



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

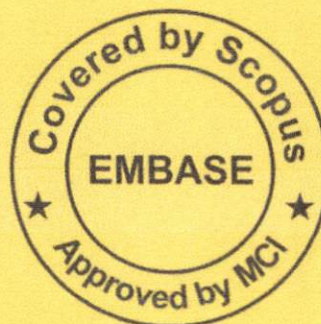
ISSN:0976-0245E-ISSN: 0976-5506 Subject area: Medicine:

Public Health, Environmental and Occupational Health

CiteScore 2017-0.03

SJR 2017 - 0.108

SNIP 2017-0.047



Website:

www.ijphrd.com



Indian Journal of Public Health Research & Development

www.ijphrd.com

Contents

Volume 10, Number 9

September 2019

1. Nasal Carriage Status of Staphylococcus *Aureus* amongst People Working in the Diagnostic Microbiology Laboratory of a Coastal Karnataka Medical College 01
Ashwini Hegde, Rahiyana T A, Mangala, Pooja Rao, Radhakrishna M
2. Sanitation and Hygiene Practices and their Determinants among the Rural Population of Vikarabad 06
Chandrasekhar Reddy Bolla, A. Revanth Kumar, Rajeshwar Rao Ahwala, Pavani Tunga
3. Parental Alcoholism - Psychosocial Problems Faced by Adolescents 13
Chinnu Sebastian, Suja M.K
4. A Comparative SEM Study of the Effects of Hand Scaling, Diode Laser and Erbium, Chromium: Yttrium-Scandium-Gallium-Garnet (Er,Cr:YSGG) Laser on Root Surface 17
Sayantan Karmakar, Deepa G. Kamath, David Kadakampally, Rashmi Nayak, Meena Anand
5. Animal Bite Surveillance Data Quality at Primary Health Centres of Hassan District 23
G.M. Venkatesh, C.R. Hiraniah, M. Sundar
6. Quality of Life of Retired and Employed Post – Retirement Professionals 28
Divi Tara, Mamata Mahapatra
7. Estimation of Average Survival Time among Under-Five Children in Empowered Action Group States of India: An Application of Non Parametric Survival Models 33
Neha Mishra, Sheela Misra
8. Neurobehavioral Effects of Losartan on Rotenone Induced Parkinsonism in Rats 38
Prakash KG, Bannur BM, Madhavrao C, Saniya K
9. An Ensemble Model for the Prediction of Gestational Diabetes Mellitus (GDM) 44
Prema N S, Pushpalatha M P
10. “Gypsy” Narikuravar Community: Problems in Accessing Health Care Services 49
R. Kanthiah Alias Deepak, C. Velaudham, M. Manivannan
11. Implications of Low-Carbohydrate -High Fat Diet on Weight Management 55
Kanagala Anusha, Anuradha Averineni
12. The Behavioural Risk Factors Contributing to Non-Communicable Diseases among Women 60
Sheeba S R. Rima, Parvathy Suresh
13. Mental and Physical Wellbeing of Elderly 66
Sunitha P P, Surya M Nair, Swapna S Nair

265. The Effect of Indomethacin and Ambon Banana Stem Extract (*Musa paradisiaca* var. *sapientum*) on Ileum Histopathology of Indomethacin-induced Rats (*Rattus novergicus*) 1445
Dian Afikasari, Kadek Rachmawati, Romziah Sidik
266. Attenuation of *Eimeria tenella* with Immersion Various Concentration of Formaldehyde in Inducing Protective Immunity after Challenge Test by Featuring Macroscopic and Microscopic Caecum 1451
Rizki Rohmah Armiani, Muchammad Yunus, Chairul Anwar Nidom
267. The Potential of Immune Response Improvement through *Brucella abortus* Outer Membrane Protein and Whole *Brucella abortus* S19 Vaccinations on White Pulp Diameter of *Lepus nigricollis* 1457
Muhammad Ardiansyah, Chairul Anwar, Imam Mustofa
268. The Effect of Adding Moringa Leave (*Moringa oleifera*) to Male Broiler Feed 1462
Mien Qurrati A'yuni Muis, Kadek Rachmawati, Mohammad Anam Al Arif
269. The Effect of Vitamin on Wistar Rats' Testicle s Exposed to Lethal Insecticide 1467
Gabriella Ayu Pitaloka, Kusnoto, Thomas Valentinus Widijatno
270. The Potency of Formalin in Atenuation of Pathogenicity in *Eimeria Tenella* at the Caecum of Broiler Chicken 1472
Enik Setyowati, Muchammad Yunus, Dadik Rahardjo
271. Fasciolosis Prevalence on Several Cattle Breeds 1478
Kurnia Winda Pratiwi, Setiawan Koesdarto, Nenny Harijani
272. BPJS Kesehatan Patients Satisfaction on Pharmaceutical Services in Community Health Center (PUSKESMAS)—South Surabaya Area 1482
Assyifa Ilmi Auliya, I Nyoman Wijaya, Catur Dian Setiawan, Gesnita Nugraheni
273. The Effect of Lower Extremity Massage with Lavender Essential Oil on Decreasing Blood Pressure in Elderly with Hypertension in UPTD Griya Werdha Surabaya 1488
Fatih Haris Maulana, Joni Haryanto, Elida Ulfiana
274. Fine Motor Skill and Cognition Development in Children with Autism Using Finger Painting Method 1494
Okgi Tiara, Ah Yusuf, Rr. Dian Tristiana
275. The Effectiveness of Afternoon Sunbath in Improving Elderly Sleep Quality 1500
Zaenal Abidin, Harmayetty, Deni Yasmara
276. Family Burden and Coping in Family Caregivers of Patients with Schizophrenia 1506
Winda Kusumawardani, Ah. Yusuf, Lailatun Ni'mah
277. Antibacterial Activities of Extract n-Butanol-Methanol (1:1) Filtrat of the Fermentation Results of *Streptomyces* sp. B10 Against *Mycobacterium tuberculosis* H37Rv: An Experimental Study 1511
Septa Devi Adetya Putri, Isnaeni, M. Faris Adrianto
278. The Correlation between Goat Maintenance Management to the Incidence of Gastrointestinal Parasite Infections 1517
Zahrotul Hurriyyah, Nunuk Dyah Retno Lastuti, Lianny Nangoi
279. Histopathology of Esophagus and Crop of Pigeon (*Columbia livia*) Infected by *Trichomonas gallinae* 1522
Aprilia Eva Widiawati, