



# Indian Journal of Public Health Research & Development

An International Journal

## SCOPUS IJPHRD CITATION SCORE

Indian Journal of Public Health Research and Development

Scopus coverage years: from 2010 to till date. Publisher: R.K.

Sharma, Institute of Medico-Legal Publications ISSN:0976-

0245E-ISSN:0976-5506 Subject area: Medicine: Public Health,

Environmental and Occupational Health

CiteScore 2015- 0.02

SJR 2015- 0.105

SNIP 2015- 0.034



Website:

[www.ijphrd.com](http://www.ijphrd.com)

# Indian Journal of Public Health Research & Development

## EXECUTIVE EDITOR

**Prof Vidya Surwade**

Prof Dept of Community Medicine SIMS, Hapur

### INTERNATIONAL EDITORIAL ADVISORY BOARD

1. **Dr. Abdul Rashid Khan B. Md Jagar Din**, (*Associate Professor*)  
Department of Public Health Medicine, Penang Medical College, Penang, Malaysia
2. **Dr. V Kumar** (*Consulting Physician*)  
Mount View Hospital, Las Vegas, USA
3. **Basheer A. Al-Sum**,  
Botany and Microbiology Deptt, College of Science, King Saud University,  
Riyadh, Saudi Arabia
4. **Dr. Ch Vijay Kumar** (*Associate Professor*)  
Public Health and Community Medicine, University of Buraimi, Oman
5. **Dr. VMC Ramaswamy** (*Senior Lecturer*)  
Department of Pathology, International Medical University, Bukit Jalil, Kuala Lumpur
6. **Kartavya J. Vyas** (*Clinical Researcher*)  
Department of Deployment Health Research,  
Naval Health Research Center, San Diego, CA (USA)
7. **Prof. PK Pokharel** (*Community Medicine*)  
BP Koirala Institute of Health Sciences, Nepal

### NATIONAL SCIENTIFIC COMMITTEE

1. **Dr. Anju Ade** (*Associate Professor*)  
Navodaya Medical College, Raichur, Karnataka
2. **Dr. E. Venkata Rao** (*Associate Professor*) Community Medicine,  
Institute of Medical Sciences & SUM Hospital, Bhubaneswar, Orissa.
3. **Dr. Amit K. Singh** (*Associate Professor*) Community Medicine,  
VCSG Govt. Medical College, Srinagar – Garhwal, Uttarakhand
4. **Dr. R G Viveki** (*Associate Professor*) Community Medicine,  
Belgaum Institute of Medical Sciences, Belgaum, Karnataka
5. **Dr. Santosh Kumar Mulage** (*Assistant Professor*)  
Anatomy, Raichur Institute of Medical Sciences Raichur(RIMS), Karnataka
6. **Dr. Gouri Ku. Padhy** (*Associate Professor*) Community and Family  
Medicine, All India Institute of Medical Sciences, Raipur
7. **Dr. Ritu Goyal** (*Associate Professor*)  
Anaesthesia, Sarswathi Institute of Medical Sciences, Panchsheel Nagar
8. **Dr. Anand Kalaskar** (*Associate Professor*)  
Microbiology, Prathima Institute of Medical Sciences, AP
9. **Dr. Md. Amirul Hassan** (*Associate Professor*)  
Community Medicine, Government Medical College, Ambedkar Nagar, UP
10. **Dr. N. Girish** (*Associate Professor*) Microbiology, VIMS&RC, Bangalore
11. **Dr. BR Hungund** (*Associate Professor*) Pathology, JNMC, Belgaum.
12. **Dr. Sartaj Ahmad** (*Assistant Professor*),  
Medical Sociology, Department of Community Medicine, Swami Vivekananda Subharti  
University, Meerut, Uttar Pradesh, India
13. **Dr Sumeeta Soni** (*Associate Professor*)  
Microbiology Department, B.J. Medical College, Ahmedabad, Gujarat, India

### NATIONAL EDITORIAL ADVISORY BOARD

1. **Prof. Sushanta Kumar Mishra** (Community Medicine)  
GSL Medical College – Rajahmundry, Karnataka
2. **Prof. D.K. Srivastava** (*Medical Biochemistry*)  
Jamia Hamdard Medical College, New Delhi
3. **Prof. M Sriharibabu** (*General Medicine*) GSL Medical College, Rajahmundry,  
Andhra Pradesh
4. **Prof. Pankaj Datta** (*Principal & Prosthodontist*)  
Indraprastha Dental College, Ghaziabad

### NATIONAL EDITORIAL ADVISORY BOARD

5. **Prof. Samarendra Mahapatro** (*Pediatrician*)  
Hi-Tech Medical College, Bhubaneswar, Orissa
6. **Dr. Abhiruchi Galhotra** (*Additional Professor*) Community and Family  
Medicine, All India Institute of Medical Sciences, Raipur
7. **Prof. Deepti Pruthvi** (*Pathologist*) SS Institute of Medical Sciences &  
Research Center, Davangere, Karnataka
8. **Prof. G S Meena** (*Director Professor*)  
Maulana Azad Medical College, New Delhi
9. **Prof. Pradeep Khanna** (*Community Medicine*)  
Post Graduate Institute of Medical Sciences, Rohtak, Haryana
10. **Dr. Sunil Mehra** (*Paediatrician & Executive Director*)  
MAMTA Health Institute of Mother & Child, New Delhi
11. **Dr Shailendra Handu**, *Associate Professor*, Phrma, DM (Pharma, PGI  
Chandigarh)
12. **Dr. A.C. Dhariwal**: *Directorate* of National Vector Borne Disease  
Control Programme, Dte. DGHS, Ministry of Health Services, Govt. of  
India, Delhi

Print-ISSN: 0976-0245-Electronic-ISSN: 0976-5506, Frequency: Monthly

**Indian Journal of Public Health Research & Development** is a double blind peer reviewed international journal. It deals with all aspects of Public Health including Community Medicine, Public Health, Epidemiology, Occupational Health, Environmental Hazards, Clinical Research, and Public Health Laws and covers all medical specialties concerned with research and development for the masses. The journal strongly encourages reports of research carried out within Indian continent and South East Asia.

The journal has been assigned International Standards Serial Number (ISSN) and is indexed with Index Copernicus (Poland). It is also brought to notice that the journal is being covered by many international databases. The journal is covered by EBSCO (USA), Embase, EMCare & Scopus database. The journal is now part of DST, CSIR, and UGC consortia.

**Website : [www.ijphrd.com](http://www.ijphrd.com)**

©All right reserved. The views and opinions expressed are of the authors and not of the Indian Journal of Public Health Research & Development. The journal does not guarantee directly or indirectly the quality or efficacy of any product or service featured in the advertisement in the journal, which are purely commercial.

