



eveline-margo fk <eveline-margo@trisakti.ac.id>
to Editor ▾

Sep 28, 2022, 5:00 PM

Dear JDDT editor and team,
I already sent all my documents for the jurnal submission.
Kindly tell me if you don't accept it all and if you can give me another email to process it.
Thank you.

Regards,
Eveline Margo
Faculty of Medicine
Universitas Trisakti
Jakarta, Indonesia
eveline-margo@trisakti.ac.id



Editor JDDT <editor,jddt@gmail.com>
to me ▾

Sep 28, 2022, 5:22 PM ☆ ↶

Dear Author,

We have received the CTA & APC of your paper.

Final proof of your paper will be sent to you within 48 hours.

...

--

Editor, Journal of Drug Delivery and Therapeutics
Website: jddtonline.info
+91-9783920207 Email: editor.jddt@gmail.com



Editor JDDT <editor,jddt@gmail.com>
to me ▾

📧 Sep 28, 2022, 11:36 PM ☆ ↶

Dear Author,

The Editorial Board of [Journal of Drug Delivery and Therapeutics \(JDDT\)](#) is pleased to inform you that your manuscript is accepted for publication in the forthcoming issue, JDDT, **Volume 12, Issue 5-S, 2022 (Available online on 15-10-2022)**.

An edited and formatted version of your article (Final Proof), which is scheduled for publication in a forthcoming issue, is attached here. You are requested to check the proofs and notify us if there is any correction in your article within 3 days.

Please ENDORSE our journal on PUBLONS. Endorsing journal helps the community to identify those with good publishing and review processes.

Our Journal PUBLONS Link: <https://publons.com/journal/44107/journal-of-drug-delivery-and-therapeutics/>

In case we do not hear from you within the stipulated time, we may proceed with publication of the article as it is or postpones the publication to the next issue.

We value your support of our journal and Thank you for considering this journal as a venue for your work. If you have any questions, please do not hesitate to contact me.

Regards:

Ram C Dhakar, Editor

[Journal of Drug Delivery and Therapeutics\(JDDT\)](#)



JDDT
JOURNAL OF DRUG DELIVERY AND THERAPEUTICS (JDDT)
An Official Journal of Society of Pharmaceutical Technocrats (SoPhTech)

COPYRIGHT TRANSFER AGREEMENT (CTA)

To

The Editor-in-Chief
 Journal of Drug Delivery and Therapeutics

All manuscript submitted must include this form, signed by the author(s), to the address above.

Manuscript Entitled: Relationship Blood Pressure and Exercise with Vitamin D levels in Employees

AGREEMENT

For the submission of an article (mention paper type here): JDDT- 5709

- I/we certify that I/we have participated sufficiently in the conception and design of this work and the analysis of the data, as well as the writing of the manuscript, to take communal responsibility for it. The manuscript in its present form has not been published elsewhere either as a whole or in part, that it has not so far been submitted to any journal and that it will not be submitted to any other journal, if it is accepted for publication in your esteemed journal.
- I am/we are the sole author(s) of the article and maintain the authority to enter into this agreement and the granting of rights to JDDT does not infringe any clause of this agreement.
- The article contains no such material that may be unlawful, defamatory, or which would, if published, in any way whatsoever, violate the terms and conditions as laid down in the agreement.
- I/we have taken due care that the scientific knowledge and all other statements contained in the article conform to true facts and authentic formulae and will not, if followed precisely, be detrimental to the user.
- I/we permit the adaptation, preparation of derivative works, oral presentation or distribution, along with the commercial application of the work.
- No responsibility is assumed by JDDT, its staff or members of the editorial board for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, Products instruction, advertisements or ideas contained in a publication by JDDT.

COPYRIGHT TRANSFER

Copyright to the above work (including without limitation, the right to publish the work in whole, or in part, in any and all forms) is hereby transferred to JDDT, to ensure widest dissemination and protection against infringement. No proprietary right other than copyright is proclaimed by JDDT. I/we hereby give the transfer of exclusive copy rights to JDDT to develop, sponsor, trade and documentation of scientific research work throughout the world.

Under the Following Conditions: Attribution

- The services of the inventive author must be agreed
- In case of reuse or distribution, the license conditions must be clarified to the user of this work,
- Any of these conditions can be ignored on the consent of the author.

I hereby certify that I am authorized to sign this document either in my own right or as an agent of my employer, and have made no changes to the current valid document supplied by JDDT.

Name of Author

Author's Signature

Eveline Margo, M0, M. Biomed

Permanent address of the Author with contact number & Email ID:

Jl. Kyai Tapa no. 260, Grogol, Jakarta Barat 11440, Indonesia
 email ID > eveline-margo@trisakti.ac.id.

INVOICE

JOURNAL OF DRUG DELIVERY AND THERAPEUTICS

Vinita Nagar
dhakarvinita@gmail.com



Invoice no: 0505
Invoice date: 25-Sep-2022
Due date: 10-Oct-2022



\$ 65.00
AMOUNT DUE

BILL TO

eveline-margo@trisakti.ac.id

no	ITEMS AND DESCRIPTION	QTY/HRS	PRICE	AMOUNT(\$)
1	APC-JDDT-5709 The Editorial Board of Journal of Drug Delivery and Therapeutics (JDDT) is pleased to inform you that your manuscript Relationship Blood Pressure and Exercise with Vitamin D Levels in Employees is accepted for publication in JDDT as it is found as per the scientific requirement of our journal and assigned to publish in the forthcoming issue, JDDT, Volume 12, Issue 5-S, 2022 which will be available online on 15-10-2022.	1	\$ 65.00	\$ 65.00
			Subtotal	\$ 65.00
			TOTAL	\$ 65.00 USD

NOTES TO CUSTOMER

Regards:

Ram C Dhakar, Editor

Journal of Drug Delivery and Therapeutics(JDDT)

Website: jddtonline.info

editor.jddt@gmail.com, +91-978392020

<p>ISSN: 2250-1177</p> <p>NLM ID: 101656626</p> <p>CrossRef DOI Prefix:10.22270</p> <p>CODEN (CAS-USA): JDDTAO</p> <p>CAS (American Chemical Society)</p>	<p>CAB Abstracts</p> <p>ICMJE</p> <p>Index Copernicus</p> <p>Global Health</p> <p>Publons</p>	<p>E-Mail: editor.jddt@gmail.com</p> <p>Phone: +91-9783920207</p> <p>Frequency: 12 Issue/Year</p> <p>Double-Blind Peer-reviewed</p>
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------

Journal of Drug Delivery and Therapeutics (JDDT) is a *double-blind peer-reviewed International Journal* dedicated to the publication of research papers, reviews, mini-reviews, Short communications and case studies. This publication is aimed at a broad, interdisciplinary audience of academic and industrial researchers actively engaged in basic and applied laboratory practice, related to Pharmaceutical Science and Therapeutics.

About the Society:

Journal of Drug Delivery and Therapeutics is an official publication of Society of Pharmaceutical Technocrats (SoPhTec). The objects of the society are nurturing and encouragement of the study and practice of Pharmaceutical and Medical Sciences to promote social contacts among Pharmacists of the country.

Basic Information

1. **Journal Title:** Journal of Drug Delivery and Therapeutics
2. **Discipline, Focus & Scope:** Pharmaceutical Sciences & Medical Sciences
3. **Publisher:** Vinita Nagar, Society of Pharmaceutical Technocrats
4. **Country:** India
5. **Language:** English
6. **Publishing Frequency:** Monthly
7. **Editor Name:** Ram C Dhakar

Editorial Office: SRG Hospital & Medical College, Jhalawar, Rajasthan, India

Phone: +91-9783920207

Email: editor.jddt@gmail.com

Website: <http://jddtonline.info/index.php/jddt>

8. **Current Status:** Online only
9. **e-ISSN:** 2250-1177 **P-ISSN:** NA
10. **Membership:** International Committee of Medical Journal Editors ([ICMJE](#))
11. **Year of Start:** 2011

Editorial Board

EDITOR-IN-CHIEF

Dr. Ram C Dhakar, SRG Hospital and Medical College Jhalawar, India-326001, India. Email: editor.jddt@gmail.com Phone: +91-9783920207 [Google Scholar](#) [ResearchGate](#)

ASSOCIATE EDITORS

Dr. Aamir Jalal Al-Mosawi, Advisor And Expert Trainer, Baghdad Medical City And The National Training And Development Center, Iraqi Ministry Of Health, Baghdad, Iraq. [ResearchGate](#) [Google Scholar](#) [SCOPUS](#) [ORCID](#) [NCBI-NLM](#) Email: almosawiaj@yahoo.com. Research Fields: Pediatrics, pediatric psychiatry, nephrology, pediatric neurology, genetics

Dr. S K Prajapati, Professor, Institute of Pharmacy, Bundelkhand University, Jhansi (U.P.), India, India. Email: drsunitprajapati@gmail.com [ResearchGate](#) [Website](#) Research fields: Novel Drug Delivery, Microspheres, Nanoparticles

Dr. Rajesh Ramasamy, Associate Professor, Head of Department, Department of Pathology, Faculty Medicine and Health Science, Universiti Putra Malaysia, Malaysia Phone: +603 8947 2377 Mobile: +6012 393 6444 Fax: +603 8941 2787 Email: rajesh@upm.edu.my [Google Scholar](#) [ResearchGate](#) [Website](#) SCOPUS ID: 26024442700 Research Fields: Stem Cells, Immunology, Diabetes, Medicinal Plant Research, Sidha Medicine

Dr. Syed Mohd Danish Rizvi, Associate Professor, Department of Pharmaceutics, College of Pharmacy, University of Hail, Hail, Saudi Arabia. Email: syedrizvi10@yahoo.com Official Email: sm.danish@uoh.edu.sa | [ORCID ID](#) | [Google Scholar](#) | [Scopus](#) | [Research Gate](#) | [Website](#) | Research fields: Microspheres, Nanoparticles, Cancer Therapy

SECTION EDITORS

Dr. Priyanka Bhatt, Department of Pharmaceutical Sciences, College of Pharmacy, University of South Florida, 12901 Bruce B. Downs Blvd., MDC30, Tampa, FL 33612, Email: priyankabhattach88@yahoo.com psbhatt@health.usf.edu [Google Scholar](#) [ResearchGate](#) [Website](#)

Dr. Siddhartha Pati, Research Associate, Centre of Excellence, Khallikote University, Odisha, India. +91-8895577750/7008251372 Patisiddhartha@gmail.com [ResearchGate](#) [ORCID](#)

Dr. Prakash Doddapattar, Carver College of Medicine, University of Iowa, USA. Research Fields: Molecular Biology · Immunology · Cardiovascular Biology. [ResearchGate](#) [LinkedIn](#) [ORCID ID](#) Email: prakashdpbt@gmail.com

