN patients (p<0.01) (Table 2). Mean serum creatinine and urea levels were found be more compared to controls which was significant at (p<0.01) (Table 1). Serum creatinine and urea levels showed gradual increase from stage-1 to stage -5 with the advanced stage of the disease which was found to be significant at (One-way ANOVA, p<0.01) (Table 2).

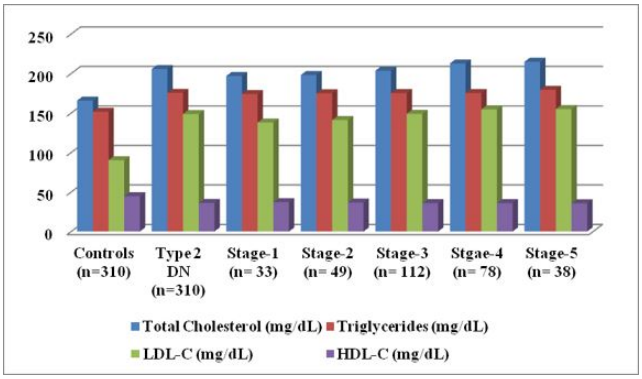


Figure 4: Lipid profiles in the study population.

The prevalence of nephropathy is strongly related to the duration of diabetes. In most individuals were with 5-10 years history of diabetes, i.e., stage 1: 69.69%, stage 2: 65.30%, and stage 3: 63.39% when compared to stage 4: 52.56% and stage 5: 26.31%. Furthermore, 38.46% of the individuals in stage 4 were presented with 10-15 yrs of type 2 DM. While 44.73% individuals in stage 5 were reported with 10-15 years and 28.94% were reported with 15-20 yrs of duration of diabetes. Overall our results indicate that longer the duration of diabetes, higher is the risk for disease progression as shown in Table 3.

Duration (years)	Stage-1 (N=33) N (%)	Stage-2 (N=49) N (%)	Stage-3 (N=112) N (%)	Stage-4 (N= 78) N (%)	Stage-5 (N=38) N (%)
5-10	23 (69.69)	32 (65.30)	71 (63.39)	41 (52.56)	10 (26.31)
10-15	9 (27.27)	15 (30.61)	35 (31.25)	30 (38.46)	17 (44.73)
15-20	1 (3.0)	2 (4.08)	6 (5.35)	7 (8.97)	11 (28.94)

Table 3: Duration of type 2 diabetes mellitus in different stages of type 2 DN.

Immune-inflammatory markers ADA and CRP levels were found to be higher in type 2 DN patients compared to controls. The difference

in the mean values was statistically significant at p<0.01 (Table 4). The mean CRP of patients with different stages of type 2 DN patients also showed significant difference, whereas no significant difference was observed with ADA in stage wise comparison (Table 5).

In the present study oxidative stress was measured by indices of lipid peroxidation (LP) (MDA: malondialdehyde) and nitric oxide (Nitrate/Nitrite). The mean level of malondialdehyde and DNA damage (Comet tail length) were significantly higher in type 2 DN patients compared to controls as shown in Table 4 and Figure 5. In the present study the mean levels of MDA and DNA damage in patients with different stages of type 2 DN patients also showed a gradual increase of these oxidative stress markers from stage 1 to stage 5 (One-way ANOVA, p<0.01) (Table 5). The mean NO levels in type 2 DN patients were high compared to controls which was significant at p<0.01 shown in Table 4, whereas no significant result was observed among type 2 DN patients among different clinical stages (Table 5).

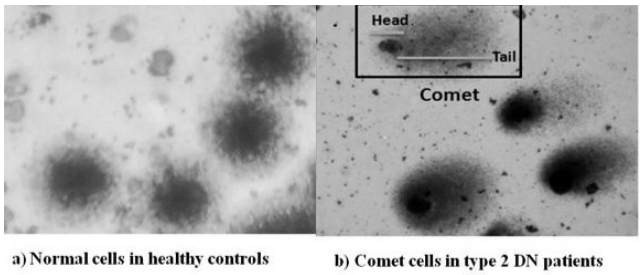


Figure 5: Representative microscopic appearances of comet assay.

Parameter	Biochemical variables	Controls (N=310)	Type 2 DN (N=310)	p-value
	CRP (mg/dL)	10.00 ± 6.70	47.51 ± 14.69	0.01†
Immune-inflammatory markers	ADA (nmoles/mL)	15.69 ± 5.55	36.02 ± 11.17	0.01†
	NO (µmoles/mL)	1.89 ± 0.79	3.51 ± 1.35	0.01†
Oxidative stress markers	MDA (nmoles/mL)	2.08 ± 1.37	7.86 ± 2.69	0.01†
	DNA Damage (µm)	10.55 ± 1.68	23.48 ± 6.40	0.01†
†Significant at p<0.01				
All the variables are expressed as mean ±SD				

Table 4: Immune-inflammatory and oxidative stress markers in controls and type 2 DN patients.

Hyperglycemic markers (FBS, PLBS and HbA1c) were correlated with oxidative stress markers and found that FBS was significantly associated with MDA and NO (r=0.004, r=0.023, p<0.05), PLBS was found to be significantly associated with MDA, NO and DNA damage (r=0.052, r=0.046, r=0.016, p<0.05) and HbA1c was found to be significantly associated with MDA and DNA damage (r=0.035, r=0.037, p<0.05) (Table 6).