### Editor

**Dr. R.K. Sharma**  
Institute of Medico-legal Publications  
Logix Office Tower, Unit No. 1704, Logix City Centre Mall,  
Sector- 32, Noida - 201 301 (Uttar Pradesh)

### Printed, published and owned by

**Dr. R.K. Sharma**  
Institute of Medico-legal Publications  
Logix Office Tower, Unit No. 1704, Logix City Centre Mall,  
Sector- 32, Noida - 201 301 (Uttar Pradesh)

### Published at

**Institute of Medico-legal Publications**  
Logix Office Tower, Unit No. 1704, Logix City Centre Mall,  
Sector- 32, Noida - 201 301 (Uttar Pradesh)



# Indian Journal of Public Health Research & Development

www.ijphrd.com

---



---

## CONTENTS

---



---

Volume 9, Number 10

October 2018

1. Personal Fableness and Perception of Risk Behaviors among Adolescents ..... 01  
*Pooja Mamidanna, Aneesh Kumar P*
2. The Effect of One-Time Dynamic Soft Tissue Mobilization on Hamstring Flexibility Sustenance between Healthy Males and Females ..... 06  
*Thadsayini Kulendran, D Rajesh, Satheesh Kumar*
3. Effectiveness of Finger Weight-Lift Training and Finger Exercises on Hand Grip Strength among Elderly ..... 11  
*D Malarvizhi, G Vidya*
4. Policy and Determinant Analysis in Effort to Control Stunting Case in Bengkulu Province ..... 17  
*Desri Suryani, Betty Yosephin, Miratulhaya, Dailin<sup>1</sup>, Yandrizal, Bintang Agustina P, Wulan Angraini*
5. Children's Understanding of Cancer: Developmental Trend in their Conceptual Complexity ..... 23  
*Swarajya Kopparty, Tiamongla, C Vanlalhruaii, Meena Hariharan, Padmaja Gadiraju, C Raghavendra Rao*
6. Parental Knowledge, Attitude and Practices Regarding Antibiotic use for Respiratory Tract Infections in Children ..... 29  
*Prini Varghese, Sunil M*
7. Informal Healthcare Providers in India : Illegal and Indispensable ..... 35  
*Sagarika Kamath, Rajesh Kamath, Rohan Kamath, Bryal D'Souza*
8. Premenstrual Symptoms and Lifestyle Factors Associated with it among Medical Students ..... 39  
*Pragya Sharma, Amrita Patro, Sufyan Ibrahim, Sravan Kumar Reddy T, Neha Jain, Sneha Deepak Mallya*
9. Impact of Biomedical Waste Management Training Intervention on Knowledge, Attitude and Practices of Health Care Workers in Telangana ..... 46  
*MD Mustafa Ahmed, Sayyad Tajmul Sayyad Usman, Humera Abida*
10. Evaluation of Knowledge, Attitude and Practice on First Aid Measures among Students ..... 50  
*Deekshitha P, Dhivya K, Pravallika S, Lavanya D, Kesini M*
11. Subjective Assessment of Sleep Quality and its Associated Factors among Adult Population in Urban Puducherry ..... 57  
*Nitesh Mangal, Matariswa Samanta, Rajkumar Patil, ALokeshmaran, Piyushkumar C Parmar*
12. Healthcare Providers Views on Husband-Participation in Maternal Healthcare ..... 63  
*Gyanvati*

13. The Role of Alcohol in the Aetiology of Oral Cancer: A Study Done in Southern India ..... 68  
*Nirmala C J Hemanth T Dharaneesh Prasad S*
14. Incidence and Implications of Outpatient Care among the Vendors Employed in Punjab ..... 74  
*Pooja Kansra, Vijay Srivastava*
15. Awareness of Swine Flu (Influenza H1N1) among the Rural Population of Shamirpet Mandal, Telangana ..... 80  
*Umama Zareen, M Surya Durga Prasad*
16. Factors Affecting Investor's Perception of Mutual Fund Investment W.R.T Andhra Pradesh ..... 85  
*P Subba Rao*
17. Local Governance and Management of Health Care Services: A Community based Case Study in Rural Odisha ..... 91  
*Sucharita Pujari*
18. Incipient Study to Control LDPE Pollution by *Streptomyces Werraensis* SDJM from Garbage Soil .... 96  
*S Deepika, R Jaya Madhuri*
19. Effect of Proprioceptive and Flexibility Exercise Program along with Resisted Training on Anxiety and Depression with Diabetic Neuropathy ..... 101  
*Kannan Dhasaradharaman, Prathap Suganthirababu, K Mohanraj*
20. Feasibility Study and Project Conceptualization of an upcoming Hospital in Navi Mumbai ..... 106  
*Er. Lalit Varma, A P Pandit, Madhura Ghatol*
21. The Application of Irene's Donuts Innovative School Program Towards the Oral Health Care and the Hygiene Index of Children with Special Needs ..... 112  
*Betty Saptiwi, Sukini, Salikun, Endah Aryati Ekoningtyas, Ismi Rajiani*
22. Self Perceived Hand Hygiene among Student Health Professionals in a Tertiary Care Teaching Hospital in Southern India ..... 116  
*Heena Kausar, Rajesh Kamath, Brayal D'Souza, Sagarika Kamath, Rohan Kamath*
23. Efficacy of Interferential Therapy Versus Transcutaneous Electrical Nerve Stimulation to Reduce Pain in Patients with Diabetic Neuropathy ..... 121  
*Chiranjeevi Jannu, Prathap Suganthira Babu, Goverdhan Puchchakayala, Vahini Devi Chandupatla*
24. Translation and Validation of Mc Monnies (V2) Questionnaire English Version to Local Vernacular Language Kannada Version- A Pilot Study ..... 125  
*Avinash Prabhu, Sinchana Sedyapu, Premjit Bhakat*
25. Vitamin D Levels in Late Pre-Term Neonates and its Association with Sepsis ..... 128  
*Rahul Prasad, Baliga Shanataram, Baliga Kiran, Smitha Dsa*
26. Interprofessional Assessment of Accessibility to Public Buildings by Individuals with Visual Impairment: A Report from Udupi Taluk – A Pilot Study ..... 133  
*Avinash V Prabhu, Sidhiprada Mohapatra, Shashank Mehrotra*
27. Assessment of Hand Washing Practices among School going Children- A Cross Sectional Study from India ..... 137  
*Kavitha E, Srikumar R*

28. The Behavior of Fertile Women in Rural Areas toward the Acetic Acid Visual Inspection ..... 143  
*Aprina, Leni Agustina, Ismi Rajiani*
29. Association of Frequency of Toothbrushing to Periodontal Findings in Elderly Subjects of Dakshina  
Kannada District ..... 149  
*Smitha Shetty, Smeeth Gusani*
30. The Effect of Oxytocin Massage on Changing of Symphysis-Fundal Height (SFH) in Post Normal and  
Post Caesarean Birth Delivery ..... 153  
*Yuliawati, Yetti Anggraini, and Ismi Rajiani*
31. Study of Association between Calcium and Lipid Profile with Respect To Menopause ..... 158  
*Anuja A Pawar, Ajit V Sontakke, Krishnaji L Garud, Dhirajkumar A Mane*
32. Development of Empowerment Model of People with Mental Health Disorders in Community and  
Prison, to Improve Productivity and Quality of Life, in Indonesia ..... 163  
*Amar Akbar, Lilik Ma'rifatul Azizah, Imam Zainuri*
33. Management of an Unusual Midline Diastema with a Fixed Appliance: A Case Report ..... 167  
*Ashwin Rao, Avani Jain, Anupama Nayak P, Suprabha B S, Karuna YM*
34. Comparative Study on Overweight and Obesity among School Going Adolescent boys in Small Town  
and Metropolitan City of West Bengal ..... 171  
*Sanjay Vashisth, Alpana Chhetri*
35. Effects of Mode of Delivery on Cord Blood Thyroid Stimulating Hormone ..... 175  
*Krishnaji L Garud, Ajit V Sontakke, Dhirajkumar Mane, Sharmista K Garud*
36. The Effectiveness of Acupressure Intervention and Birth Delivery Standing Position to Decrease the  
Intensity of Labor Pain ..... 179  
*Yetti Anggraini, Pranajaya, Ismi Rajiani*
37. Determinants of Vendor-Client Relationship in Medical Equipment Industry ..... 184  
*P Praveen Kumar, K. C. Raja Shree*
38. Macronutrient and Micronutrient Knowledge among Adolescent Girls of Udipi Taluk Karnataka ..... 190  
*Anjali Gupta, Judith A Noronha, Shobha*
39. Health Status of Under Five Children Living in Urban Slums ..... 195  
*Roja V R, Abhiruchi Galhotra, Ancil V Rajan, Namesh Malarout, Shilpa Pateria, Rajesh Kamath*
40. Is Telemedicine Best Alternative to Reaching Last Mile: Investigation in the Context of  
Rural India ..... 202  
*Samyadip Chakraborty, Vaidik Bhatt, Tulika Chakravorty*
41. Improvement of Job Engagement after doing Team Job Crafting in Human Resource Management of  
Hospital ..... 207  
*Nanda Aulya Ramadhan, Dwi Rahayuningtyas, Nyoman Anita Damayanti, Djazuly Chalidyanto*
42. Awareness about the Management of Avulsed Tooth among Medical Interns in Mangalore, India ..... 212  
*Puttur Laxmish Mallya, Kundabala M, Srikant N, Asadur Rahaman Middy*
43. A Comparative Evaluation of Stress Distribution between Conventional and Platform Switched Implant  
Supported Crown in Different Densities of Bone: A Three Dimensional Finite Element Analysis ..... 217  
*Sharuti Yakmi, Thilak Shetty, Shobha J Rodrigues, Vidya K Shenoy, Sharon Saldanha, Umesh Pai, Mahesh Mundathaje*

44. Activities of Daily Living and Instrumental Activities of Daily Living in Patients with Schizophrenia: A Scoping Review ..... 223  
*Karyn Suzette Mendonza, Farzana Palathingal, Sumit Prasad, Shashank Mehrotra*
45. Comparison of Tear Film Characteristics between **Kajal** (Kohl) Users and Non-Users ..... 228  
*Radhika R P, Babu Noushad, Jyothi Thomas*
46. Empirical Evidences for Effectiveness of Employee Participation in IT Companies .....231  
*P Vijayashree, M Chandran*
47. Biosignal Processing Approaches for Detecting Mental Fatigue ..... 236  
*K Mohanavelu, S Poonguzhali, R Banuvathy, K Adalarasu, M Jagannath*
48. Team Based Learning an Active Teaching and learning Pedagogy: A Narrative Literature Review. 242  
*Shashidhara YN, Elissa Ladd*
49. A Structured Exercise Training Protocol after Renal Transplantation in Indian Population ..... 249  
*Senthil Kumar Thillai Govindarajan, Soundararajan Periyasamy, Arun G Maiya, Ravi Annamalai, Venkatesh Natarajan*
50. Association of TNF- $\alpha$  with Fasting Glucose, Insulin and Insulin Resistance in Complete Glycemic Spectrum ..... 255  
*Rajathi Rajendran, Vivek Kumar Sharma, Ramesh A, Vinod K V*
51. Inter-Professional Education and Collaboration in Dentistry – Current Issues and Concerns, in India: A Narrative Review ..... 261  
*Ramprasad Vasthare, Prateek Mansingh, Kanishk Gupta*
52. Heart Rate Variability Non-Linear Analysis by Poincare Plot in the Complete Glycemic Spectrum ... 266  
*Rajathi Rajendran, Vivek Kumar Sharma, Ramesh, Vinod K V, Hanumanthappa Nandeesh*
53. Knowledge and Perception of Nutrition and Health among Pregnant Women in Rural Central Kalimantan, Indonesia ..... 273  
*Dhini, Yulius Saden, Riyanti, Yetti Wira Citerawati, Irene Febriani, and Ismi Rajiani*
54. A Hospital based Study of Clinico-Socioeconomic Profile of Musculoskeletal Tuberculosis ..... 278  
*Amarnath D Savur, Atmananda S.Hegde, Basanagouda Chandragouda Karigoudar*
55. Knowledge, Attitude, and Practices about Obesity among Obese Homemakers in Urban Udupi: A Cross-Sectional Study ..... 282  
*Guruprasad V, PSVN Sharma, Binu V.S, KR. Banumathe, Shovan Saha*
56. Behavioural Analysis of Consumers Towards Fairness Cream Brands and their Preferences; with Reference to Hul, Madanapalle, Chittoor District ..... 286  
*Kuchi. Srinivasa Krishna, Shaik Ahamed Basha*
57. Bicondylar Tibial Fractures: Comparison of Single Lateral Locked Plate and Double Incision Dual Plate Osteosynthesis ..... 293  
*Rakesh Sera, Atmananda S Hegde, Arjun Naik*
58. Prevalence of Protein Energy Malnutrition among Underfive Children ..... 297  
*Ambica.C, Viruben H Bhudia, Shashikala J Maheshwari, Kiran A Raval*

59.	Analysis of Risk Factors of Personality Type with Hypertension Occurrence of Young Adult .....	301
	<i>Ruslan Majid, Nani Yuniar, Yusuf Sabilu, Farit Rezal</i>	
60.	The Self-Care Learning Exchange (SCLE) Model: A Model for Promoting Nutrition in Malnourished Children in Indonesia .....	306
	<i>Abdul Aziz Alimul Hidayat, Musrifatul Uliyah</i>	
61.	The Development of Islamic Caring Model to Improve Psycho-Spiritual Comfort of Coronary Disease Patients .....	312
	<i>Abu Bakar, Nursalam, Merryana Adriani, Kusnanto, Siti Nur Qomariah, Ferry Efendi</i>	
62.	Influence of <b>Picture and Picture</b> Method against Moral Development of Children .....	318
	<i>Ah. Yusuf, Nurullia Hanum Hilfida, Ilya Krisnana, Putri Yunida Riza</i>	
63.	The Awareness of the Effect of Black Seeds on Blood Glucose in Private University .....	324
	<i>Mohammed Faez Baobaid, Alabed Ali A. Alabed, Mahfoudh A. M. Abdulghani, Mohammed A. Abdelqader, Hasanain Faisal Ghazi, Mustafa Fadil Mohammed, Nurin Qistina Binti Roslan</i>	
64.	The Correlation between the Quality of Nursing Work Life and Job Performance .....	330
	<i>Nursalam Nursalam, Amalia Fardiana, Candra Panji Asmoro, Harif Fadhillah, Ferry Efendi</i>	
65.	Role of MRI in Comparison with DWI-MRI in Diagnosis of Intracranial Meningioma .....	336
	<i>Wijdan Yousif Taher, Kassim A. H. Taj-Aldean</i>	
66.	The Effect of Conditioning Therapy and Model Therapy Toward Pre-School Child Behavior in Tooth Brushing .....	342
	<i>Berthiana T, Widya Warastuti</i>	
67.	Factors Related to Blood Glucose Levels among Type II Diabetes Mellitus Patients (A Cross-Sectional Study in Kedungmundu Public Health Center, Semarang) .....	347
	<i>Lintang Dian Saraswati, Anto Budiharjo, Putri Septyarini, Praba Ginandjar</i>	
68.	Developing a Hospital Electronic Death Record and Storage System for Deceased Patients in Developing Countries .....	351
	<i>Alfred Coleman</i>	
69.	Sexually Transmitted Viral Infections Involving the Genitalia among Females in Nassiryia; a Clinical & Histopathological Study .....	357
	<i>Hadaf H Aljunaiyeh</i>	
70.	Factors Associated to Infant Vaccination in Madurese, Indonesia .....	364
	<i>Esti Yunitasari, Aria Aulia Nastiti, Wini Damayanti Hasan, Ah Yusuf, Heru Santoso Wahito Nugroho</i>	
71.	Assessment Potential of Families Increasing ability to Care for Schizophrenia Post Restrain at East Java, Indonesia .....	369
	<i>Muhammad Suhron, Ah Yusuf, Rika Subarniati</i>	
72.	Role of Vitamin C as Antioxidant in Psoriasis Patients Treated with NB-UVB Phototherapy .....	375
	<i>Sami R. Al-Katib, Hadi A.AL-Wakeel, Riyam F.AL-Rawaf</i>	
73.	Analysis of the Stressor and Coping Strategies of Adolescents with Dysmenorrhoea .....	381
	<i>Nursalam Nursalam, Devi Wahyu Dwi Oktaviani, Ni Ketut Alit Armini, Ferry Efendi</i>	
74.	Cranial CT Scan and Sonographic Finding in Term and Preterm Newborn .....	387
	<i>Kassim Amir Hadi Taj-aldean, Adnan Handhil Aljawdhari, Ahmed Sabah AbdulKhudhur</i>	

75.	Xilem <i>Pinus merkusii</i> as Martapura River Water Biofilter .....	392
	<i>Ratih Dewi Dwiyanti, Leka Lutpiatina</i>	
76.	Factors Influencing Health Conservation of Middle-aged Men in Korea .....	398
	<i>Hee Kyung Kim</i>	
77.	Micro Oxidation Sterilization by Non-Thermal Plasma Technology .....	405
	<i>Jamal Hussaini, Siti Nur Hidayah Bt Muhammad, Noor Masyitah Jumahat, Navindra Kumari Palanisamy, Farzana Y, Najnin A, Nazmul MHM</i>	
78.	Practical and Simple Method in Measurement of Forearm Muscle Fatigue in Computer Operator .....	409
	<i>Hendrik, Yonathan Ramba, Arpandjam'an, M. Nurdin T., Gaurav Kapoor, Heru Santoso Wahito Nugroho</i>	
79.	Knowledge of Antenatal Mothers Admitted in King Abdul-Aziz Medical City (KAMC), Riyadh Regarding Therapeutic Benefits of Post-Natal Exercises .....	413
	<i>Jobby George, Meshal Ibrahim A Alnafjan, Mufleh Saeed H Alshahrani, Rakan Khaled M Alsugali, Zamil Abdullah Z Alsubaie</i>	
80.	The Effect of Physical Activity (Endurance and Strength) and Sleep Management on BMI and Body Fat Children Overweight in Makassar City .....	417
	<i>Jamil Anshory, Hardinsyah, Ikeu Tanziha, Adam Mappaompo, Nur Miftahul Jhanna Nasrah</i>	
81.	Occupational Health and Safety Risk Assessment in Chrome Production .....	423
	<i>Laura Sakebayeva, Gulsim Karashova, Galya Kuspangaliyeva, Kulyan Shayakhmetova, Dina Yegizbayeva, Asem Ktabaliyeva, Ainur Zinaliyeva</i>	
82.	Food Stalls Ownership and Its Contribution on Body Mass Index and the Risk of Cardiovascular Disease in Cooker Profession .....	429
	<i>Novita Medyati, Ridwan Amiruddin, Syamsiar Russeng, Stang Abdul Rahman</i>	
83.	General Knowledge and Misconceptions about HIV/AIDS among the University Students in Malaysia .....	435
	<i>Nazmul MHM, Farzana Y, Deepthi S, Fazlul MKK, Najnin A, Srikumar C</i>	
84.	Supportive Group Therapy as a Prediction of Psychological Adaptation of Breast Cancer Patients Undergoing Chemotherapy .....	441
	<i>Awatiful Azza, Cipto Susilo, Ferry Efendi</i>	
85.	The Effectiveness of “Neherta” Model as Primary Prevention of Sexual Abuse against Primary School Children in West Sumatera Indonesia 2017 .....	446
	<i>Yonrizal Nurdin Meri Neherta, Dilgu Meri</i>	
86.	Impact of Strategic Information System on Quality of Public Healthcare Services .....	453
	<i>Hamad Karem Hadrawi</i>	
87.	The Analysis of Risk Factors Associated with Nutritional Status of Toddler in Posyandu of Beringin Village, Alalak Sub-District, Barito Kuala District .....	459
	<i>Aris Rahman, Ardik Lahdimawan, Syamsul Arifin, Husaini, Rahayu Indriasari</i>	
88.	The Findings of Escherichia Coli in Drinking Water with Reverse Transcriptase Polymerase Chain Reaction Method at 16S RNA Gene .....	465
	<i>Alfina Baharuddin, Anwar Daud, Thahir Abdullah, Mochammad Hatta</i>	

89. Development of Organizational Effectiveness Indicators for Delivery Departments at the Secondary Level Hospitals affiliated to the Thai Ministry of Public Health ..... 471  
*Nongnaphat Wongchantorn, Netchanok Sritoomma, Janjira Wongkhomthong*
90. Incidence of Cleft Lip and Palate in Karbala Province ..... 477  
*Ebtisam A Kadhim*
91. Isolation and Identification of *Aggregatibacter Actinomycetemcomitans* Bacteria by Culturing and Polymerase Chain Reaction Methods in Patients with Chronic Periodontitis ..... 482  
*Sura Dakhil Jassim, Fatima Malik Abood*
92. Inhibition of Propolis and Trigona spp's honey towards Methicilin-Resistant Staphylococcus aureus and Vancomycin-Resistant Staphylococcus aureus ..... 488  
*Leka Lutpiatina, Ratih Dewi Dwiyantri, Anny Thuraidah*
93. Barriers Faced by School Community in the Prevention of Smoking Initiation among Early Adolescents ..... 494  
*Kumboyono Kumboyono, Achir Yani S Hamid, Junaiti Sahar, Saptawati Bardosono*
94. The Behaviors of Ethical Leadership of Division Head Nurses at Advanced Hospitals Under Ministry of Public Health: A Qualitative Study ..... 499  
*Pommala W, Sritoomma, N, Wongkhomthng, J*
95. Quality of Medical Record Document Management System in Banjarmasin Islamic Hospital Installation in 2017 ..... 504  
*Eka Rahma Ningsih, Mohammad Isa, Lenie Marlinae, Husaini, Syamsul Arifin, Jhudi Bonosari Soediono*
96. The Prevalence of Blood Borne Diseases in The Community (A Cross Sectional Study in the District of Semarang) ..... 509  
*Lintang Dian Saraswati, Henry Susanto, Ari Udiyono, Praba Ginandjar, Teguh Winarno*
97. Knowledge, Attitude, and Behavior of Farmers in the Use of Pesticides with Health Complaints in Cikandang Village, Cikajang Sub-District, Garut Regency 2017 ..... 515  
*Suyud Warno Utomo, Karimah Mahdiyyah, Haryoto Kusnopranto*
98. Service Excellence: Strategies for Healthcare and Nursing Services ..... 521  
*Netchanok Sritoomma*
99. Changing Rural Communities Behavior Towards Safe Water and Improved Sanitation in Indonesia .. 527  
*Rahmi Yetri Kasri, Haryoto Kusnopranto, Paulus Wirutomo, Setyo Moersidik*
100. **Leptin and Cortisol: Relationships with Metabolic Syndrome in Male and Female Teachers ..... 534**  
***Nurzakiah Hasan, Veni Hadju, Nurhaedar Jafar, Ridwan Mochtar Thaha***
101. Awareness of Obstructive Sleep Apnea among University Students in Malaysia ..... 540  
*Kavitha Ashok Kumar, Syamil Bin Mazni, Ashok Kumar Jeppu*
102. Learning Model in Nursing Education ..... 544  
*Hammad, Augustine Ramie, Heru Santoso Wahito Nugroho*
103. Effect of Low Methionine Formula on Levels of IL-1 $\beta$  Serum and IL-1 $\beta$  Gene Expression in Knee Joint Cartilage Tissues of Normal Rabbits and ACL Induction OA Models ..... 549  
*Endang Sutjiati, Kusworini, Bambang Wirjatmadi, Handono Kalim*

104. Pseudo National Security System of Health in Indonesia ..... 556  
*Arief Budiono, Absori Ayesha Hendriana Ngestiningrum, Heru Santoso Wahito Nugroho*
105. The Effectiveness of Clinical Supervision Model Based on Proctor Theory and Interpersonal Relationship Cycle (PIR-C) toward Nurses' Performance in Improving the Quality of Nursing Care Documentation ..... 561  
*Tri Johan Agus Yuswanto, Naya Ernawati, Ismi Rajiani*
106. Psychoreligy Strengthens the Parent Self-Acceptance on Children Suffering Cancer ..... 567  
*Ilya Krisnana, Iqlima Dwi Kurnia, Ninik Dwi Purweni*
107. Ex-Leprosy Patients Empowerment for Improving Living Quality through Empirical Rational Strategy in Makassar 2018 ..... 572  
*Andi Rizki Amelia, Ridwan Amiruddin, Andi Arsunan Arsin, Burhanuddin Bahar, Haeruddin, Sukri Palutturi*
108. Safety Risk Factors amongst Online Motorcycle Taxi Drivers Who Provide Public Transportation in Depok, Indonesia ..... 578  
*Indri Hapsari Susilowati, Tiara Nurhafizhah, Akbar Maulana, Muhammad Fitrah Habibullah, Winona Salsabila Sunukanto, Laksita Ri Hastiti, Mufti Wirawan*

# Leptin and Cortisol: Relationships with Metabolic Syndrome in Male and Female Teachers

Nurzakiah Hasan<sup>1,2</sup>, Veni Hadju<sup>3</sup>, Nurhaedar Jafar<sup>3</sup>, Ridwan Mochtar Thaha<sup>4</sup>

<sup>1</sup> Doctor Program, Faculty of Public Health, Hasanuddin University, Makassar-South Sulawesi, Indonesia,

<sup>2</sup> Heath College Baramuli Pinrang, South Sulawesi, Indonesia, <sup>3</sup>Department of Nutrition, Faculty of Public Health,

<sup>4</sup>Health Promotion Department, Faculty of Public Health, Hasanuddin University, Makassar-South Sulawesi, Indonesia

## ABSTRACT

**Background :** Increasing prevalence of metabolic syndrome causes the need for prevention of risk factors and markers, some of them are the role of leptin and cortisol. The aim of this study was to investigate the relationship between leptin and cortisol levels as risk factors of metabolic syndrome among men and women in the teacher group.

**Method:** A cross sectional study was performed with 86 teachers (16 men and 70 women). Characteristic sample, Anthropometry, Lipid profile, fasting blood glucose, blood pressure, cortisol and leptin were measured for all samples.

**Results:** Leptin levels are higher in women than in men ( $30.64 \pm 15.50$  vs  $7.87 \pm 6.02$ ;  $p=0.005$ ). While cortisol levels are higher in men than in women ( $12.09 \pm 4.94$  vs  $8.64 \pm 4.15$ ;  $p < 0.001$ ). Age, stress levels, leptin and cortisol showed a significant association with metabolic syndrome. Leptin correlates significantly with High Density Lipoprotein/ HDL levels ( $r=0.391$ ) for all samples. In men, leptin is significantly correlated with triglycerides/ TG ( $r=0.529$ ) and systolic blood pressure ( $r=0.510$ ), whereas in women, leptin correlates with abdominal circumference ( $r=0.479$ ). Cortisol was significantly correlated with Fasting Blood Glucose/ FBG ( $r = 0.30$ ) in all samples. In men cortisol was significantly correlated with Body mass index/ BMI ( $r = 0.612$ ) while in women it was significantly correlated with FBG ( $r = 0.328$ ).

**Conclusions:** Leptin levels are higher in women than in men, but cortisol is higher in men than in women. In men, triglyceride levels and systolic blood pressure correlate with an increase in leptin, whereas in women is the abdominal circumference. In men, BMI correlates with cortisol and in women fasting blood glucose levels.

**Keyword:** markers, metabolic syndrome, leptin, cortisol

## INTRODUCTION

Non-communicable diseases (NCD) cause the death of 40 million people each year, equivalent to 70% of deaths globally. The highest causes of death were vascular disease, chronic lung cancer, diabetes, and

other NCD (44,25%; 22%; 9,75%; 4%; and 20%)<sup>1</sup>. Of this amount, 85% are in developing countries, one of which is Indonesia.

One of the main risk factors for NCD is metabolic syndrome<sup>2</sup>. The main parameters are blood glucose level, abdominal circumference, blood pressure, HDL levels, and triglyceride levels<sup>3</sup>. Several markers were then developed to detect an increased risk of metabolic syndrome including cortisol and leptin<sup>4,5</sup>.

The hormone cortisol is a hormone that is associated with stress, not only in negative conditions, but also

---

### Corresponding author:

**Nurzakiah Hasan,**

Health College Baramuli, Pinrang, South Sulawesi, Indonesia, e-mail, nurzakiah15p@student.unhas.ac.id, 081342226001 yurniati.nurung7@gmail.com

in a comfortable and happy condition<sup>6</sup>. Chronic stress is associated with hypercortisolemia and long-term sympathetic nervous system (SNS) activation that results in fat accumulation, especially in the abdomen<sup>7</sup>. Excess fat in the abdomen is one of the parameters of the metabolic syndrome. Identifying risk factors for cortisol is important for stress management as an effort to prevent metabolic syndrome.

Leptin is commonly known as the obese gene. People who are obese have high leptin levels. Leptin is identified as a regulator in regulating body weight. Errors in transportation can cause leptin resistance and cause obesity<sup>8</sup>. A literature review shows that of several markers available, leptin is an appropriate biomarker to identify metabolic syndrome<sup>9</sup>.

Research on metabolic syndrome in Indonesia is still very limited. The results of the analysis of the Riskesdas data 2007 conducted by Nurhaedar Jafar showed that the prevalence of metabolic syndrome was 5.2% which increased along with the increasing prevalence of obesity<sup>10</sup>. Research on leptin and cortisol as a marker of metabolic syndrome has never been done before in Indonesia. This study aims to determine the relationship between differences in levels of leptin and cortisol in men and women, the influence of risk factors on metabolic syndrome and risk factors that correlate with leptin and cortisol in men and women in the teacher group.

### **Method**

The study with a cross sectional study design was conducted on a group of teachers in Makassar City. This study involved 12 selected schools and was part of a cohort study, educating teachers as an effort to prevent metabolic syndrome.

The number of samples that can be analyzed for this study is 86 people (16 men and 70 women). Demographic characteristics (age and sex), stress levels were measured using a questionnaire through interviews with respondents. Interview and measurement of anthropometry (weight, height, waist circumference/WC) was carried out by trained personnel taken from undergraduate nutrition students public health faculty of Hasanuddin University. Blood collection is carried out by the prodia laboratory.

### **Metabolic syndrome**

Metabolic syndrome is defined using criteria from the results of harmonization of several groups in the world. The following are the limits for determining the risk of metabolic syndrome parameters.

HDL levels, risk if <40 mg / dl male and <50 mg / dl female

Triglyceride levels, risk if  $\geq$  150 mg / dl

Glucose blood sugar levels, risk if fasting blood glucose levels  $\geq$  100 mg / dl

Blood pressure, risk if  $\geq$  130/85 mmHg

Abdominal circumference, risk if > 90 cm for men and > 80 cm for women

Blood samples were taken after fasting respondents for 12-14 hours were taken by medical personnel from the Prodia laboratory. HDL examination is carried out by Homogenous Enzymatic Colorimetric Assay method, examination of triglycerides by using enzymatic colorimetric method, whereas fasting blood glucose examination using the Hexokinase method. Blood pressure was measured in the condition of the respondent being seated, and being relaxed using Mercurial Sphygmomanometer.

### **Leptin and cortisol**

Leptin and cortisol were measured using the enzyme immunoassay test method. Reagents used in the Diagnostic Biochem Canada Inc brand, where cortisol uses reagents with Ref can-C-270 and leptin using reagents with Ref: can-L-4260. Leptin and cortisol examinations were carried out at the Hasanuddin University Hospital Laboratory.

### **RESULT**

Characteristics of samples based on sex can be seen in Table 1. The average age of male samples is higher than women (50,81 vs 48,89) but the stress level in women is higher than in men (29,00 vs 27,56). There are differences in anthropometry in men and women ( $p < 0,001$ ). There are differences in levels of leptin and cortisol in men and women ( $p < 0,001$  and  $p = 0,005$ ). Fasting blood glucose and triglyceride levels do not show the difference between men and women. However, there are significant differences in HDL levels, systolic blood pressure, diastolic and abdominal girth, where women are better than men.

The relationship between how many risk factors for MetS can be seen in table 2. The risk factors for age and stress are higher in respondents who experience MetS than those who are only at risk (consecutive  $p=0,010$  and  $p=0,026$ ). All MetS parameters show a meaningful relationship with MetS ( $p<0,05$ ) as well as levels of the hormone leptin and cortisol. Respondents who have lower levels of leptin are at risk of developing metabolic syndrome ( $p=0,016$ ) and respondents who have higher cortisol levels are at risk of developing metabolic syndrome ( $p=0,014$ ). The relationship of MetS risk

factors stratified based on sex can be seen in table 3. There were significant differences in age, systolic blood pressure, fasting blood glucose levels, triglyceride levels, HDL levels, between men and women in respondents who experienced metabolic syndrome.

The relationship between leptin and cortisol in several MetS risk factors and MetS parameters can be seen in Table 4. Leptin hormone is significantly associated with HDL levels and abdominal circumference ( $p < 0,05$ ) while cortisol hormone is significantly associated with fasting blood glucose levels ( $p < 0,001$ ).

**Table 1. Characteristics of Samples Based on Sex**

	Variable	Men (n=16)	Women (n=70)	P value*
	Age (Mean±SD)	50.81± 3.89	48.89 ± 5.79	0.210
	Stress level (Mean±SD)	27.56±4.77	29.00±8.28	0.506
Anthropometry	weight (Mean±SD)	73.37±6.48	59.69±5.87	<0.001
	height (Mean±SD)	166.20±5.61	153.05±5.51	<0.001
	BMI (Mean±SD)	26.57±1.99	25.49±2.23	0.081
Hormone	Leptin (Mean±SD)	7.87±6.02	30.64±15.50	<0.001
	Cortisol (Mean±SD)	12.09±4.94	8.64±4.15	0.005
MetS parameter	FBG (Mean±SD)	99.81±25.41	94.46±22.95	0.411
	TG (Mean±SD)	176.81±94.95	135.14±67.70	0.113
	HDL (Mean±SD)	42.06±7.51	58.16±10.90	<0.001
	Systole (Mean±SD)	130.00±12.65	119.71±12.74	0.005
	Diastole (Mean±SD)	85.63±6.29	81.00±7.45	0.024
	WC (Mean±SD)	93.42±3.30	86.66±5.06	<0.001

\*Sex difference are using T test

**Table 2. MetS Risk Factors**

	Mets (n=24)	Risk Mets (n=62)	P value
Age	51.21±3.39	48.48±5.99	0.010*
Stress	31.71±12.01	27.58±4.94	0.026*
BMI	26.29±2.21	25.46±2.19	0.122
WC	89.99±5.57	87.11±5.23	0.027*
Systole	130.42±15.17	118,23±10.79	<0.001**
Diastole	84.58±8,84	80.81±6.60	0.034*
FBG	113.58±34.06	88.44±11.99	<0.001**
TG	198.46±84.08	121.39±58.50	<0.001**
HDL	46.08±10.26	58.68±10.90	<0.001**
Leptin	19.46±12.49	29.09±17.50	0.016*
<b>Cortisol</b>	11.17±5.04	8.54±4.07	0.014*

\* P < 0,05

\*\* P < 0,001

**Table 3. MetS Risk Factor by Sex**

	Mets		Risk Mets	
	Male (n=10)	Female (n=14)	Male (n=6)	Female (n=56)
<b>Age</b>	50.40±4.11	51.79±2.77*	51.50±3.73	48.16±6.13
<b>BMI</b>	27.01±1.97	25.77±2.31	25.83±1.99	25.42±2.23
<b>WC</b>	93.62±3.74	87.41±5.29	93.08±2.69	86.47±5.04
<b>Systole</b>	136±11.74*	126.43±16.46*	120.00±6.33	118.04±11.19
<b>Diastole</b>	86.00±6.99	83.57±10.08	85.00±5.48	80.36±6.59
<b>FBG</b>	101.50±31.37	122.21±34.34*	97.00±12.23	87.52±11.69
<b>TG</b>	212.10±103.80*	188.71±69.29*	118.00±31.88	121.75±60.85
<b>HDL</b>	38.80±6.32*	51.29±9.43*	47.50±6.35	59.88±10.64
<b>Leptin</b>	10.09±6.59	26.16±11.42	4.18±2.06	31.76±16.26
<b>Cortisol</b>	12.69±5.52	10.08±4.55	11.08±4.04	8.28±4.01

\*P &lt; 0.05

\*\*P &lt; 0,001

**Table 4. Correlation Table Between Leptin and Cortisol With MetS Risk Factors and MetS Parameters**

	Leptin			Kortisol		
	Men (n=16)	Women (n=70)	Total (n=86)	Men (n=16)	Women (n=70)	Total (n=86)
<b>Stress</b>	-0.263	-0.083	-0.038	0.130	-0.055	-0.051
<b>Spiritual</b>	-0.069	-0.178	-0.198	-0.293	-0.057	-0.063
<b>Age</b>	-0.226	-0.021	-0.099	0.124	-0.059	0.012
<b>FBG</b>	0.172	-0.150	-0.147	0.153	0.328**	0.302*
<b>TG</b>	0.529*	-0.032	-0.095	-0.352	0.027	-0.003
<b>HDL</b>	-0.212	0.180	0.391**	0.074	0.041	-0.120
<b>Sistole</b>	0.510*	-0.008	-0.136	0.007	0.006	0.097
<b>Diastole</b>	-0.078	0.107	-0.053	0.321	-0.089	0.059
<b>WC</b>	-0.074	0.479**	0.074	-0.483	0.014	0.099
<b>BMI</b>	0.420	0.050	0.067	-0.612*	-0.079	-0.083

\*P &lt; 0.05

\*\*P &lt; 0,001

## DISCUSSION

This study shows the relationship between levels of leptin and cortisol with metabolic syndrome in teachers who are distinguished by sex. Leptin levels are higher in women than in men. In the group that experienced the MetS and risk of MetS, female respondents had higher levels of leptin than men. Leptin hormone levels are associated with obesity. Research conducted in Korea

shows that serum leptin is associated with metabolic syndrome, especially in the body mass index<sup>12</sup>. A meta-analysis conducted by Zeng, et al showed that there was a relationship between leptin and an increased risk of heart and stroke<sup>13</sup>.

Leptin is a hormone associated with regulating food intake and energy balance<sup>14</sup>. Leptin is closely related to the level of obesity, where obese people also have higher hormone levels than those who do not obese<sup>15</sup>. This

study showed that the average abdominal circumference and BMI of men were higher than women, however, based on the results of the analysis it was seen a positive correlation with the increase in levels of leptin hormone with abdominal circumference in women. The higher the abdominal circumference, the higher the level of leptin hormone. This study is in line with research conducted in Saudi Arabia, where leptin levels are higher in women and are positively correlated with BMI and abdominal circumference<sup>16</sup>.

The hormone cortisol shows a significant relationship with the metabolic syndrome, where respondents who experience metabolic syndrome have higher cortisol levels than those at risk. Hormone cortisol is higher in men than in women, as well as in respondents who experience mets and are at risk of MetS, men have higher cortisol levels than women. This is the same as research conducted by Esteghamati, et al in Tehran, which shows high levels of serum cortisol in men compared to women after being justified by age, BMI, and abdominal circumference<sup>17</sup>. High cortisol levels are strongly associated with a person's stress level<sup>7</sup>.

The hormone cortisol can be a marker of the metabolic syndrome. One mechanism that shows the relationship between metabolic syndrome and cortisol is hypothalamic-pituitary-adrenal (HPA) active in respondents who experience Mets. One of the active activities of HPA is due to sustained levels of stress<sup>4</sup>. One of the factors associated with stress is work<sup>18</sup>.

In this study, stress showed a significant relationship with the metabolic syndrome, but did not show a significant relationship with cortisol levels. A meta-analysis was conducted on 29 cross sectional studies by Pan, et al. Which showed that respondents who experienced higher stress had a higher prevalence of metabolic syndrome than those who experienced less stress<sup>19</sup>. Some mechanisms that can show this relationship are obesity<sup>20</sup>, the occurrence of inflammation<sup>21</sup> and an increase in oxidative stress in respondents who are obese<sup>22</sup>.

## CONCLUSION

Leptin levels are higher in women than in men, but cortisol levels are higher in men than in women. Increased parameters of the metabolic syndrome also increase levels of leptin and cortisol, but there are different parameters that increased in men and women.

This study strengthens that the hormone leptin and the hormone cortisol are markers for the determination of the metabolic syndrome.

**Conflict of Interest:** There is no any conflict of interest within this study and publication

**Ethical Clearence:** Taken from Hasanuddin University Ethics Committee with number: 969/H4.8.4.5.31 /PP36-KOMETIK / 2017.

**Source of Funding :** Ministry of Research, Technology and Higher Education, Indonesia.

## REFERENCES

1. WHO. WHO Fact Sheet. 2017; <http://www.who.int/mediacentre/factsheets/fs355/en/>. Accessed 16 April, 2017.
2. Kaur J. A comprehensive review on metabolic syndrome. *Cardiology research and practice*. 2014;2014.
3. Alberti K, Zimmet P, Shaw J. The metabolic syndrome—a new worldwide definition. *Lancet*. 2005;366.
4. Anagnostis P, Athyros VG, Tziomalos K, Karagiannis A, Mikhailidis DP. The Pathogenetic Role of Cortisol in the Metabolic Syndrome: A Hypothesis. *The Journal of Clinical Endocrinology & Metabolism*. 2009;94(8):2692-2701.
5. Uzcátegui E, Valery L, Uzcátegui L, Gomez Perez R, Marquina D, Baptista T. Prevalence of the metabolic syndrome, insulin resistance index, leptin and thyroid hormone levels in the general population of Mérida (Venezuela). *Investigación Clínica*. 2015;56(2).
6. Shier D, Butler J, Lewis R. *Human anatomy and physiology*. McGraw-Hill Boston, MA, USA; 2001.
7. Kyrou I, Tsigos C. Stress hormones: physiological stress and regulation of metabolism. *Current opinion in pharmacology*. 2009;9(6):787-793.
8. Nappo A, Gonzalez-Gil E, Ahrens W, et al. Analysis of the association of leptin and adiponectin concentrations with metabolic syndrome in children: Results from the IDEFICS study. *Nutrition, Metabolism and Cardiovascular Diseases*. 2017;27(6):543-551.
9. Falahi E, Rad AHK, Roosta S. What is the best biomarker for metabolic syndrome diagnosis?

- Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2015;9(4):366-372.
10. Jafar N. Sindroma metabolik dan epidemiologi. *Media Gizi Masyarakat Indonesia*. 2012;1(2).
  11. Alberti K, Eckel RH, Grundy SM, et al. Harmonizing the metabolic syndrome a joint interim statement of the international diabetes federation task force on epidemiology and prevention; national heart, lung, and blood institute; American heart association; world heart federation; international atherosclerosis society; and international association for the study of obesity. *Circulation*. 2009;120(16):1640-1645.
  12. Yun JE, Kimm H, Jo J, Jee SH. Serum leptin is associated with metabolic syndrome in obese and nonobese Korean populations. *Metabolism*. 2010;59(3):424-429.
  13. Zeng R, Xu C-H, Xu Y-N, Wang Y-l, Wang M. Association of leptin levels with pathogenetic risk of coronary heart disease and stroke: a meta-analysis. *Arquivos Brasileiros de Endocrinologia & Metabologia*. 2014;58(8):817-823.
  14. Zhang F, Chen Y, Heiman M, DiMarchi R. Leptin: structure, function and biology. *Vitamins & Hormones*. 2005;71:345-372.
  15. Al-Sultan AI, Al-Elq AH. Leptin levels in normal weight and obese Saudi adults. *Journal of family & community medicine*. 2006;13(3):97.
  16. Al-Amodi HS, Abdelbasit NA, Fatani SH, Babakr AT, Mukhtar MM. The effect of obesity and components of metabolic syndrome on leptin levels in Saudi women. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*. 2018;12(3):357-364.
  17. Esteghamati A, Novin L, Nakhjavani M. Association of serum cortisol levels with parameters of metabolic syndrome in men and women. *Clinical and Investigative Medicine (Online)*. 2011;34(3):E131.
  18. Bergmann., Natasha C, Gyntelberg., Finn F, Jens. Chronic stress and the development of the metabolic syndrome: a systematic review of prospective cohort studies. *Endocrine connections*. 2014:EC-14-0031.
  19. Pan A, Keum N, Okereke OI, et al. Bidirectional association between depression and metabolic syndrome: a systematic review and meta-analysis of epidemiological studies. *Diabetes care*. 2012;35(5):1171-1180.
  20. Xu Q, Anderson D, Lurie-Beck J. The relationship between abdominal obesity and depression in the general population: A systematic review and meta-analysis. *Obesity research & clinical practice*. 2011;5(4):e267-e278.
  21. Howren MB, Lamkin DM, Suls J. Associations of depression with C-reactive protein, IL-1, and IL-6: a meta-analysis. *Psychosomatic medicine*. 2009;71(2):171-186.
  22. Furukawa S, Fujita T, Shimabukuro M, et al. Increased oxidative stress in obesity and its impact on metabolic syndrome. *The Journal of clinical investigation*. 2004;114(12):1752-1761.