Dr. Ashok K Datusalia, Assistant Professor, National Institute of Pharmaceutical Education and Research, Raebareli, Uttar Pradesh, 226002, India Email: ashokdatusalia@gmail.com [Google Scholar](#) [ResearchGate](#) [Website](#) Research Interests: Neuroscience, Pharmacology and Toxicology

Dr. Dinesh Nyavanandi, Formulation Scientist Continuus Pharmaceuticals 25 Olympia Ave, Woburn, Massachusetts, USA. 01801. (P): +1(662) 550-9555 (E): ndinesh624@gmail.com; dnyavanandi@continuuspharma.com *Research Experience*: Oral drug delivery, Lipid based drug delivery, Strategies for enhancement of solubility and bioavailability, Gastro-retentive Drug delivery, Ocular Drug Delivery, Topical Drug Delivery [LinkedIn](#) [Google Scholar](#) [ORCID](#) [SCOPUS](#)

INTERNATIONAL EDITORIAL MEMBERS

Dr. Sitansu Sekhar Nanda, Department of Chemistry, Myongji University, Yongin, South Korea, Email: nandasitansusekhar@gmail.com [Google Scholar](#) [ResearchGate](#) [Website](#)

Dr. Kishor Mazumder, School of Biomedical Sciences, Charles Sturt University, Boorooma St, Locked Bag 588, Wagga Wagga, NSW 2678, Australia Email: mazumderkis2002@yahoo.com +610426449178 [ResearchGate](#)

Dr. Priya Bharate, Analytical Scientist, Continuous Pharmaceuticals, MA, USA. [Google Scholar](#) [ResearchGate](#) [Website](#)
Interested fields: Carbohydrates synthesis, Chemical biology, Supramolecular chemistry, Analytical method development and qualifications of drug molecules, Nanomaterials, and organic chemistry

Dr. Ahmed Salih Sahib; Professor, Dept of Pharmacology & Toxicology, College of Pharmacy, University of Kerbala, Iraq, Email: ahmedsalih73@yahoo.com ahmed.alkhezaly@uokerbala.edu.iq Tel : +964-7901585579 [Google Scholar](#) [ResearchGate](#) [Website](#) Interested fields: Pharmacology, Clinical Pharmacology, Pharmacogenomics

Prof. Fahad I. Al-Saikhan, Department of Clinical Pharmacy, Prince Sattam Bin Abdulaziz University, College of Pharmacy, Kingdom of Saudi Arabia Email: f.alsaikhan@psau.edu.sa Telephone: +966115886074 [ResearchGate](#) [Website](#) Interested fields: Primary care/Ambulatory care, health outcome, pharmacogenomics

Dr. Ramesh Kenchappa, Head - Formulation Development (Pharma & Biotech), Lonza, Tampa, Florida, United States, United States. Specialist: in developing various pharmaceutical dosage forms including Tablets, Soft Gel and Hard Gel Capsules, Liquids, Topical applications for IND/NDA and ANDA Email: Ramesh.Kenchappa@catalent.com [LinkedIn](#)

Dr. Nahlah Elkudssiah Ismail, Professor, Department of Clinical Pharmacy, Malaysian Academy of Pharmacy, Malaysia. researchgate.net orcid.org Email: elkudssiah77@yahoo.com, nahlah@salam.uitm.edu.my Research interest: Pharmaceutics (drug delivery; nanotechnology), Pharmaceutical Analysis (method development and validation), Clinical Pharmacy, Pharmacy Education, Pharmacy Practice & Public Health.

Dr. Vijai Kumar Reddy Tangadanchu, Ph. D. Postdoctoral Research Associate, Mallinckrodt Institute of Radiology, Washington University School of Medicine Saint Louis, Missouri-63110, USA E-mail: tvjaikumarreddy@wustl.edu tkreddyjiict@outlook.com Mobile: +1 314-665-8974. [Google Scholar](#) [Publons](#)

Dr. Solmaz Ghaffari, Department of Pharmaceutics, Faculty of Pharmacy, Islamic Azad University, Tehran, Iran; Email: soligh@yahoo.com [Google Scholar](#) researchgate.net Tel: +9891252721 Fax: +982122600091

Dr. Mostafa Madmoli, Emergency Medical Technician, Dezful University of Medical Sciences, Dezful, Iran. Email: mostafamadmoli10@yahoo.com Phone: [989370176590] Interested fields: Diabetes, Alzheimer's Disease,

Dr. Vijay Kumar Siripuram, Laboratory of Molecular and Cellular Neuroscience The Rockefeller University, New York, NY, USA. Email: vijay.aleru@gmail.com ; Phone: (+1) 646-238-5620. Interested fields: NMR, FTIR, HPLC, GCMS/LCMS, column chromatography, crystallization [Google Scholar](#) [Publons](#)

Dr Saket Patel, Research Associate at Memorial Sloan Kettering Cancer Center, Department of Radiology, New York, 10065, USA. Interested fields: Organic chemistry, new molecule design, developing new methods for hyperpolarization via dissolution DNP, and real time metabolism (in vivo/ in vitro). Phone: +1 929-553-4960 Email: saketpatel32@gmail.com patels24@mskcc.org [Google Scholar](#) [Website](#)

Dr Arun Butreddy, Ph.D., Scientist, Protein Pharmaceutical Development, Biogen Inc, Massachusetts, USA. [ResearchGate](#) [Google Scholar](#) [LinkedIn](#) Email: butreddyarun@gmail.com Mobile: +1 (662)-380-0558

Dr. Madhukiran Parvathaneni, Manager - Global Regulatory Affairs, CRC Pharma, New Jersey, USA. Interested Fields: Regulatory Affairs, Clinical Research, Pharmaceuticals and Medical Devices. Ph: +1 (609)582-6496 Email: madhukiran.parvathaneni@gmail.com [Website](#) [ResearchGate](#) [Google Scholar](#) [LinkedIn](#)

EXECUTIVE EDITORS

Dr. Krishan Kumar Verma, Ram-Eesh College of Pharmacy, Ram-Eesh Institute of Vocational and Technical Education, Greater Noida, India, India Email: krishver@gmail.com [ResearchGate](#) [Google Scholar](#)

Dr. Sheo Datta Maurya, Sarvodaya College of Pharmacy, Azamgarh, India Email: meetshiv23@gmail.com [Google Scholar](#) [ResearchGate](#) Interested fields: Pharmacy (Novel Drug delivery, Liposomes, Ethosomes,)

Dr. Jitendra Kumar Badjatya, M. Pharm (PMRA), MIPL, Ph.D. Manager - RA (Oral Solution & Injection), 206 Razn House, Al Nahda 2, Dubai, UAE India Email: jeetbadjatya@gmail.com

ASSISTANT EDITORS

Dr. Mousumi Kar, Professor and Head, Faculty of Pharmacy Medi-Caps University, Indore, INDIA, India. Email: karmousumi@hotmail.com [Website](#) [Google Scholar](#) Interested fields: Pharmaceutics, Novel Drug Delivery

Dito Anurogo, M.D., M.Sc., International PhD Program for Cell Therapy and Regeneration Medicine (IPCTRM), College of Medicine, Taipei Medical University Taiwan and Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Makassar, Makassar, Indonesia. Mail: dito.anurogo@med.unismuh.ac.id d151109004@tmu.edu.tw Phone: +62-81224422693. [Google Scholar](#) [Publons](#) [LinkedIn](#) Research Interest: drugs and delivery, pharmacology, regenerative medicine, oncohematology, neuroscience, molecular biology & medicine, bioinformatics, nanomedicine.

Dr. Nilesh Jain, Sagar Institute of Research Technology & Science-Pharmacy, Bhopal, India. Phone: +919425074520, Email: prof.nileshjain@gmail.com [ORCID](#) [SCOPUS](#)

Indexing

1. [EBSCO](#) (Elsevier's Database)
2. [PORTICO](#)
3. [Sherpa Romeo](#)
4. [Global Health](#)
5. [CAB Abstracts](#)
6. [International Committee of Medical Journal Editors](#) (ICMJE)
7. [Index Copernicus, ICV 2021:100](#)
8. [Scilit](#)
9. [SCITE](#)
10. [EXALY](#)
11. [ScienceGate](#)
12. [NLM](#) (ID:101656626)
13. [ROAD](#)
14. [CAS Source Index](#) (CASSI, American Chemical Society)
15. [Publons](#)
16. [Google Scholar](#)
17. [Geneva Foundation of Medical Education & Research](#) (GFMER)
18. [WorldCat](#) (ID: 879704190)
19. [MIAR](#) (Information Matrix for analysis of Journals)
20. [SCISPACE](#)
21. [Open Academic Journal Index](#) (OAJI)
22. [Bielefeld Academic Search Engine](#) (BASE)
23. [Veterinary Science Database](#)
24. [Review of Medical and Veterinary Entomology](#)
25. [Review of Aromatic and Medicinal Plants](#)
26. [Open University of Malaysia Library](#) OUM Control No: [000330909](#)

HOME / ARCHIVES / Vol 12 No 5-S (2022): Volume 12, Issue 5-S, Sep-Oct 2022

Published: 2022-10-15

MINI REVIEW

NANOPARTICLES OF CERIUM DIOXIDE AND PRISTINE (UNMODIFIED) FULLERENE C60 PROTECT LIVING CELLS AGAINST ADVERSE ENVIRONMENTAL EXPOSURE: DOES IT WORK?

Oksana V. Falko, Viktor V. Chizhevskiy, Vladimir K. Klochkov, Viktoria V. Yevlash

Pages 1-4

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5697](https://doi.org/10.22270/jddt.v12i5-S.5697) [View HTML](#)

STATIN THERAPY FOR THE PRIMARY PREVENTION OF CARDIOVASCULAR DISEASE: PROS

Sidhi Laksono, Fadhilla Umami, Zahra Nurushofa, Ety Farida Mustifah

Pages 5-8

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5728](https://doi.org/10.22270/jddt.v12i5-S.5728) [View HTML](#)

CASE STUDIES

CASE REPORT ON THE INTERACTION BETWEEN FUROSEMIDE AND DIGOXIN THAT CAUSED DIGOXIN TOXICITY

Riya Patel, Prancy Patel, Nisarg Patel, Jatin Gangwani, Dhaval Patel

Pages 9-12

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5717](https://doi.org/10.22270/jddt.v12i5-S.5717) [View HTML](#)

RESEARCH

FACTOR XIII GENE POLYMORPHISMS AMONG SUDANESE PATIENTS WITH INTRACEREBRAL HEMORRHAGE, KHARTOUM STATE 2022

Wessam Salah Ibrahim, Abubker Alsiddig Abd Algader, Esraa Kamal Almahy Abdallah, Manasik Siddig Hasssan, Sawsan A. Hamed, Alsadig Gassoum, Tyseer Alabid, Maye M. Merghani, Nihad Elsadig Babiker

Pages 13-19

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5685](https://doi.org/10.22270/jddt.v12i5-S.5685) [View HTML](#)

DEVELOPMENT AND CHARACTERIZATION OF FLOATING MICROSPHERES OF DEXRABEPRAZOLE SODIUM FOR THE TREATMENT OF PEPTIC ULCER

Ragini Sahu, Sarang Jain

Pages 20-26

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5616](https://doi.org/10.22270/jddt.v12i5-S.5616) [View HTML](#)

RELATIONSHIP BLOOD PRESSURE AND EXERCISE WITH VITAMIN D LEVELS IN EMPLOYEES

Eveline Margo, , Meiyanti, Fransisca Chondro, Erlani Kartadinata, , Yohana

Pages 27-30

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5709](https://doi.org/10.22270/jddt.v12i5-S.5709) [View HTML](#)

CHARACTERIZATION OF KAOLIN-RICH LATERITE SOIL FOR APPLICATIONS FOR THE DEVELOPMENT OF SOIL-BASED COSMETIC PRODUCTS

N.U.S. Dissanayake, P.G.H. Pupulewatte, D.T. Jayawardana, D.M. Senevirathne

Pages 31-40



Online ISSN: 2250-1177

[MAKE A SUBMISSION](#)

- [Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5615](https://doi.org/10.22270/jddt.v12i5-S.5615) [View HTML](#)
- PHYTOCHEMICAL ANALYSIS AND ANTIOXIDANT ACTIVITY OF AQUEOUS FRACTION OF MORINGA OLEIFERA LEAVES**
- Abubakar Amali Muhammad, Muhammad Ramadan Abubakar Pages 41-46
- [Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5619](https://doi.org/10.22270/jddt.v12i5-S.5619) [View HTML](#)
- TOXICOLOGICAL AND ANTI-HYPERGLYCEMIC STUDIES OF FIVE PLANTS USED FOR THE TREATMENT OF TYPE 2 DIABETES IN BENIN**
- Santorin SETON, Omédine KOUKOU, Jean Baptiste AMAGBEGNON, Mansouratou BETIRA, Fidèle SONOUNAMETO, Eudoxie ASSO, Alphonse SEZAN Pages 47-53
- [Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5629](https://doi.org/10.22270/jddt.v12i5-S.5629) [View HTML](#)
- MEASUREMENT OF PROTEIN C LEVELS AMONG SUDANESE CHILDREN AND INFANTS WITH SEPSIS AT KHARTOUM STATE, 2022**
- Zakaria Mohamed Mohamad, Maye M. Merghani, Nihad Elsadig Babiker Pages 54-58
- [Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5699](https://doi.org/10.22270/jddt.v12i5-S.5699) [View HTML](#)
- THE ANALYSIS OF ISCHEMIC STROKE AND HEMORRHAGIC STROKE BASED ON SUGAR LEVEL**
- Vidi Posdo A. Simarmata, Wiradi Suryanegara Pages 59-68
- [Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5630](https://doi.org/10.22270/jddt.v12i5-S.5630) [View HTML](#)
- THE RELATIONSHIP BETWEEN LONG USE OF COMMUNICATION DEVICES THAT EMIT BLUE LIGHT WITH SLEEP QUALITY**
- Marjasa D. Dicky Newton, Fransiskus Harf Poluan Pages 69-74
- [Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5631](https://doi.org/10.22270/jddt.v12i5-S.5631) [View HTML](#)
-
- FORMULATION AND EVALUATION OF ORODISPERSIBLE TABLETS CONTAINING CO-CRYSTALS OF MODAFINIL**
- Rajeev Kumar, M.A. Sheela, Monika Sachdeva Pages 82-89
- [Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5634](https://doi.org/10.22270/jddt.v12i5-S.5634) [View HTML](#)
- COMPARISON AND ASSESSMENT OF PRESCRIBING PATTERN OF PSYCHOTROPIC AGENTS IN BIPOLAR AFFECTIVE DISORDER WITH MANIA AND DEPRESSION**
- AJMAL SHAJAHAN, Angel Princy K R, Mahima M S, Muhammed Safwan, Fathima Jaleela M A Pages 90-99
- [Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5702](https://doi.org/10.22270/jddt.v12i5-S.5702) [View HTML](#)
- ANALYSIS OF THE PHYSICO-CHEMICAL CONFORMITY OF ANTIBIOTICS: CASE OF AMOXICILLIN 500 MG CAPSULE AT THE NATIONAL HEALTH LABORATORY DISTRIBUTED IN HEALTH STRUCTURES IN MALI**
- Mody CISSE, Ousmane DEMBELE, Nah TRAORE, Seydou Moussa COULIBALY, B. Moussa CISSE, Niélé Ousmane TRAORE, Niaboula DEMBELE, Mamadou BADIAGA, Boubacar TRAORÉ, Rokia TRAORE, Modibo SANGARE, A. Aimé SOMBORO, Y. Benoit KOUARE Pages 100-105
- [Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5641](https://doi.org/10.22270/jddt.v12i5-S.5641) [View HTML](#)
- FORMULATION DEVELOPMENT AND EVALUATION OF NANOPARTICULATE SYSTEMS OF LEVOFLOXACIN**
- Nitesh Kumar, Dilip Kumar Tiwari, Parul Ben D Mehta Pages 106-111
- [Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5741](https://doi.org/10.22270/jddt.v12i5-S.5741) [View HTML](#)
- ANTIMICROBIAL AND ANTIOXIDANT ACTIVITIES OF SECONDARY METABOLITES OF AN ENDOPHYTIC FUNGUS OF AZADIRACHTA INDICA**
- Nkechi J. Okonkwo-Uzor, Cynthia Obi, Adaobi Enwelum, Ugochukwu M. Okezie, Peter M. Eze, Festus B. C. Okoye, Charles O. Esimone Pages 112-117
- [Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5642](https://doi.org/10.22270/jddt.v12i5-S.5642) [View HTML](#)

STERCULIA SETIGERA HYDROETHANOLIC EXTRACT PROTECTS BRAIN TISSUES EX VIVO AGAINST LIPID PEROXIDATION AND POSSESSES IN VITRO ANTIOXIDANT AND ANTI-INFLAMMATORY PROPERTIES

Yendubé T. Kantati, Magloire K. Kodjo, Bignoate Kombate, Lucie A. Togbossi, Kwashie Eklou-Gadegbeku, Messanvi Gbeassor Pages 118-122

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5643](https://doi.org/10.22270/jddt.v12i5-S.5643) [View HTML](#)

FORMULATION AND EVALUATION OF NORFLOXACIN OCULAR IN-SITU GEL

Urvashi Vyas, Narendra Gehalot, Vikas Jain, S C Mahajan Pages 123-126

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5644](https://doi.org/10.22270/jddt.v12i5-S.5644) [View HTML](#)

FORMULATION AND EVALUATION OF EXTENDED RELEASE GASTRORETENTIVE TABLETS OF METOPROLOL SUCCINATE

Reena Varshi, Vikas Jain, Pradeep Pal, Narendra Gehalot Pages 127-132

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5653](https://doi.org/10.22270/jddt.v12i5-S.5653) [View HTML](#)

PROFILE OF PHYTOCHEMICALS AND GCMS ANALYSIS OF BIOACTIVE COMPOUNDS IN NATURAL DRIED-SEED REMOVED RIPENED PODS METHANOLIC EXTRACTS OF MORINGA OLEIFERA

K. Sukanandam, A. Jeevalatha, C. Kandeepan, N. Kavitha, N. Senthilkumar, S. Sutha, Mohamed Ali Seyed, Sanyam Gandhi, S. Ramya, G Grace Lydial Pushpalatha, GC. Abraham, R. Jayakumararaj Pages 133-141

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5657](https://doi.org/10.22270/jddt.v12i5-S.5657) [View HTML](#)

PHYTOCHEMICAL SCREENING, GC-MS AND FTIR ANALYSIS OF BIOACTIVE COMPOUNDS IN METHANOLIC LEAF EXTRACTS OF COSTUS IGNEUS (CIMLE) AS A NATURAL SOURCE OF DRUG LEAD MOLECULES FOR NEXT-GENERATION DRUG-DESIGN, DEVELOPMENT AND THERAPEUTICS

V. Vijaya, B. Karunai Selvi, Paul J. Arockia John, S. Ramya, R. Jayakumararaj Pages 142-155

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5658](https://doi.org/10.22270/jddt.v12i5-S.5658) [View HTML](#)

A CLINICAL STUDY ON THE USE OF METHOTREXATE IN RHEUMATOID ARTHRITIS BASED ON CDAI SCORE

K Anjali, P Radhika, P Devanshi, T Vivek, K Bhavy Pages 156-159

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5737](https://doi.org/10.22270/jddt.v12i5-S.5737) [View HTML](#)

POTENTIAL ANALGESIC ACTIVITY OF THE METHANOLIC F4 FRACTION OF LEAF EXTRACTS OF ANNONA SENEGALENSIS PERS. (ANNONACEAE)

Ousmane Dembele, Mahamane Haidara, Awa Ndong, Firmin Barbosa, Guata Yoro Sy, Alassane Wélé Pages 160-162

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5662](https://doi.org/10.22270/jddt.v12i5-S.5662) [View HTML](#)

ANTI-INFLAMMATORY POTENTIAL OF BRUCEA JAVANICA FRUIT

Ifora Ifora, Rahmad Abdillah, Ridum Shyntia Pages 163-167

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5661](https://doi.org/10.22270/jddt.v12i5-S.5661) [View HTML](#)

SPATIO-TEMPORAL VARIATION WITHIN IN PH AND TDS IN GROUNDWATER USING STATISTICS AND GIS IN NASHIK DISTRICT, MAHARASHTRA INDIA

C.A. Patil, P.M. Nalawade, B.L. Gadakh, K.P. Amrutkar Pages 168-173

[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5691](https://doi.org/10.22270/jddt.v12i5-S.5691) [View HTML](#)

FORMULATION AND EVALUATION OF MUCOADHESIVE BILAYERED BUCCAL TABLET OF ZIPRASIDONE HYDROCHLORIDE

Mohammed Omer, S.M. Shahidulla Pages 174-180


[Abstract](#) [Download PDF](#) [View PDF](#) DOI [10.22270/jddt.v12i5-S.5757](https://doi.org/10.22270/jddt.v12i5-S.5757) [View HTML](#)

REVIEW

AN INSIGHT INTO THE MULTIFARIOUS APPLICATIONS OF BIOSENSORS AND THE WAY FORWARD

Mandeep Kaur, Shikha Sharma, Deepak Kumar

Pages 181-188

 [Abstract](#)

 [Download PDF](#)

 [View PDF](#)


DOI [10.22270/jddt.v12i5-S.5633](https://doi.org/10.22270/jddt.v12i5-S.5633)

 [View HTML](#)