Lipid profiles when correlated with oxidative stress markers have revealed that TC was significantly associated with MDA and DNA damage (r=0.009, r=0.042, p<0.05), TG was found to be significantly associated with DNA damage ((r=0.035, p<0.05) and LDL-C was found to be significantly associated with MDA, NO and DNA damage (r=0.014, r=0.004, r=0.023, p<0.05), while HDL-C was found to be negatively associated with MDA (r=-0.027, p<0.05) (Table 6).

Immune-inflammatory markers CRP, was found to be significantly associated with MDA, NO and DNA damage (r=0.026, r=0.041, r=0.035, p<0.05) (Table 6), whereas ADA has shown no significant association with oxidative stress markers.

Blood glucose, lipid profile and inflammatory markers were correlated with oxidative stress markers and our results have shown that PLBS (r=0.052, r=0.046, r=0.016, p<0.05), LDL-C (r=0.014, r=0.004, r=0.023, p<0.05) and CRP (r=0.026, r=0.041, r=0.035, p<0.05) were strongly associated with all the oxidative stress markers (MDA, NO, DNA damage respectively) (Table 6).

Discussion

Type 2 diabetic nephropathy is a multifactorial and most prevalent complication of diabetes mellitus worldwide accounting for nearly 44 percent of new cases [14]. Type 2 DM gradually affects the kidneys and kidney failure is the final stage of type 2 DN. The diabetic prevalence has extended epidemic magnitudes worldwide and is expected to rise to 350 million people by the year 2035 [15]. The risk factors for type 2 DN progression include genetic, environmental and metabolic factors like blood pressure, blood lipids, glycemic control, duration of diabetes, smoking, glomerular hypertension, inflammation, and oxidative stress worsen albuminuria.

Long-standing hyperglycemia may directly increase the mesangial cell glucose concentration and results in mesangial expansion and injury. Initially, the glomerular mesangium expands by cell proliferation and then by cell hypertrophy, this expansion is stimulated by an increase in mesangial stretch and pressure, as can high glucose levels. Hyperglycemia aggravates glomerular lesions and metabolic effects of long standing hyperglycemia causes AGE production that binds to collagen and causes renal complications. AGE containing protein increases PKC and TGFβ which plays an important role in cell proliferation, differentiation and mesangial cell apoptosis. Recent studies by researchers showed the increase of FBS and PLBS levels in type 2 DN patients [16-19]. In our study, we observed that patients in stage 5 with type 2 diabetes with more aged had significantly higher blood glucose levels compared to patients in stage 1, 2, 3 and 4.

In the blood and kidneys circulation glucose combines with proteins and forms advanced glycosylation end products (AGEs), such as glycosylated proteins of the basement membrane of the renal glomerulus contributing to increased diabetic complications [20]. Higher levels of HbA1c were associated with increased risk for development of type 2 DN. Our study was consistent with the reports by Timothy and Peter [21] where variations in HbA1c levels were strongly associated with DN in patients with type 2 diabetes. The mean HbA1c levels of patients with different stages of type 2 DN patients as depicted in Table 1, show increased levels of HbA1c from stage 1 to stage 5 indicating the severity of the disease and the results are consistent with the study observed by Chen et al., [22]. Previous studies have shown that patients with HbA1c >8% are at higher risk for renal diseases [23]. Studies by Williams & Garg [24] have revealed a significant association of HbA1c with clinical stages of diabetic

nephropathy, where higher HbA1c levels were associated with stage 3 and stage 4 and increased risk of mortality in diabetic nephropathy patients.

Previous studies by Daiji Kawanami et al., [25] and Chehade et al., [26] have shown that dyslipidemia facilitates glomerulosclerosis under diabetic conditions. Dyslipidemia complicated with diabetes has been shown to be involved in the development of type 2 DN. Dyslipidemia in type 2 diabetes is characterized by an increase in VLDL, LDL and TG and a decrease in HDL [27,28]. In the present study, we have observed high levels of triglycerides, VLDL, LDL and low levels of HDL in type 2 DN compared to controls. These findings agreed with Jyothi Dwivedi and Sarkar [29] reports where the levels of each of T-C, TAG and LDL in type 2 DN progression was significantly increased. However, in stage wise comparison there was no significant difference observed except for LDL which showed significant at $p<0.05$.

Hyperglycemia is also associated with increased levels of ADA and CRP, playing an important role in modulation of insulin action on glucose and lipid [30,31] ADA may serve as an immune-enzyme marker in the etiopathology of type 2 DN. In a study, Prakash et al., [32] reported elevated serum ADA activity in patients with type 2 diabetes mellitus. It has been observed, with higher ADA activity in insulin-sensitive tissues, glucose uptake into cells is reduced; thus, if ADA activity is suppressed, insulin sensitivity may be improved. The high plasma ADA activity might be due to abnormal T-lymphocyte responses or proliferation. In the present study, significantly higher ADA levels were found in cases compared to controls suggesting that ADA plays a key role in the pathophysiology of type 2 DN due to altered insulin related T-lymphocyte function [33] similar association was reported in our earlier studies on Rheumatoid Arthritis patients and Unstable Angina [34].

Hyperglycemia, insulin resistance, oxidative stress and innate immune system activation results in chronic inflammation playing a crucial role in perpetuating renal damage and progression of type 2 DN [35-37]. Dalla Vestra et al., [38] reported that patients with type 2 diabetes and overt nephropathy exhibit the highest levels of acute phase markers of inflammation, including C-reactive protein (CRP). In our study, CRP levels were found to be higher in type 2 DN subjects compared to controls. Our results also showed a significant association of high CRP levels with low GFR values in the advanced stage of type 2 DN. The CRP levels found is more in stage 4 and 5 compared to stage 1, 2 and 3 indicating the highly active inflammatory response during the late stages of type 2 DN (Table 5).

Parameter	Biochemical variables	Stage- 1 (n= 33)	Stage- 2 (n= 49)	Stage- 3 (n= 112)	Stage- 4 (n= 78)	Stage- 5 (n= 38)	p-value
Immune-inflammatory markers	CRP (mg/dL)	44.16 ± 12.22	44.78 ± 12.26	46.37 ± 13.62	49.59 ± 16.07	53.06 ± 17.88	0.01†
	ADA (n moles/mL)	32.68 ± 9.93	35.77 ± 10.33	35.29 ± 11.64	37.14 ± 11.21	39.09 ± 11.24	0.78
Oxidative stress markers	NO (µmoles/mL)	3.22 ± 1.24	3.50 ± 1.21	3.51 ± 1.48	3.59 ± 1.41	3.89 ± 1.81	0.01†
	MDA (n moles/mL)	7.59 ± 2.47	7.71 ± 2.26	7.78 ± 3.03	8.05 ± 2.79	8.17 ± 2.15	0.01†
	Comet tail length (µm)	19.36 ± 4.5	22.10 ± 5.53	22.30 ± 5.19	26.28 ± 7.13	26.58 ± 7.07	0.01†
†Significant at $p<0.01$							
All the variables are expressed as mean ±SD							

Table 5: Immune-inflammatory & oxidative stress markers in different stages of type 2 DN patients.

In type 2 DN a significant increase of these oxidative stress markers with hyperglycemia was also observed. The role of chronic hyperglycemia in type 2 DN is thought to alter metabolism which creates oxidative stress and induces apoptotic glucose responsive cells.

Hyperglycemia represents the main cause of complication of DM, growing evidence shows that AGEs and their signal-transducing receptor interaction increases oxidative stress and subsequently elicits vascular inflammation and thrombosis resulting from the increased generation of ROS, playing a major role in the development of type 2 DN [39]. The generation of ROS has long been recognized as a typical consequence of both chronic inflammatory state and immune cell stimulation [5,36,40]. In type 2 DN a significant increase of the oxidative stress markers MDA, NO, DNA damage with hyperglycemia was seen and our results were consistent with reports by Kedziora-Kornatowska et al., [41], where increased lipid peroxidation in erythrocytes of patients with type 2 DN was observed. Ha et al., (2001) [42] also observed increased lipid peroxidation product (MDA) in proximal tubular epithelial cells. The results of the present study also revealed that the mean values of MDA in type 2 DN patients were significantly higher than that of the controls as observed by earlier studies and further we also found a significant difference between the patients with different stages of type 2 DN.

Over the last decade, a remarkable burst of evidence has accumulated, offering the new perspective that nitric oxide (NO) plays a pivotal role in DN. ROS and NO react in pathophysiological conditions, to generate dinitrogen trioxide and peroxynitrite the two toxic reactive nitrogen species that cause significant damage to cellular components (nucleic acid, proteins, membranes) leading to chromosomal alterations, subsequent cellular dysfunction, and cellular death [43]. Excess ROS modulate protein kinase C activation, mitogen-activated protein kinases, and various cytokines and transcription factors that increase the expression of ECM genes towards progression to ESRD. ROS induces the activation of renin-angiotensin system (RAS), further worsens the renal injury in diabetic nephropathy.

Renal disease in diabetes is found to be associated with abnormalities of vasodilatation and generates ROS mediated by endothelial derived NO, suggesting linkage between vascular and metabolic abnormalities. Sharma et al., [44] observed a positive correlation between serum NO levels, GFR, and albuminuria, suggesting a link between NO, glomerular hyperfiltration and

microalbuminuria. Similarly, we have also observed high levels of nitrite/nitrate in type 2 DN patients compared to healthy controls which are in accordance with earlier report, but no significant difference was observed among patients with different stages of type 2 DN (Table 5).

High glucose increases ROS production in vascular cells and in renal cells including mesangial cells and tubular epithelial cells [45]. Increased ROS formation contributes to endothelial dysfunction, vessel wall thickening and lesion formation thereby playing a crucial role in the progressive deterioration of vascular structure and function [46].

ROS and their byproducts can cause oxidative damage which may be cytotoxic and may have some deleterious effects on DNA causing oxidative DNA damage resulting in cell death, loss of heterozygosity, translocations, and chromosome loss [47]. AGE-induced TGFβ expression causes glomerular basement membrane thickening, obstruction of arteries, mesangial apoptosis and dysfunction may contribute in part to glomerular hyperfiltration. Simone et al., [48] reported the presence of leukocyte DNA damage by high performance liquid chromatography in type 2 DN patients. In the present study, we have assessed the DNA damage (Comet tail length) using the comet assay and found that there is a significant increase in DNA damage in type 2 DN patients compared to controls.

Our study reports that patients with type 2 DN had increased levels of oxidative stress markers (MDA, Nitric oxide and DNA damage). Therefore, it might be suggested that hyperglycemia increases the oxidative stress and causes more DNA damage as observed in the late stages of type 2 DN stage- 4, 5 compared to stage-1, 2 and 3 (Table 5).

Further blood glucose, lipid profile and inflammatory markers were correlated with oxidative stress markers and our results have shown that PLBS, LDL-C and CRP were strongly associated with all the oxidative stress markers (MDA, NO, DNA damages respectively) under study ($p<0.05$) (Table 6).

Oxidative stress markers				
		MDA	**NO**	**Comet tail length (r)**
Glucose profile	FBS	0.004†	0.023*	0.076
	PLBS	0.052*	0.046*	0.016*
	HbA1c	0.035*	0.112	0.037*
Lipid profile	TC	0.009†	0.095	0.042*
	TG	0.113	0.12	0.035*
	LDL-C	0.014*	0.004†	0.023*
	HDL-C	-0.027*	0.36	0.065
Immune-inflammatory Markers	ADA	0.085	0.144	0.106
	CRP	0.026*	0.041*	0.035*
*Correlation is significant at the level 0.05 level (2-tailed)				
†Correlation is significant at the level 0.01 level (2-tailed) (p<0.01)				

Table 6: Pearson's correlation between blood glucose markers, lipid profile markers and Immune-inflammatory markers with oxidative stress markers (MDA, NO, DNA damage (Comet tail length)) in type 2 DN patients.

Conclusion

Type 2 end-stage renal disease is a devastating condition, blood glucose control is critical in preventing or slowing the progression of renal damage. Thus, from the above study, we conclude that hyperglycemia mediated regulation of immune-inflammation and oxidative stress have a significant role on development and progression of type 2 DN. Understanding the development of diabetic nephropathy and its progression into ESRD is important for the interpretation of clinical studies which helps in early diagnosis, prognosis and therapeutics.

Acknowledgements

This study was supported by contingency grant from the UGC-BSR-RFSMS and UGC-MJRP for providing consumables. The sponsors of the study had no role in study design, data collection and analysis or writing of the manuscript. The authors thank all the participants in this research and special thanks are extended to medical staff of the Nizams Institute of Medical Sciences (NIMS), for their assistance.

References

1. Chan JC, Malik V, Jia W, Kadowaki T, Yajnik CS, et al. (2009) Diabetes in Asia: epidemiology, risk factors, and pathophysiology. Jama 301: 2129-2140.
2. Vos FE, Schollum JB, Coulter CV, Manning PJ, Duffull SB, et al. (2012) Assessment of markers of glycaemic control in diabetic patients with chronic kidney disease using continuous glucose monitoring. Nephrology 17: 182-188.
3. Andy KH, Lim (2014) Diabetic nephropathy complications and treatment. Int J Nephrol Renovasc Dis 7: 361-381.
4. Cheng W, Hua S, Chun Z (2016) Role of NADPH Oxidase in Metabolic Disease-Related Renal Injury: An Update. Oxid Med Cell Longev Article ID 7813072: 8.
5. Hojs R, Ekart R, Bevc S, Hojs N (2016) Markers of Inflammation and Oxidative Stress in the Development and Progression of Renal Disease in Diabetic Patients. Nephron 133: 159-162.
6. Asgary S, Naderi GH, Sarrafzadegan N, Ghassemi N, Boshtam M, (1999) Anti-oxidant effect of flavonoids on hemoglobin glycosylation. Pharmaceutica Acta Helvetiae 73: 223-226.
7. Friedewald WT, Levy RI, Fredrickson DS (1972) Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clin Chem 18: 499-502.
8. Giusti G, Galanti B, Gaeta GB, Piccinino F, Ruggiero G (1981) HBsAg carriers among blood donors in Italy- a retrospective survey of data from 189 blood banks. Hepato-gastroenterology 28: 96-98.
9. Meloni T, Forteleoni G, Meloni GF (1992) Marked decline of favism after neonatal glucose-6-phosphate dehydrogenase screening and health education: the northern Sardinian experience. Acta haematological 87: 29-31.
10. Lepoivre M, Chenais B, Yapo A, Lemaire G, Thelander L, et al. (1990) Alterations of ribonucleotide reductase activity following induction of the nitrite-generating pathway in adenocarcinoma cells. Journal of Biological Chemistry 265: 14143-14149.
11. Singh J, Comfort SD, Shea PJ (1998) Remediating RDX-contaminated water and soil using zero-valent iron. Journal of environmental quality 27: 1240-1245.
12. Ahuja YR, Vijayashree B, Saran R, Jayashri EL, Manoranjani JK, et al. (1999) In vitro effects of low-level, low-frequency electromagnetic fields on DNA damage in human leucocytes by comet assay 36: 318-322.
13. Euan AS, Neeraj D, James W, David JW (2013) Measurement of renal function in patients with chronic kidney disease. Br J Clin Pharmacol 76: 504-515.

14. Martinez-Castelao A, Navarro-Gonzalez JF, Gorriz JL, Alvaro F (2015) The concept and the epidemiology of diabetic nephropathy have changed in recent years. Journal of clinical medicine 4: 1207-1216.
15. Gheith O, Farouk N, Nampoory N, Halim MA, Al-Otaibi T (2016) Diabetic kidney disease: worldwide difference of prevalence and risk factors. Journal of Nephropharmacology 5: 49.
16. Lipska KJ, Krumholz H, Soones T, Lee SJ (2016) Polypharmacy in the aging patient: a review of glycemic control in older adults with type 2 diabetes. Jama 315: 1034-1045.
17. Schwartz AV, Vittinghoff E, Sellmeyer DE, Feingold KR, De Rekeneire N, et al. (2008) Diabetes-related complications, glycemic control, and falls in older adults. Diabetes care 31: 391-396.
18. Shurraw S, Hemmelgarn B, Lin M, Majumdar SR, Klarenbach S, et al. (2011) Alberta Kidney Disease Network Association between glycemic control and adverse outcomes in people with diabetes mellitus and chronic kidney disease: a population-based cohort study. Archives of internal medicine 171: 1920-1927.
19. Ricks J, Molnar MZ, Kovesdy CP, Shah A, Nissenson AR, et al. (2012) Glycemic control and cardiovascular mortality in hemodialysis patients with diabetes. Diabetes 61: 708-715.
20. Helen V (1996) Protein glycation in the kidney: Role in diabetes and aging. Kidney International 49: 1795-1804.
21. Timothy CE, Peter C (2000) Diabetic Nephropathy. Clinical Diabetes 18: 1.
22. Chen HS, Wu TE, Lin HD (2010) Hemoglobin A(1c) and fructosamine for assessing glycemic control in diabetic patients with CKD stages 3 and 4. Am J Kidney Dis 55: 867-874.
23. Jawa A, Kcomt J, Fonseca VA (2004) Diabetic nephropathy and retinopathy. Medical Clinics 88: 1001-1036.
24. Williams ME, Garg R (2014) Glycemic management in ESRD and earlier stages of CKD. American journal of kidney diseases 63: S22-S38.
25. Kawanami D, Matoba K, Utsunomiya K (2016) Dyslipidemia in diabetic nephropathy. Renal Replacement Therapy 2: 16.
26. Chehade JM, Gladysz M, Mooradian AD (2013) Dyslipidemia in type 2 diabetes: prevalence, pathophysiology, and management. Drugs 73: 327-339.
27. Mooradian AD (2009) Dyslipidemia in type 2 diabetes mellitus. Nature Reviews Endocrinology 5: 150.
28. Parveen K, Siddiqui WA, Kausara MA, Kuddusa M, Syed Monowar AS (2016) Diabetic Nephropathy – A Major Macrovascular Complication. International Journal of Pharmaceutical Research & Allied Sciences 5: 132-158.
29. Dwivedi J, Sarkar PD (2017) The study of lipid profile, LP (a) and electrolytes with oxidative stress, total protein and albumin in nephrotic syndrome. J Res Med Sci Title 2: 62-66.
30. Gohe MG, Sirajwala HB, Kalaria TR, Kamariya CP (2013) A study of serum adenosine deaminase level in patients with type 2 diabetes mellitus and its correlation with glycemic control. Int J Res Med Appl Sci 2: 259-267.
31. Ramu A, Susheel Kumar N, Pankaj KB, Ayan KB, Saidulu M, et al. (2015) Hyperglycaemia Enhances Nitric Oxide Production in Diabetes: A Study from South Indian Patients. PLoS One 10: e0125270.
32. Shiva Prakash M, Chennaiah S, Murthy YSR, Anjaiah E, Ananda Rao S, et al. (2006) Altered Adenosine Deaminase Activity in Type 2 Diabetes Mellitus. JIACM 7: 114-117.
33. Mon Mohan B, Deepika L, Barnali BT (2015) A study of serum adenosine deaminase activity in type 2 diabetes mellitus with and without complications and its co-relation with serum uric acid level in glycemic control. Int J App Basic Med Res 5: 619-633.
34. Surekha Rani H, Madhavi G, Srikanth BMV, Jharna P, Rao URK, et al. (2006) Serum ADA and C - reactive protein in Rheumatoid Arthritis. Int J Hum Genet 6: 195-198.
35. Pickup JC (2004) Inflammation and activated innate immunity in the pathogenesis of type 2 diabetes. Diabetes care 27: 813-823.
36. Mima A (2013) Inflammation and oxidative stress in diabetic nephropathy: new insights on its inhibition as new therapeutic targets. J Diabetes Res 2013: 1-8.
37. Vozarova B, Weyer C, Hanson K, Tataranni PA, Bogardus C, et al. (2001) Circulating interleukin-6 in relation to adiposity, insulin action, and insulin secretion. Obesity 9: 414-417.
38. Dalla Vestra M, Mussap M, Gallina P, Bruseghin M, Cernigoi AM, et al. (2005) Acute-phase markers of inflammation and glomerular structure in patients with type 2 diabetes. Clin J Am Soc Nephrol 16: S78-S82.
39. Dwivedi J, Sarkar PD (2010) Oxidative stress with homocysteine, lipoprotein (A) and lipid profile in diabetic nephropathy 1: 340-350.
40. Muriach M, Flores-Bellver M, Romero FJ, Barcia JM (2014) Diabetes and the brain: oxidative stress, inflammation, and autophagy. Oxid Med Cell Longev 2014: 1-9.
41. Kedziora-Kornatowska KZ, Luciak M, Blaszczyk J, Pawlak W (1998) Lipid peroxidation and activities of antioxidant enzymes in erythrocytes of patients with non-insulin dependent diabetes with or without diabetic nephropathy. Nephrology, dialysis, transplantation: official publication of the European Dialysis and Transplant. Nephrol Dial Transplant 13: 2829-2832.
42. Ha H, Lee HB (2001) Oxidative stress in diabetic nephropathy: basic and clinical information. Curr Diab Rep 1: 282-287.
43. Routledge MN, Wink DA, Keefer LK, Dipple A (1994) DNA sequence changes induced by two nitric oxide donor drugs in the supF assay. Chem Res Toxicol 7: 628-632.
44. Sharma K, Danoff TM, DePiero A, Ziyadeh FN (1995) Enhanced expression of inducible nitric oxide synthase in murine macrophages and glomerular mesangial cells by elevated glucose levels: possible mediation via protein kinase C. Biochem Biophys Res Commun 207: 80-88.
45. Ha H, Lee HB (2000) Reactive oxygen species as glucose signaling molecules in mesangial cells cultured under high glucose. Kidney Int 58: S19-S25.
46. Cervelli T, Borghini A, Galli A, Andreassi MG (2012) DNA damage and repair in atherosclerosis: current insights and future perspectives. International journal of molecular sciences 13: 16929-16944.
47. Shrivastav M, De Haro LP, Nickoloff JA (2008) Regulation of DNA double-strand break repair pathway choice. Cell research 18: 134.
48. Simone S, Gorin Y, Velagapudi C, Abboud HE, Habib SL (2008) Mechanism of oxidative DNA damage in diabetes. Diabetes 57: 2626-2636.