POST-COVID ERA: PREDICTIVE ASPECT OF PSYCHOLOGICAL CONDITION DUE TO SUDDEN PANDEMIC

Smriti Ojha, Amrita Singh, Ayoni Pandey, Siddhant Kumar, Sudhanshu Mishra

Pages 189-193

 [Abstract](#)

 [Download PDF](#)

 [View PDF](#)


DOI [10.22270/jddt.v12i5-S.5723](https://doi.org/10.22270/jddt.v12i5-S.5723)

 [View HTML](#)

THE COMPLEX PATHOPHYSIOLOGY OF UROLITHIASIS (KIDNEY STONES) AND THE EFFECT OF COMBINATIONAL DRUGS

Meenakshi Malhotra, Pooja Tandon, Kritika Wadhwa, Indu Melkani, Ajeet Pal Singh, Amar Pal Singh

Pages 194-204

 [Abstract](#)

 [Download PDF](#)

 [View PDF](#)


DOI [10.22270/jddt.v12i5-S.5718](https://doi.org/10.22270/jddt.v12i5-S.5718)


 [View HTML](#)

IMMUNOTHERAPY: A NEW REVOLUTIONARY TREATMENT IN CANCER

Prajakta Shivaji Bhasme, Vikram Sadashiv Sarukh, Shital Digambar Sole, Aarti Sampatlal Bhandari, Vaishnavi Rajendra Bhosale, Sandip Suresh Khandagale


Pages 205-207

 [Abstract](#)

 [Download PDF](#)

 [View PDF](#)


DOI [10.22270/jddt.v12i5-S.5666](https://doi.org/10.22270/jddt.v12i5-S.5666)

 [View HTML](#)

THE PHARMACOLOGICAL AND THERAPEUTIC ACTIVITIES OF CANAVALIA GLADIATA (JACQ.) DC.

Mrinalini Pal, Vaibhav Sharan Pandey, Ajay Dhawal, Prachi Upadhyay, Prachi Upadhyay, Vartika, Ratanajay Sharma, Brahmanand Singh, Ishwar Das, Vashist Narayan Pandey

Pages 208-216

 [Abstract](#)

 [Download PDF](#)

 [View PDF](#)


DOI [10.22270/jddt.v12i5-S.5729](https://doi.org/10.22270/jddt.v12i5-S.5729)


 [View HTML](#)


NANOPARTICLE APPLICATIONS IN INTRACELLULAR INFECTIONS

Judith Torres, Tatiana Lara, Marcelo Grijalva

Pages 217-219

 [Abstract](#)

 [Download PDF](#)

 [View PDF](#)


DOI [10.22270/jddt.v12i5-S.5738](https://doi.org/10.22270/jddt.v12i5-S.5738)


 [View HTML](#)

REVIEW ARTICLE ON PHARMACEUTICAL INVENTORY MODELS

Mahima Dubey, Harshna Vishwakarma, Parveen Nisha

Pages 230-235

 [Abstract](#)

 [Download PDF](#)

 [View PDF](#)


DOI [10.22270/jddt.v12i5-S.5659](https://doi.org/10.22270/jddt.v12i5-S.5659)


 [View HTML](#)

AYURVEDA REVIEW ON BANDHA VIDHI AND CLINICAL SIGNIFICANCE OF PICHU, PLOTA, KAVALIKA AND VIKESHIKA

Shailesh N Chovatia, Neha Thumar

Pages 236-238

 [Abstract](#)

 [Download PDF](#)

 [View PDF](#)

DOI [10.22270/jddt.v12i5-S.5660](https://doi.org/10.22270/jddt.v12i5-S.5660)

 [View HTML](#)

Relationship Blood Pressure and Exercise with Vitamin D Levels in Employees

by Eveline Margo

Submission date: 15-Aug-2022 02:32PM (UTC+0700)

Submission ID: 1882694176

File name: Relationship_BP_and_Exercise_with_Vitamin_D.docx (47.83K)

Word count: 3168

Character count: 18567

Relationship Blood Pressure and Exercise with Vitamin D Levels in Employees

Eveline Margo^{1*}, Meiyanti², Fransisca Chondro¹, Erlani Kartadinata³

¹Departement Physiology Faculty of Medicine, Universitas Trisakti

² Department Pharmacology and dan Pharmacy Faculty of Medicine, Universitas Trisakti

³ Departement Ophthalmology Faculty of Medicine, Universitas Trisakti

Jl. Kyai Tapa No.260, Grogol, Jakarta Barat 11440.

email: eveline-margo@trisakti.ac.id

ABSTRACT

In Indonesia prevalence of vitamin D deficiency is 63%, so although Indonesia is tropical country on the equator, but it doesn't guarantee the vitamin D levels. Vitamin D deficiency can cause bone deformitas and increase the risk of various chronic diseases such as diabetes, autoimun diseases, arthritis, cancer, obese, distraction of lipid profile, metabolic syndrome, hypertension and cardiovascular diseases. Increases blood pressure in global still remains the leading caused of death. In Indonesia, hypertension prevalence reach out 47.8% with 70% of them suffer undiagnosed hypertension. About 50-90% vitamin D is mainly synthesized in the skin after exposure to UVB whereas only a minor part is derived from dietary sources. Exercise in the morning can help synthesized of vitamin D. Because of that, the aim of this study is to researching relationship blood pressure and exercise with vitamin D levels. The study was conducted on 63 employees with range aged 19-60 years in February 2021 at USAKTI Faculty of Medicine, East Jakarta. The research design used in this study was an observational analytic with cross-sectional approach and analysed by chi-square test. This research presents significant relationship between blood pressure with vitamin D levels ($p=0.044$), meanwhile for exercise doesn't have any significant relationship with vitamin D levels ($p=0.565$). This study shown vitamin D can impact blood pressure, while vitamin D source not only from sun-exposure but can be take from food or supplements.

Key words: blood pressure, exercise, vitamin D levels

INTRODUCTION

Over 1 billion world population are suffering vitamin D deficiency with 50% from population suffering vitamin D insufficiency.⁽¹⁾ Based on data from WUS, the prevalence of vitamin D deficiency in various contries in Europe, America, and Asia including Malaysia, Singapura, Thailand, Vietnam, India, Japan and Hongkong are varies from 42% to 90%.⁽²⁾ Data in Indonesia showed that vitamin D deficiency around 63%, so it can be said that although Indonesia is a tropical islands in equator line, but it can't guarantee the status of vitamin D levels.^(2,3)

Human can make vitamin D3 naturally in response to sun exposure, especially UVB radiation so it can becomes an endocrine hormones precursor. Along with parathyroid hormone, vitamin D have a role in calcium-phosphate homeostatis and cofactor for enzymes like lipase and ATPase.⁽⁴⁾ Vitamin D plays an important role in absorption of calcium, magnesium, phosphate, bone metabolism and helps to mantains neuromuscular function.^(5,6) Although bone, small intestine and kidneys are the main organs that has response to vitamin D, but there are still many vitamin D effects in the body through vitamin D receptor (VDR). VDR is steroid hormone receptor which can bind 1,25(OH)D with high affinity and mediates the regulation of gene transcription. Some of VDR located in heart, smooth muscle blood vessels, endothel, abdomen, brain, skin, gonad and various cells for the immune system.⁽⁵⁾ Recently, some studies showed that VDR plays a role in renin angiotensin aldosterone system (RAAS), so it can affect

10 blood pressure regulation. Vitamin D deficiency can caused bone abnormalities and increased the risk of various chronic diseases, such as diabetes mellitus, cardiovascular diseases due to hypertension, obese, lipid profile disorder, cancer, autoimun disease and metabolic syndrome.^(2,5,7)

13 Globally, increased blood pressure still remains the leading cause of death. In 2014, around 1.39 billion people suffered hypertension and 10.4 million deaths per year due to hypertension.⁽⁸⁾ In Indonesia, the prevalence of hypertension reaches 47.8% with 70% of them suffering undiagnosed hypertension. Even now, it seems that many young people are suffering hypertension, although most of them are still suffered by elderly.⁽⁹⁾ *Institute for Health Metrics and Evaluation* (IHME) (2017) said that 23.7% of the 1.7 million deaths in 2016 were caused by hypertension and based on *Riskesmas* data (2018), it showed that hypertension prevalence rate in the population over 18 years old is 34.11%.⁽¹⁰⁾

3 Regular exercise in the morning can increase vitamin D levels. Around 50% to 90%, vitamin D is obtained through absorption by skin that exposed to sunlight and only 10% is obtained from foods. Direct sunlight exposure to the skin with an exposed area about 40% in 20 minutes 15 prevent vitamin D deficiency. Morning exercise around 07.00 am to 10 am can help the vitamin D forming. Vitamin D is produced from 7-dehydrocholesterol which it found in the skin or from food sources such as fish, milk, butter, egg yolks, meat, etc. Through the help of UVB from sunlight with 290-380nm wavelength will convert provitamin D3 into active vitamin D. Vitamin D deficiency can be caused by various factors, such as increasing 25(OH)D degradation, low intake food or supplements cointaning vitamin D, malabsorption, celiac disease, gaster area operation, and less exposure to sunlight.^(1,8,11,12,13)

The research conducted by Yosephin et.al. to fertile 18 men found that sunlight exposure and doing regular exercise in the morning for 30 minutes three times a week for 21 weeks can helped lowers blood pressure and improved vitamin D levels.⁽¹¹⁾ Study 17 that conducted by Hermawan et.al., showed that vitamin D intake had effect to lowering blood pressure in the elderly who suffer from hypertension.⁽¹⁴⁾ Shu and Huang's research showed that vitamin D intake caused decrease blood pressure in Asia.⁽¹⁵⁾ As well as research conducted by Farapti et.al, showed that decrease blood pressure in the elderly after taking vitamin D supplementation.⁽¹⁵⁾ But, Forman et.al., study showed that there is no relationship between vitamin D intake from foods or supplements with hypertension and Bahrami et.al., also said that only decreased diastolic pressure in adults patients with coronary artery disease.⁽¹⁵⁾

Various clinical trial results showed that vitamin D has inconsistent effects on blood pressure with various health condition across all ages. Based on that, the researchers intend to examine the relationship between blood pressure and exercise habits with vitamin D in employees.

METHODS

4 This research was analytic observational study with crosssectional design. The aim was to find the relationship between blood pressure and exercise with vitamin D levels in employees, which held on February 2021. The research subjects was calculated using an infinite-finite population formula with the prevalence in Indonesia was 63% with the accuracy level was 0.05. Based on this calculation, we got 63 subjects. The subjects were collected by consecutive nonrandom sampling method. The inclusion criteria were men and women aged 19-60 years old, willing to participate and signed informed consent. Exclusion criteria were consuming

alcohol, hypertension drugs or antioxidants, having history of malignancy, smoking, liver or kidney dysfunction, history of hospitalization in the last 1 month.

Data was collected by filling out a questionnaire, which before filling out, the subjects was given an explanation beforehand. The questionnaire contains information that includes identity (name, age, gender, ethnicity and regular exercise habits). Exercise habits are asked to do at least walking in the morning for at least 30 minutes, 3 times a week.⁽¹⁷⁾ The subjects blood pressure were measured using digital sphygmomanometer which already calibrated. Measurements were taken in a calm situation, sitting position and the measurements were taken three times and then the average was taken. The results are declared hypertension if the systolic blood pressure is ≥ 140 mmHg and /or diastolic blood pressure is ≥ 90 mmHg.⁽⁸⁾

Two milli litre of blood samples was collected in plain vial, aseptically for vitamin D levels examination using ELISA method. The levels of vitamin D 30-100 ng/ml was indicate sufficient/normal, whereas below that there was a deficiency.⁽¹²⁾ This research obtained ethical clearance from the Research Ethics Commision of the Faculty of Medicine, Trisakti University under no. 170/KER/FK/XII/2020.

RESULTS

The univariate analysis was used to determine the distribution of subjects characteristics in the form of gender, age, ethnicity, morning routine exercise habits for at least 30 minutes, blood pressure and vitamin D levels. Data table 1 shows that from 63 subjects, 26 (41.3%) subjects were male and thirty-seven subjects (58.7%) were female. The mean patients aged 42.14 ± 8.78 years. The majority 39 (61.91%) weren't do the morning routine exercise. On blood pressure examination, it was found that 16 (25.40%) had hypertension. The mean vitamin D levels was 16.5 ± 6.68 with 53 (84.13%) were below the normal value.

8
Table 1. Distribution of features characteristics of the subjects (n=63)

Characteristic	n (%)	Mean±SD
Sex		
Male	26 (41.3 %)	
Female	37 (58.7 %)	
Age (years)		42.14 ± 8.78
Morning routine exercise		
< 3 x/week	39 (61.91 %)	
22 ≥ 3 x/week	24 (38.09 %)	
Blood pressure		
< 140/90 mmHg	47 (74.60 %)	
$\geq 140/90$ mmHg	16 (25.40 %)	
Vitamin D 25-OH levels		16.5 ± 6.68
≥ 30 ng/dl	11 (17.46 %)	
< 30ng/dl	52 (82.54 %)	

Statistical analysis was used chi-square test to determine²³ the relationship blood pressure and exercise with vitamin D levels. Based on table 2, there was a positive significant relationship between blood pressure with vitamin D levels ($p = 0.044$). Meanwhile, the relationship between morning routine exercise with vitamin D levels wasn't found in this study ($p = 0.565$)

Table 2. Relationship between blood pressure, exercise and vitamin D level

Characteristic	Vitamin D Levels		p value
	≥30 ng/dl	<30 ng/dl	
	n	n	
Blood pressure			
≥140/90mmHg	10 (21.3%)	37 (78.7%)	0.044 [€]
<140/90mmHg	1 (6.3%)	15 (93.7%)	
Morning routine exercise			
≥3x/mgg	3 (3.8%)	21 (20.2%)	0.565 [€]
<3x/mgg	7 (6.2%)	32 (32.8%)	

€ = chi-square test; p < 0.05

DISCUSSION

In this study shown that vitamin D has been able to reduce blood pressure. Vitamin D can reduce blood pressure through various mechanisms, these include inhibiting the expression of the renin gene, maintaining parathyroid hormone levels and calcium homeostasis, dilation of blood vessels and also decreased sympathetic nerve activity.⁽¹⁵⁾ Vitamin D can reduce blood pressure through vascular resistance and the RAAS. Increased vitamin D levels can lead to a decrease vascular resistance in overall when the skin goes extensive vasodilatation, resulting in an increase nitric oxide in the skin's blood vessels.^(11,12,15) The effect of vitamin D through RAAS is by suppressing renin activity. Vitamin D receptor (VDR) is found in various body tissues, which can modulates various genes, such as inhibits renin synthesis. Vitamin D can inhibit the expression of COX-2 in the macula densa cells in the kidneys, which this enzyme plays a very important role in the process of converting arachidonic acid into prostaglandins. In the absence of prostaglandins in macula cells that will be produce, will cause the absence of prostaglandins that should be capture by prostaglandin receptors in the juxtaglomerular cells, so the impact was renin can't be produced, ultimately the RAAS can't be activated and can't increase blood pressure. However, if a person is deficient in VDR or hyper-reninemia can caused increasing blood pressure.^(11,12,14,18,19)

One of the vitamin D function is to maintain blood calcium homeostatis, so when there is a deficiency of vitamin D, it will cause changes in blood calcium levels, which will increase parathyroid hormone. Increased levels of parathyroid hormone will cause RAAS disorders, atherosclerosis, increased heart contractility which can increase the risk of cardiovascular disease.^(14,15,19) There is an effect in blood vessels by the high levels of parathyroid hormone through angiotensin II release which can cause vasoconstriction, so that the pheriperal resistance will increase. Also, increase parathyroid hormone levels can caused increase of endothelin-1 levels and IL-6, so the endothelium becomes inflamed and atherosclerosis occurs through vascular endothelial growth factor (VEGF).^(20,21) Besides that, it had sclerotic effect to smooth muscle cells.⁽²²⁾

Other effects of vitamin D can regulated GuanylylCylase (GC)A in vascular smooth musclecells, stimulated production of cGMP so that can caused vasodilatation which it can lower blood pressure.^(23,24) Vitamin D can also suppressed T-elector cells activity so it can decreased the activity of the sympathetic system which can lower blood pressure.⁽²⁴⁾

Vitamin D has an effect on various organs in the body. Other than small intestine, kidneys, parathyroid glands, it also has effects on certain tissues and organs such as cardiovascular, skeletal muscle, the immune system which has a response to vitamin D, blood vessels's smooth mucle, endothel and immune cells, including CD-4⁺T cells through VDR. VDR can tightly bound to vitamin D3 becomes active and interacts with retinoid X receptor (RXR) which will

regulate gene transcription so that it can regulate calcium homeostasis, blood pressure, cardiovascular and skeletal muscle function.⁽²⁴⁾

Research by Pike and Meyer concluded VDR had an active mechanism on target genes through the activation of VDR which is activated by $1,25(\text{OH})_2\text{D}_3$ so that can modulates genes expression (transcription) at single gene locus and also at the tissue level.⁽⁵⁾ Chen et.al, stated that there is a gene that is responsible for causing hypertension induced by vitamin D deficiency. Each gene with a genomic position binds to an active VDR or indirectly regulated by vitamin D3 or VDR signals that lead to an increase or decrease transcription involved in the regulation of blood pressure can be affected by vitamin D deficiency causing hypertension.⁽²⁴⁾

A study conducted by Hermawan,⁽²⁾ al. who gave vitamin D preparations to the elderly with hypertension⁽¹⁶⁾ showed that decrease blood pressure in the elderly.⁽¹⁴⁾ Another study by Qi et.al., said that vitamin D deficiency was associated with the risk of hypertension. A study in Asia by Shu and Huang showed blood pressure in peripheral decrease after vitamin D supplementation.⁽¹⁵⁾

There are no relationship between morning routine exercise with vitamin D levels ($p=0.565$). Although Indonesia is a tropical island where it is easily exposed to sunlight so humans are able to make vitamin D3 naturally by changing 7-dehydrocholesterol which can be found in the skin, it turns out that it doesn't always guarantee a person's vitamin D levels.⁽⁷⁾ Lack of outdoor activities or longer periods of working indoors and the social lifestyle of Asian people who avoid being exposed to the sun such as the use of clothing materials that are difficult to absorb sunlight or wearing closed clothes, using body protection, such as hats, umbrellas, sunscreens cause lack of exposure to the sunlight so it causes a lack of natural vitamin D formation. Although food source such as fish, butter, egg yolks, meat, margarine, yogurt, cod liver oil, etc can become vitamin D, but apparently it isn't enough for a person.^(2,7,11,12,25,26,27) Besides that, skin tone can impact the absorption of sunlight, which dark skin color makes a person take a longer time to form vitamin D.⁽¹²⁾ Same results were⁽¹⁴⁾ obtained by several studies which said that employees who work more in the room are at risk of developing vitamin D deficiency due to lack of sun exposure and lack of opportunities to do morning exercise. Besides that, the subject's majority are females (58.7%) and most of them are muslim with using hijab as a protection and wearing close dress which can cause lack of sun exposure.

CONCLUSIONS

Blood pressure and vitamin D levels was found positive significant relationship, where indicated the higher vitamin D levels can help to reduce high blood pressure. Meanwhile there wasn't found relationship between morning routine exercise with vitamin D levels.

CONFLICT OF INTEREST⁽¹²⁾

The authors do not have any conflict of interest to declare.

ACKNOWLEDGMENTS

The researchers would like to thank subjects that willing to participate in this study.

REFERENCES

1. Sizar O, Khare S, Goyal A, et.al. Vitamin D deficiency. Treasure Island: Statpearls Publishing.2020. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK532266/>
2. Rimahardika R, Subagio HW, Wijayanti HS. Asupan vitamin D dan paparan sinar matahari pada orang yang bekerja di dalam ruangan dan di luar ruangan. Journal of Nutrition College. 2017; 6(4):333-342. DOI: <https://doi.org/10.14710/jnc.v6i4.18785>