ScienceDirect

Gene

Supports *open access*

7
CiteScore

3.913
Impact Factor

Submit your article | Guide for authors

Menu | Search in this journal

Latest issue

Volume 874

In progress • 20 July 2023

About the journal

!!! Important information for NIH authors !!!

Gene publishes papers that focus on the **regulation**, **expression**, **function**, and **evolution** of **genes** in all biological contexts, including all prokaryotic and eukaryotic organisms, as well as viruses.

Gene strives to be a very diverse journal, and topics in all fields will be considered for ...

View full aims & scope

$2940
Article Publishing Charge for open access

3.4 weeks
Time to First Decision

6 weeks

1.1 weeks

FEEDBACK

9 weeks
Review Time

14 weeks
Publication Time

View all insights

Editor-in-Chief | View full Editorial Board

Marianna Kruithof-de Julio, PhD

University of Bern, Department for BioMedical Research, Bern, Switzerland

Articles

Latest published | Articles in press | Top cited | Most downloaded | Most popular

Review article ○ Abstract only

CRISPR/Cas9-based gene-editing technology for sickle cell disease

Liangliang Ma, ... Jing Zhang

20 July 2023

Research article ○ Abstract only

A novel SLC25A13 gene splice site variant causes Citrin deficiency in an infant

Nimrod Sachs, ... Naama Orenstein

20 July 2023

Research article *Open access*

Molecular profiling of osteoprogenitor cells reveals FOS as a master regulator of bone non-union

Federico La Manna, ... Panagiotis Chouvardas

20 July 2023

View PDF

Research article ○ Abstract only

Genome-wide identification and expression pattern analysis of lipoxygenase genes of chickpea (*Cicer arietinum* L.) in response to accelerated aging

Rinku Malviya, ... Dipak Gayen

20 July 2023

Research article ○ Abstract only

A Na^+/H^+ antiporter-encoding salt overly sensitive 1 gene, *LpSOS1*, involved in positively regulating the salt tolerance in *Lilium pumilum*

Yue Yang, ... Jun Ming

20 July 2023

Research article ○ Abstract only

Genetic variants in *Mammalian STE20-like protein kinase 2* were associated with risk of NSCL/P

Xinze Xu, ... Yongchu Pan

15 July 2023

Research article ○ Abstract only

Functional analysis of *selenok*, *selenot* and *selenop* promoters and their regulation by selenium in yellow catfish *Pelteobagrus fulvidraco*

Jiang Ke, ... Zhi Luo

15 July 2023

Research article ○ Abstract only

Exploration of the ancestral inference effectiveness of 126 AI-SNPs and the genetic feature of Inner Mongolian Manchu group

Yunying Zhang, ... Bofeng Zhu

15 July 2023

Read latest issue

Calls for papers

Plant environmental and nutritional stress signaling, adaptive mechanism and crop improvement (1)

Guest editors: Houqing Zeng, Dawei Xue, & Yongbo Hong - Submission deadline: 31 July 2023

Environmental stresses such as soil nutrient limitations accompanied by other abiotic stress such as salinity and drought are major environmental and nutritional conditions that impair plant growth, productivity and quality. With the continuous ...

Recent advances in gene activation with implications in disease pathogenesis and therapeutic development.

Guest editors: Sukesh R. Bhaumik - Submission deadline: 30 June 2023

Eukaryotic gene expression is a complex process for protein biosynthesis required for maintenance of normal cellular functions. Gene expression starts in the nucleus with transcription initiation at the promoters via the formation of the PIC ...

Functional genes and genetic regulation associated with fate of xenobiotics in plants

Guest editors: Dr. Jing Jing Zhang & Dr. Zhi Min Yang - Submission deadline: 31 May 2023

Environmental xenobiotics, such as antibiotics, pesticides, microplastics, heavy metal, and polycyclic aromatic hydrocarbons are environmentally persistent and easy to accumulate in organisms. These xenobiotics are widespread in ecosystems and easy ...