3. Holt R, Mortensen LJ, Poulsen KH, et.al. Vitamin D and sex steroid production in men with normal or impaired Leydig cell function. *Journal of Steroid Biochemistry and Molecular Biology*. 2020;199 <https://doi.org/10.1016/j.jsbmb.2020.105589>
4. Lerchbaum E, Pietsch BO. Vitamin D and fertility: a systematic review. *European Journal of Endocrinology*. 2012;166:765 - 778. doi: 10.1530/EJE-11-0984
5. Pike JW, Meyer MB. The vitamin D receptor: New paradigms for the regulation of gene expression by 1,25 dihydroxyvitamin D3. *Endocrinol Metab Clin North Am*. 2012;39(2):255-269. doi:10.1016/j.ecl.2010.02.007
6. Moukayed M, and Grant WB. Molecular link between vitamin D and cancer prevention. *Nutrients*. 2013; 5(10):3993 - 4021. DOI: [10.3390/nu5103993](https://doi.org/10.3390/nu5103993)
7. Boucher JB. Is Vitamin D Status Relevant to Metabolic Syndrome? *Dermato-Endocrinology*. 2012;4(2):212-224. <https://doi.org/10.4161/derm.20012>
8. Unger T, Borghi C, Charchar F, et.al. 2020 International society of hypertension global hypertension practice guidelines. *Hypertension*.2020;75: 1334-1357. <https://doi.org/10.1161/HYPERTENSIONAHA.120.15026>
9. Hussain MA, Al Mamun A, Reid C, et al. Prevalence, Awareness, Treatment and Control of Hypertension in Indonesian Adults Aged 40 Years: Findings from the Indonesia Family Life Survey (IFLS). *PLOS ONE*.2016;11(8):1-16.doi:10.1371/journal.pone.0160922
10. Laporan Nasional RISKESDAS 2018. Kementerian Kesehatan RI. 2019. Jakarta: Balitbangkes 2019. Available at: http://labdata.litbang.kemkes.go.id/images/download/laporan/RKD/2018/Laporan_Nasional_RKD2018_FINAL.pdf
11. Yosephin B, Khomsan A, Briawan D, et.al. Peranan Ultraviolet B sinar matahari terhadap status vitamin D dan tekanan darah pada wanita usia subur. 2014; 8(6):256-260. DOI: <http://dx.doi.org/10.21109/kesmas.v0i0.377.g376>
12. Puspardini. Defisiensi vitamin D terhadap penyakit. *Indonesian Journal of Clinical Pathology and Medical Laboratory*. 2014; 21(1):90-5. <https://doi.org/10.24293/ijcpml.v21i1.1265>
13. Subagja W. Penting vitamin matahari dan mandi matahari. 2018. Available at: <https://www.otsuka.co.id/id/health-info/detail/12/Pentingnya%20Vitamin%20Matahari%20dan%20Mandi%20Matahari> Accessed at : August 8th2020
14. Hermawan D, Andoko. Pengaruh Pemberian Vitamin D terhadap Penurunan Tekanan Darah pada Usia Lanjut dengan Hipertensi. *Jurnal Dunia Kesmas*, 2017;6(1):36-42.
15. Farapti F and Fadilla C. Further Understanding about Mechanism of Vitamin D on Blood Pressure. *Indonesian J Pharm* 2021;32(3):314-327. DOI: <https://doi.org/10.22146/ijp.1439>
16. Ullah MI, Uwaifo GI, Nicholas WC, et.al. Does Vitamin D Deficiency Cause Hypertension? Current Evidence from Clinical Studies and Potential Mechanisms. *Int J Endocrinol*. 2010;2010:579640. doi: [10.1155/2010/579640](https://doi.org/10.1155/2010/579640)
17. Puspitasari DI, Hannan M, Chindy LD, et.at. Pengaruh Jalan Pagi terhadap Perubahan Tekanan Darah pada Lanjut Usia dengan Hipertensi di Desa Kalianget Timur Kecamatan Kalianget Kabupaten Sumenep. *Jurn Ners LENTERA*. 2017;5(1).
18. Bikle D. Nonclassic Actions of Vitamin D. *J Clin Endocrinol Metab*.2009;94(1):26-34. doi: [10.1210/jc.2008-1454](https://doi.org/10.1210/jc.2008-1454)
19. Zaki M, Kamal S, Basha WA. Association of vitamin D receptor gene polymorphism (VDR) with vitamin D deficiency, metabolic and inflammatory marked in Egyptian obese woman. *Genes & Disease*. 2017;4:176-82.
20. Rashid G, Bernheim J, Green, J, et.al. Parathyroid Hormone Stimulates the Endothelial Expression of Vascular Endothelial Growth Factor. *ESCI*. 2008;38(11):798-803. <https://doi.org/10.1111/j.1365-2362.2008.02033.x>

21. Martins JS, Palhares MdO, Teixeira OCM, et.al. Vitamin D Status and Its Association with Parathyroid Hormone Concentration in Brazillians. *Journal of Nutrition and Metabolism*. 2017;1:1-5. <https://doi.org/10.1155/2017/9056470>
22. Perkovic V, Hewitson TD, Kelyack KJ, et.al. Parathyroid Hormone has a Prosclerotic Effect on Vascular Smooth Muscle Cells. *Kidney and Blood Press Res*. 2003; 26(1):27-33. <https://doi.org/10.1159/000069761>
23. Fetahu IS, Höbaus J, Källay E. Vitamin D and the Epigenome. *Frontiers in Physiology*. 2014;5(164)1-12. doi: 10.3389/fphys.2014.00164
24. Chen S, Sun Y, Agrawal DK. Vitamin D Deficiency and Essential Hypertension. *J Am Soc Hypertens*. 2015; 9(11): 885-901. doi: [10.1016/j.jash.2015.08.009](https://doi.org/10.1016/j.jash.2015.08.009)
25. Holick MF, Chen TC. Vitamin D deficiency: a worldwide problem with health consequences. *Am J Clin Nutr*. 2008; 87(4):1080S-6S. doi: 10.1093/ajcn/87.4.1080S.
26. Holick MF, Binkley NC, Bischoff-Ferrari HA, et. al. Evaluation, Treatment and Prevention of Vitamin D Deficiency: an Endocrine Society Clinical Practice Guideline. *JECM*.2011; 96(7): 1911-1930. <https://doi.org/10.1210/jc.2011-0385>
27. Vera, Setiati S, Govinda A. Determinan Diagnostik Klinis Defisiensi Vitamin D pada Wanita Berusia Lebih dari 50 tahun. *JPDI*. 2015;2(1):38-48

Relationship Blood Pressure and Exercise with Vitamin D Levels in Employees

ORIGINALITY REPORT

14%

SIMILARITY INDEX

9%

INTERNET SOURCES

10%

PUBLICATIONS

2%

STUDENT PAPERS

PRIMARY SOURCES

- | | | |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1 | www.scribd.com
Internet Source | 1% |
| 2 | M. Iftekhar Ullah, Gabriel I. Uwaifo, William C. Nicholas, Christian A. Koch. "Does Vitamin D Deficiency Cause Hypertension? Current Evidence from Clinical Studies and Potential Mechanisms", International Journal of Endocrinology, 2010
Publication | 1% |
| 3 | www.ncbi.nlm.nih.gov
Internet Source | 1% |
| 4 | www.science.gov
Internet Source | 1% |
| 5 | "Extraskeletal Effects of Vitamin D", Springer Science and Business Media LLC, 2018
Publication | 1% |
| 6 | repository.trisakti.ac.id
Internet Source | 1% |
| 7 | Submitted to University of Scranton | |

1 %

8

icgh2016.ui.ac.id

Internet Source

1 %

9

Vladyslav Tsaryk, Artem Neverovskyi, Andrii Kurchenko. "Spectrum and frequency of food allergy in Kyiv`s adult citizens with allergic rhinitis: a cross-sectional study", Research Square Platform LLC, 2022

Publication

1 %

10

repository.ubaya.ac.id

Internet Source

1 %

11

ses.library.usyd.edu.au

Internet Source

1 %

12

Ali Hafedh Abbas, Ibtesam Baddai Hassan, Maysaa Kadhem Al-Malkey, Sinai Waleed Mohammed-Saeed. "Genetic polymorphisms frequency of vitamin D receptor gene rs7975232 and rs731236 in Iraqi thalassemic patients and healthy controls compared to Arabian healthy populations", Meta Gene, 2020

Publication

1 %

13

Roseana Böek Carvalho, Bruna Marmett, Sergio Luis Amantea, Cláudia Ramos Rhoden. "Occupational Exposure to Air Pollutants Among Professional Motorcyclists in Brazil

1 %

Results in Higher Health Risk and Changing in Biochemical and Cardiovascular Parameters", Water, Air, & Soil Pollution, 2022

Publication

14 dare.ubvu.vu.nl 1 %
Internet Source

15 Submitted to North West University <1 %
Student Paper

16 ovarianresearch.biomedcentral.com <1 %
Internet Source

17 Dede Nasrullah, Siti Aisyah, Azkiyatul Fitri. <1 %
"Proposing a Healthy Environment for Elderly People with Hypertension: Taichi gymnastic against blood pressure", IOP Conference Series: Earth and Environmental Science, 2020
Publication

18 journal.fkm.ui.ac.id <1 %
Internet Source

19 www.dovepress.com <1 %
Internet Source

20 Lei Yuan Lim, Naga Chalasani. "Vitamin D Deficiency in Patients with Chronic Liver Disease and Cirrhosis", Current Gastroenterology Reports, 2011 <1 %
Publication

21

Samira Faraji, Rasoul Zarrin, Asma Zamanian, Reza Hajizadeh, Parvin Ayremlou, Behzad Rahimi. "The Role of Vitamin D Supplementation in the Treatment of Primary Hypertension: A Double-Blinded Randomized Placebo-Controlled Clinical Trial", Iranian Red Crescent Medical Journal, 2020

Publication

<1 %

22

academic.oup.com

Internet Source

<1 %

23

coek.info

Internet Source

<1 %

24

eje.bioscientifica.com

Internet Source

<1 %

25

link.springer.com

Internet Source

<1 %

26

Tatiana Karonova, Elena Grineva, Olga Belyaeva, Anna Bystrova, Edward B. Jude, Alena Andreeva, Anna Kostareva, Pawel Pludowski. "Relationship Between Vitamin D Status and Vitamin D Receptor Gene Polymorphisms With Markers of Metabolic Syndrome Among Adults", Frontiers in Endocrinology, 2018

Publication

<1 %

Exclude quotes On

Exclude matches Off

Exclude bibliography On

Relationship Blood Pressure and Exercise with Vitamin D Levels in Employees

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

Available online on 15.10.2022 at <http://jddtonline.info>

Journal of Drug Delivery and Therapeutics

Open Access to Pharmaceutical and Medical Research

Copyright © 2022 The Author(s): This is an open-access article distributed under the terms of the CC BY-NC 4.0 which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited



Open Access Full Text Article



Research Article

Relationship Blood Pressure and Exercise with Vitamin D Levels in Employees

Eveline Margo^{1*}, Meiyanti², Fransisca Chondro¹, Erlani Kartadinata³, Yohana⁴

^{1*} Departement Physiology Faculty of Medicine, Universitas Trisakti, Jl. Kyai Tapa No.260, Grogol, Jakarta Barat 11440

² Departement Pharmacology and dan Pharmacy Faculty of Medicine, Universitas Trisakti, Jl. Kyai Tapa No.260, Grogol, Jakarta Barat 11440

³ Departement Ophtalmology Faculty of Medicine, Universitas Trisakti, Jl. Kyai Tapa No.260, Grogol, Jakarta Barat 11440

⁴ Departement Biochemistry Faculty of Medicine, Universitas Trisakti, Jl. Kyai Tapa No.260, Grogol, Jakarta Barat 11440

Article Info:



Article History:

Received 13 August 2022

Reviewed 19 Sep 2022

Accepted 25 Sep 2022

Published 15 Oct 2022

Cite this article as:

Margo E, Meiyanti, Chondro F, Kartadinata E, Yohana, Relationship Blood Pressure and Exercise with Vitamin D Levels in Employees, Journal of Drug Delivery and Therapeutics. 2022; 12(5-S):27-30

DOI: <http://dx.doi.org/10.22270/jddt.v12i5-s.5709>

*Address for Correspondence:

Eveline Margo, Departement Physiology Faculty of Medicine, Universitas Trisakti, Jl. Kyai Tapa No.260, Grogol, Jakarta Barat 11440.

Abstract

In Indonesia prevalence of vitamin D deficiency is 63%, so although Indonesia is a tropical country on the equator, it doesn't guarantee vitamin D levels. Vitamin D deficiency can cause bone deformity and the risk of various chronic diseases such as diabetes, autoimmune diseases, arthritis, cancer, obesity, the distraction of lipid profile, metabolic syndrome, hypertension, and cardiovascular diseases can be increased. Increases blood pressure in globally remains the leading cause of death. In Indonesia, hypertension prevalence reached 47.8% with 70% of them suffering from undiagnosed hypertension. About 50-90% of vitamin D is mainly synthesized in the skin after exposure to UVB whereas only a minor part is derived from dietary sources. Exercise in the morning can help synthesize vitamin D. Because of that, the aim of this study is to research the relationship between blood pressure and exercise with vitamin D levels. The study was conducted on 63 employees with range aged 19-60 years in February 2021 at USAKTI Faculty of Medicine, East Jakarta. The research design used in this study was an observational analytic with cross-sectional approach and analyzed by chi-square test. This research presents a significant relationship between blood pressure with vitamin D levels ($p=0.044$), meanwhile exercise doesn't have any significant relationship with vitamin D levels ($p=0.565$). This study shows vitamin D can impact blood pressure, while vitamin D source not only from sun exposure but can be taken from food or supplements.

Keywords: blood pressure, exercise, vitamin D levels

INTRODUCTION

Over 1 billion world population are suffering from vitamin D deficiency with 50% of the population suffering from vitamin D insufficiency. ¹ Based on data from WUS, the prevalence of vitamin D deficiency in various countries in Europe, America, and Asia including Malaysia, Singapura, Thailand, Vietnam, India, Japan, and Hongkong are varies from 42% to 90%.² Data in Indonesia showed that vitamin D deficiency is around 63%, so it can be said that although Indonesia is a tropical islands in equator line, but it can't guarantee the status of vitamin D levels.^{2,3}

Human can make vitamin D3 naturally in response to sun exposure, especially UVB radiation so it can become endocrine hormone precursors. Along with parathyroid hormone, vitamin D has a role in calcium-phosphate homeostasis and cofactor for enzyme-like lipase and ATPase.⁴ Vitamin D plays an important role in the absorption of calcium, magnesium, phosphate, and bone metabolism and helps to maintain neuromuscular function.^{5,6} Although bone, small intestine and kidneys are the main organs that a response to vitamin D, but there are still many vitamin D effects in the body through vitamin D receptor (VDR). VDR is a steroid hormone receptor that can bind 1,25(OH)D with high affinity and mediates the regulation of gene transcription. Some of VDRs are located in

the heart, smooth muscle blood vessels, endothelial, abdomen, brain, skin, gonad, and various cells of the immune system.⁽⁵⁾ Recently, some studies showed that VDR plays a role in the renin-angiotensin-aldosterone system (RAAS), so it can affect blood pressure regulation. Vitamin D deficiency can be caused bone abnormalities and increased the risk of various chronic diseases, such as diabetes mellitus, cardiovascular diseases due to hypertension, obesity, lipid profile disorder, cancer, autoimmune disease and metabolic syndrome.^{2,5,7}

Globally, increased blood pressure still remains the leading cause of death. In 2014, around 1.39 billion people suffered hypertension and 10.4 million deaths per year due to hypertension. ⁸ In Indonesia, the prevalence of hypertension reaches 47.8% with 70% of them suffering from undiagnosed hypertension. Even now, it seems that many young people are suffering from hypertension, although most of them are still suffered by elderly. ⁹ Institute for Health Metrics and Evaluation (IHME) (2017) said that 23.7% of the 1.7 million deaths in 2016 were caused by hypertension and based on Riskesdas data (2018), it showed that the hypertension prevalence rate in the population over 18 years old is 34.11%.¹⁰

Regular exercise in the morning can increase vitamin D levels. Around 50% to 90% of vitamin D is obtained through

absorption by skin that is exposed to sunlight and only 10% is obtained from foods. Direct sunlight exposure to the skin with an exposed area of about 40% in 20 minutes can prevent vitamin D deficiency. Morning exercise around 07.00 am to 10 am can help the vitamin D forming. Vitamin D is produced from 7-dehydrocholesterol which it found in the skin or from food sources such as fish, milk, butter, egg yolks, meat, etc. Through the help of UVB from sunlight with 290-320nm wavelength will convert provitamin D3 into active vitamin D. Vitamin D deficiency can be caused by various factors, such as increasing 25(OH)D degradation, low intake food or supplements containing vitamin D, malabsorption, celiac disease, gaster area operation, and less exposure to sunlight.^{1,8,11,12,13}

The research conducted by Yosephin et.al. to fertile women found that sunlight exposure and doing regular exercise in the morning for 30 minutes three times a week for 12 weeks can help lowers blood pressure and improve vitamin D levels.¹¹ Study conducted by Hermawan et.al., showed that vitamin D intake had the effect to lowering blood pressure in the elderly who suffer from hypertension.¹⁴ Shu and Huang's research showed that vitamin D intake caused decreased blood pressure in Asia.¹⁵ As well as research conducted by Farapti et.al, showed decreased blood pressure in the elderly after taking vitamin D supplementation.¹⁵ But, Forman et.al., the study showed that there is no relationship between vitamin D intake from foods or supplements with hypertension, and Bahrami et.al., also said that only decreased diastolic pressure in adult patients with coronary artery disease.¹⁵

Various clinical trial results showed that vitamin D has inconsistent effects on blood pressure with various health conditions across all ages. Based on that, the researchers intend to examine the relationship between blood pressure and exercise habits with vitamin D in employees.

MATERIAL AND METHODS

This research was analytic observational study with crosssectional design. The aim was to find the relationship between blood pressure and exercise with vitamin D levels in employees, which was held on February 2021. The research subjects were calculated using an infinite-finite population

formula with the prevalence in Indonesia was 63% with the accuracy level was 0.05. Based on this calculation, we got 63 subjects. The subjects were collected by consecutive nonrandom sampling method. The inclusion criteria were men and women aged 19-60 years old, willing to participate and signed informed consent. Exclusion criteria were consuming alcohol, hypertension drugs or antioxidants, having a history of malignancy, smoking, liver or kidney dysfunction, history of hospitalization in the last 1 month.

Data was collected by filling out a questionnaire, which before filling out, the subjects were given an explanation beforehand. The questionnaire contains information that includes identity (name, age, gender, ethnicity, and regular exercise habits). Exercise habits are asked to do at least walking in the morning for at least 30 minutes, 3 times a week.¹⁷ The subject's blood pressure was measured using a digital sphygmomanometer which was already calibrated. Measurements were taken in a calm situation, sitting position, and the measurements were taken three times and then the average was taken. The results are declared hypertension if the systolic blood pressure is ≥ 140 mmHg and /or diastolic blood pressure is ≥ 90 mmHg.⁸

Two milliliters of blood samples were collected in a plain vial, aseptically for vitamin D levels examination using the ELISA method. The levels of vitamin D 30-100 ng/ml were indicated sufficient/normal, whereas below that there was a deficiency.¹² This research obtained ethical clearance from the Research Ethics Commission of the Faculty of Medicine, Trisakti University under no. 170/KER/FK/XII/2020.

RESULTS

The univariate analysis was used to determine the distribution of subject's characteristics in the form of gender, age, ethnicity, morning routine exercise habits for at least 30 minutes, blood pressure, and vitamin D levels. Data table 1 shows that of 63 subjects, 26 (41.3%) subjects were male, and thirty-seven subjects (58.7%) were female. The mean patients were aged 42.14 ± 8.78 years. The majority 39 (61.91%) didn't do the morning routine exercise. On blood pressure examination, it was found that 16 (25.40%) had hypertension. The mean vitamin D levels were 16.5 ± 6.68 with 53 (84.13%) below the normal value.

Table 1: Distribution of features characteristics of the subjects (n=63)

Characteristic	n (%)	Mean \pm SD
Sex		
Male	26 (41.3 %)	
Female	37 (58.7 %)	
Age (years)		42.14 \pm 8.78
Morning routine exercise		
< 3 x/week	39 (61.91 %)	
\geq 3 x/week	24 (38.09 %)	
Blood pressure		
< 140/90 mmHg	47 (74.60 %)	
\geq 140/90 mmHg	16 (25.40 %)	
Vitamin D 25-OH levels		16.5 \pm 6.68
\geq 30ng/dl	11 (17.46 %)	
< 30ng/dl	52 (82.54 %)	

Statistical analysis used chi-square test to determine the relationship between blood pressure and exercise with vitamin D levels. Based on table 2, there was a positive significant relationship between blood pressure with vitamin

D levels ($p = 0.044$). Meanwhile, the relationship between morning routine exercise with vitamin D levels wasn't found in this study ($p = 0.565$).

Table 2: Relationship between blood pressure, exercise and vitamin D level

Characteristic	Vitamin D Levels		p value
	>30 ng/dl	≤30 ng/dl	
	n	n	
Blood pressure			
≥140/90mmHg	10 (21.3%)	37 (78.7%)	0.044 [€]
<140/90mmHg	1 (6.3%)	15 (93.7%)	
Morning routine exercise			
≥3x/mgg	3 (3.8%)	21 (20.2%)	0.565 [€]
<3x/mgg	7 (6.2%)	32 (32.8%)	

€ = chi-square test; $p < 0.05$

DISCUSSION

This study shows that vitamin D has been able to reduce blood pressure. Vitamin D can reduce blood pressure through various mechanisms, these include inhibiting the expression of the renin gene, maintaining parathyroid hormone levels and calcium homeostasis, dilation of blood vessels, and decreased sympathetic nerve activity.¹⁵ Vitamin D can reduce blood pressure through vascular resistance and RAAS. Increased vitamin D levels can lead to a decrease vascular resistance in overall when the skin goes through extensive vasodilatation, resulting in an increase in nitric oxide in the skin's blood vessels.^{11,12,15} The effect of vitamin D through RAAS is by suppressing renin activity. Vitamin D receptor (VDR) is found in various body tissues, which can modulate various genes, such as inhibiting renin synthesis. Vitamin D can inhibit the expression of COX-2 in the macula densa cells in the kidneys, which this enzyme plays a very important role in the process of converting arachidonic acid into prostaglandins. In the absence of prostaglandins in macula cells that will be produced, will cause the absence of prostaglandins that should be captured by prostaglandin receptors in the juxtaglomerular cells, so the impact was renin can't be produced, ultimately the RAAS can't be activated and can't increase blood pressure. However, if a person is deficient in VDR or hyper-reninemia can be caused increased blood pressure.^{11,12,14,18,19}