View all calls for papers for special issues

More opportunities to publish your research:

Browse open Calls for Papers beta

Special issues and article collections

Multidisciplinary attempts for getting evidence on the molecular as well as gene expression levels for the efficacies of traditional medicines

Edited by Norihiro Okada, Kazushige Mizoguchi, Takashi Gojobori

9 November 2022

Gene Wiki Review

Edited by Andre J. van Wijnen, Andrew I. Su, Erica Golemis, Ginger Tsueng, Israel Hanukoglu

5 May 2022

Special Issue on Oddpols 2021

Edited by Astrid Engel

21 October 2021

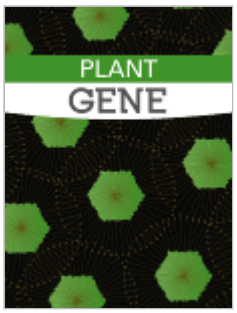
Articles initially published in Gene: X 5, 2020

December 2020

View all special issues and article collections

View all issues

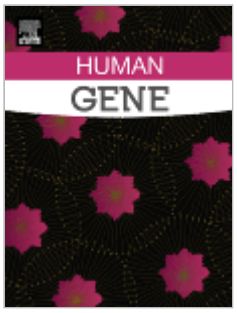
Partner journals



Plant Gene

Supports *open access*

Animal Gene



Human Gene

Gene Reports

Related journals

Animal Gene

Animal Gene

Gene Reports

Gene Reports

Plant Gene

Plant Gene

Online ISSN: 1879-0038
Print ISSN: 0378-1119

For Authors

Track your accepted paper

Journal Finder

Researcher Academy

Rights and permissions

Journal Article Publishing Support Center

For Editors

Publishing Ethics Resource Kit

Guest Editors

For Reviewers

Reviewer recognition

Gene. 2018 Oct 5;673:22-31. doi: 10.1016/j.gene.2018.06.007. Epub 2018 Jun 5.

Collagenase-1 (-1607 1G/2G), Gelatinase-A (-1306 C/T), Stromelysin-1 (-1171 5A/6A) functional promoter polymorphisms in risk prediction of type 2 diabetic nephropathy

Srilatha Reddy Gantala [1], Mrudula Spurthi Kondapalli [1], Ramanjaneyulu Kummari [1], Chiranjeevi Padala [1], Mohini Aiyengar Tupurani [1], Keerthi Kupsal [1], Rajesh Kumar Galimudi [1], Kishore Kumar Gundapaneni [1], Kaushik Puranam [1], Nivas Shyamala [1], Swarnalatha Guditi [2], Ram Rapur [2], Surekha Rani Hanumanth [3]

Affiliations

PMID: 29883760 DOI: 10.1016/j.gene.2018.06.007

Abstract

Type 2 Diabetic Nephropathy (DN) is a common multifactorial disorder. Degradation of glomerular basement membrane (GBM) by matrix metalloproteases (MMPs) is a key event in the progression of renal disease. A functional polymorphism at position -1607 1G/2G, -1306 C/T and -1171 5A/6A has been shown to alter the transcriptional activity of MMP-1, MMP-2, and MMP-3 respectively, and also associated with several diseases contributing to inter-individual differences in susceptibility to type 2 DN. The study population consisted of 310 type 2 DN patients and 310 healthy controls. Genotypes of MMP-1, 2 and 3 were determined by PCR-RFLP assay. Gene interactions, Linkage disequilibrium, and haplotype analysis were carried out by MDR analysis and Haploview software respectively. The promoter binding sites of MMP genes were determined by using Alibaba 2.1 and the gene-gene interactions of MMPs were analyzed by GeneMania. The individuals carrying 2G allele of -1607, C allele of -1306 and 5A/6A genotype of -1171 were associated with type 2 DN susceptibility and progression from stage 1 to stage 5. 2G-5A haplotypes of MMP-1 (-1607 1G/2G) and MMP-3 (-1171 5A/6A) gene polymorphisms were found to be significantly predominant in the disease group. MDR analysis revealed a strong interaction between the genes under study. 2G allele of MMP-1, C allele of MMP-2 and 5A/6A genotype of MMP-3 were associated with susceptibility and disease progression of type 2 DN and might be used as potential markers for risk prediction and prognosis of type 2 DN.

Keywords: Diabetic nephropathy; Haplotype; LD; MDR; Matrix metalloprotease; Promoter binding sites.

Related information

GEO Profiles
Gene
Gene (GeneRIF)
MedGen
Nucleotide (RefSeq)
Nucleotide (RefSeq)
Nucleotide (Weighted)

Protein (RefSeq)
Protein (Weighted)
PubChem Compound (MeSH Keyword)
Taxonomy via GenBank
UniGene

LinkOut – more resources

Full Text Sources

Elsevier Science

Other Literature Sources

scite Smart Citations

Medical

MedlinePlus Health Information

Research Materials

NCI CPTC Antibody Characterization Program

Miscellaneous

NCI CPTAC Assay Portal

Journal Of Medical Science

IJSR
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH
PRINT ISSN NO 2277 - 8179
IF OF IJSR: 5.711 (SJIF)
PEER REVIEW, INTERNATIONAL JOURNAL
JOURNAL DOI : 10.36106/IJSR

Saturday, May,20th, 2023
12:57:36 PM
ijsr@worldwidejournals.co
+91 88 66 00 3636
Publishes on 1st Day Of Th

Current Issue

May 2023 NEW!

Online Payment

Indian Authors | **International** Authors

Join as Reviewer

Indexing & Abstracting UGC Sr.No.49217

IJSR - International Journal of Scientific Research

IJSR - International Journal of Scientific Research is a Double Reviewed,Peer Reviewed monthly print journal, accepts intensive and exclusive research works in all spheres of Medical Science from Academicians, Professors, residents in their respective medico field. The journal aims to disseminate high quality research work in the form of Original Research Papers, Case Reports, Review Reports, etc to the medical fraternity. The quality papers published are inline and acceptable by Medical Council of India (MCI), Other Statutory Authorities in India and across the World. The journal releases on every 1st of the Month.