One of the vitamin D functions is to maintain blood calcium homeostasis, so when there is a deficiency of vitamin D, it will cause changes in blood calcium levels, which will increase parathyroid hormone. Increased levels of the parathyroid hormone will cause RAAS disorders, atherosclerosis, and increased heart contractility which can increase the risk of cardiovascular disease.^{14,15,19} There is an effect in blood vessels by the high levels of the parathyroid hormone through angiotensin II release which can cause vasoconstriction, so that the peripheral resistance will increase. Also, increased parathyroid hormone levels can cause an increase of endothelin-1 levels and IL-6, so the endothelium becomes inflamed, and atherosclerosis occurs through vascular endothelial growth factor (VEGF).^{20,21} Besides that, it had a sclerotic effect to smooth muscle cells.²²

Other effects of vitamin D can regulate GuanylylCylase (GC)A in vascular smooth muscle cells, stimulated production of

cGMP so which can cause vasodilatation which it can lower blood pressure.^{23,24} Vitamin D can also suppress T-effector cell activity so it can decrease the activity of the sympathetic system which can lower blood pressure.²⁴

Vitamin D has an effect on various organs in the body. Other than the small intestine, kidneys, and parathyroid glands, it also has effects on certain tissues and organs such as cardiovascular, skeletal muscle, the immune system which has a response to vitamin D, blood vessels' smooth muscle, endothelial and immune cells, including CD-4⁺T cells through VDR. VDR can tightly bind to vitamin D3 becomes active and interacts with retinoid X receptor (RXR) which will regulate gene transcription so that it can regulate calcium homeostasis, blood pressure, and cardiovascular and skeletal muscle function.²⁴

Research by Pike and Meyer concluded that VDR had an active mechanism on target genes through the activation of VDR which is activated by $1,25(\text{OH})_2\text{D}_3$ so which can modulate gene expression (transcription) at a single gene locus and at the tissue level.⁵ Chen et.al, stated that there is a gene that is responsible for causing hypertension induced by vitamin D deficiency. Each gene with a genomic position bind to an active VDR or is indirectly regulated by vitamin D3 or VDR signals that lead to an increase or decrease in transcription involved in the regulation of blood pressure and can be affected by vitamin D deficiency causing hypertension.²⁴

A study conducted by Hermawan, et al. who gave vitamin D preparations to the elderly with hypertension showed decreased blood pressure in the elderly.¹⁴ Another study by Qi et.al., said that vitamin D deficiency was associated with the risk of hypertension. A study in Asia by Shu and Huang showed blood pressure in the peripheral decreased after vitamin D supplementation.¹⁵

There is no relationship between morning routine exercise with vitamin D levels ($p=0.565$). Although Indonesia is a tropical island where it is easily exposed to sunlight so humans can make vitamin D3 naturally by changing 7-dehydrocholesterol which can be found in the skin, it turns out that it doesn't always guarantee a person's vitamin D levels.⁷ Lack of outdoor activities or longer periods of working indoors and the social lifestyle of Asian people who avoid being exposed to the sun such as the use of clothing materials that

are difficult to absorb sunlight or wearing closed clothes, using body protection, such as hats, umbrellas, sunscreens cause lack of exposure to the sunlight so it causes a lack of natural vitamin D formation. Although food sources such as fish, butter, egg yolks, meat, margarine, yogurt, cod liver oil, etc can become vitamin D, apparently it isn't enough for a person.^{2,7,11,12,25,26,27} Besides that, skin tone can impact the absorption of sunlight, which dark skin color makes a person take a longer time to form vitamin D.¹² Same results were obtained by several studies which said that employees who work more in the room are at risk of developing vitamin D deficiency due to lack of sun exposure and lack of opportunities to do morning exercise. Besides that, the subject's majority are females (58.7%) and most of them are Muslim using a hijab as protection and wear a closed dress which can cause a lack of sun exposure.

CONCLUSIONS

Blood pressure and vitamin D levels were found positive significant relationship, which indicated that higher vitamin D levels can help to reduce high blood pressure. Meanwhile, there wasn't found the relationship between morning routine exercise with vitamin D levels.

CONFLICT OF INTEREST

The authors do not have any conflict of interest to declare.

ACKNOWLEDGMENTS

The researchers would like to thank subjects that willing to participate in this study.

REFERENCES

- Sizar O, Khare S, Goyal A, et al. Vitamin D deficiency. Treasure Island: Statpearls Publishing, 2020. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK532266/>
- Rimahardika R, Subagio HW, Wijayanti HS. Asupan vitamin D dan paparan sinar matahari pada orang yang bekerja di dalam ruangan dan di luar ruangan. *Journal of Nutrition College*. 2017; 6(4):333-342. DOI: <https://doi.org/10.14710/jnc.v6i4.18785>
- Holt R, Mortensen LJ, Poulsen KH, et al. Vitamin D and sex steroid production in men with normal or impaired Leydig cell function. *Journal of Steroid Biochemistry and Molecular Biology*. 2020; 199 <https://doi.org/10.1016/j.jsbmb.2020.105589>
- Lerchbaum E, Pietsch BO. Vitamin D and fertility: a systematic review. *European Journal of Endocrinology*. 2012; 166:765 - 778. doi: 10.1530/EJE-11-0984
- Pike JW, Meyer MB. The vitamin D receptor: New paradigms for the regulation of gene expression by 1,25 dihydroxyvitamin D3. *Endocrinol Metab Clin North Am*. 2012; 39(2):255-269. doi:10.1016/j.ecl.2010.02.007
- Moukayed M, and Grant WB. Molecular link between vitamin D and cancer prevention. *Nutrients*. 2013; 5(10):3993 - 4021. DOI: 10.3390/nu5103993
- Boucher JB. Is Vitamin D Status Relevant to Metabolic Syndrome? *Dermato-Endocrinology*. 2012; 4(2):212-224. <https://doi.org/10.4161/derm.20012>
- Unger T, Borghi C, Charchar F, et al. 2020 International society of hypertension global hypertension practice guidelines. *Hypertension*. 2020; 75: 1334-1357. <https://doi.org/10.1161/HYPERTENSIONAHA.120.15026>
- Hussain MA, Al Mamun A, Reid C, et al. Prevalence, Awareness, Treatment and Control of Hypertension in Indonesian Adults Aged 40 Years: Findings from the Indonesia Family Life Survey (IFLS). *PLOS ONE*. 2016; 11(8):1-16. doi:10.1371/journal.pone.0160922
- Laporan Nasional RISKESDAS 2018. Kementerian Kesehatan RI. 2019. Jakarta: Balitbangkes 2019. Available at: http://labdata.litbang.kemkes.go.id/images/download/laporan/RKD/2018/Laporan_Nasional_RKD2018_FINAL.pdf
- Yosephin B, Khomsan A, Briawan D, et al. Peranan Ultraviolet B sinar matahari terhadap status vitamin D dan tekanan darah pada wanita usia subur. 2014; 8(6):256-260. DOI: <http://dx.doi.org/10.21109/kesmas.v0i0.377.g376>
- Pusparini. Defisiensi vitamin D terhadap penyakit. *Indonesian Journal of Clinical Pathology and Medical Laboratory*. 2014; 21(1):90-5. <https://doi.org/10.24293/ijcpml.v21i1.1265>
- Subagja W. Penting vitamin matahari dan mandi matahari. 2018. Available at: <https://www.otsuka.co.id/id/health-info/detail/12/Pentingnya%20Vitamin%20Matahari%20dan%20Mandi%20Matahari> Accessed at : August 8th 2020
- Hermawan D, Andoko. Pengaruh Pemberian Vitamin D terhadap Penurunan Tekanan Darah pada Usia Lanjut dengan Hipertensi. *Jurnal Dunia Kesmas*, 2017; 6(1):36-42.
- Farapti F and Fadilla C. Further Understanding about Mechanism of Vitamin D on Blood Pressure. *Indonesian J Pharm* 2021; 32(3):314-327. DOI: <https://doi.org/10.22146/ijp.1439>
- Ullah MI, Uwaifo GI, Nicholas WC, et al. Does Vitamin D Deficiency Cause Hypertension? Current Evidence from Clinical Studies and Potential Mechanisms. *Int J Endocrinol*. 2010; 2010:579640. doi: 10.1155/2010/579640
- Puspitasari DI, Hannan M, Chindy LD, et al. Pengaruh Jalan Pagi terhadap Perubahan Tekanan Darah pada Lanjut Usia dengan Hipertensi di Desa Kalianget Timur Kecamatan Kalianget Kabupaten Sumenep. *Jurn Ners LENTERA*. 2017;5(1).
- Bikle D. Nonclassic Actions of Vitamin D. *J Clin Endocrinol Metab*. 2009; 94(1):26-34. doi: 10.1210/jc.2008-1454
- Zaki M, Kamal S, Basha WA. Association of vitamin D receptor gene polymorphism (VDR) with vitamin D deficiency, metabolic and inflammatory marked in Egyptian obese woman. *Genes & Disease*. 2017; 4:176-82.
- Rashid G, Bernheim J, Green, J, et al. Parathyroid Hormone Stimulates the Endothelial Expression of Vascular Endothelial Growth Factor. *ESCI*. 2008; 38(11):798-803. <https://doi.org/10.1111/j.1365-2362.2008.02033.x>
- Martins JS, Palhares MdO, Teixeira OCM, et al. Vitamin D Status and Its Association with Parathyroid Hormone Concentration in Brazillians. *Journal of Nutrition and Metabolism*. 2017; 1:1-5. <https://doi.org/10.1155/2017/9056470>
- Perkovic V, Hewitson TD, Kelynack KJ, et al. Parathyroid Hormone has a Prosclerotic Effect on Vascular Smooth Muscle Cells. *Kidney and Blood Press Res*. 2003; 26(1):27-33. <https://doi.org/10.1159/000069761>
- Fetahu IS, Höbaus J, Källay E. Vitamin D and the Epigenome. *Frontiers in Physiology*. 2014; 5(164):1-12. doi: 10.3389/fphys.2014.00164
- Chen S, Sun Y, Agrawal DK. Vitamin D Deficiency and Essential Hypertension. *J Am Soc Hypertens*. 2015; 9(11): 885-901. doi: 10.1016/j.jash.2015.08.009
- Holick MF, Chen TC. Vitamin D deficiency: a worldwide problem with health consequences. *Am J Clin Nutr*. 2008; 87(4):1080S-6S. doi: 10.1093/ajcn/87.4.1080S.
- Holick MF, Binkley NC, Bischoff-Ferrari HA, et al. Evaluation, Treatment and Prevention of Vitamin D Deficiency: an Endocrine Society Clinical Practice Guideline. *JECM*. 2011; 96(7): 1911-1930. <https://doi.org/10.1210/jc.2011-0385>
- Vera, Setiati S, Govinda A. Determinan Diagnostik Klinis Defisiensi Vitamin D pada Wanita Berusia Lebih dari 50 tahun. *JPDI*. 2015; 2(1):38-48