The periphery of the Medical subject areas includes:

Anatomy	Anesthesiology	Ayurveda	Biochemistry	Cardiology
Clinical Research	Clinical Science	Community Medicine	Dental Science	
Dermatology	Diabetology	Electrotherapy	Endocrinology	Endodontic	ENT
Epidemiology	Forensic Medicine	Forensic Science	Gastroenterology	General Medicine

UGC CARE JOURNAL APPRO STATUS

NEW! IJSR is a Peer-Revie Journal and valid as pe UGC Gazette regulation minimum qualifications for appointment of teachers and academic staff in universities colleges (Date:18/07/2018) Vie More Detail

QUALIS APPROVED JOUR BRAZIL, **Click Here**

Journal Template

Download Template

General Surgery | Genetics | Gynaecology | Health Science | Healthcare
Hepatobiliary Surgery | Homeopathic | Human Genetics | Immunohaematology
Immunology | Medical Physics | Medical Science | Medicine
Microbiology | Morphology | Neonatology | Nephrology | Neurology | Neurosurgery | Nursing
Gynaecology | Oncology | Ophthalmology | Oral Medicine
Oral Pathology | Orthodontology | Orthopaedics | Paediatrics
Pathology | Periodontology | Pharma | Otolaryngology
Pharmaceutical | Pharmacology | Pharmacy | Physiology | Physiotherapy
Plastic Surgery | Prosthodontics | Psychiatry | Pulmonary Medicine | Radiodiagnosis
Radiology | Rehabilitation Science | Rheumatology | Surgery
Unani Medicine | Urology

Latest News

Google Scholar Citations

Benefits of IJSR Publication:

- ✔Quality Publication with Reasonable time
- ✔Indexed Journal with Cross Ref, Google Scholar, Index Medicus, Pubmed, Citation Index etc.
- ✔Publication Acceptable in India and Over 100 Countries
- ✔Scientific Peer Reviewed Process
- ✔Open Access Journal for Better High visibility and promotion

Most Popular Articles of the Month

SELECT * FROM months where status = 0 ORDER BY mid DESC LIMIT 1 Select * from issues where mid = '142' order by view Desc limit 5

Title : Does Alzheimer's Disease Stem From Insufficient Glucose Consumption?

Authore(s) : Mr. Amos Gelbard

Subject : Medicine

READ MORE

Title : Comparison Of Erector Spinae Plane Block & Conventional Analgesic Technique For Postoperative Pain Relief In Caesarean Section - A Prospective Randomised Study

Authore(s) : Dr. Shridhar Nathuji Chopade, Dr. Suchita Annasaheb Joshi, Dr. Chetan Gopal Agrawal, Dr. Milind Raman Raut

Subject : Anaesthesiology

READ MORE

Title : Association Of Maternal Serum Total Protein And Albumin Level With Birth Weight Of Newborn

Authore(s) : Bhuvanesh S Panwar

Subject : Medical Biochemistry

READ MORE

Title : Diagnostic Value Of Endometrial Curettage In Abnormal Uterine Bleeding (AUB) - A Histopathological Study Done At A Tertiary Health Care Centre Of South Gujarat, India

Authore(s) : Dr. Shruti Gheewala, Dr. Pinal C Shah, Dr. Sakshi Lapsiwala, Dr. Kavita Vaghasiya

Subject : Pathology

READ MORE

Title : Immunohistochemical Expression Of Vimentin In Cervical Carcinoma And Its Correlation With Clinicopathological Parameters

Authore(s) : Dr. Saudamini, Dr. Ruchee Khandelwal, Dr. Surabhi Pandey, Dr. Nidhi Johri, Dr. Shashibala Arya, Dr. Hema Pant

Subject : Histopathology

READ MORE

Journal Of Medical Science

IJSR
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH
PRINT ISSN NO 2277 - 8179
IF OF IJSR: 5.711 (SJIF)
PEER REVIEW, INTERNATIONAL JOURNAL
JOURNAL DOI : 10.36106/IJSR

Saturday, May,20th, 2023
12:58:25 PM
ijsr@worldwidejournals.co
+91 88 66 00 3636
Publishes on 1st Day Of Th

Volume : VII, Issue : V, May - 2018

Recruitment Process and Staffing Sector: A Big Data Paradigm

Vidyalakshmi. V

Abstract :

Finding the right talent is akey advantage in the recruitment and staffing sector. Internet is considered as wealth of information and data flowis abundant from a sources and directions.In the current situation recruiters find identifyingthe suitable candidates a challenging task.Presently data flow is enormousand is in eithe structured or unstructured format. It is not the amount of data that is important but the challenge isto analyse, visualize, query and update the data. Th traditional way of keying suitable words or using Boolean search might no longer be efficient and inclusive enough for the recruiters to uncover the right candidat for the job. Big data is helping all growing organizations to find their perfect engineers, developers and executives with advanced sourcing and screenin methodologies. This research paper provides an understanding about how recruitment process and staffing in an organization occurs using Big Data approach.

Keywords :

Big data data analytics algorithms recruitment process

Article: Download PDF DOI : 10.36106/ijsr

Cite This Article:

Vidyalakshmi. V, Recruitment Process and Staffing Sector: A Big Data Paradigm, INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH : Volume-7 | Issue-5 | May-2018

Number of Downloads : 178

References :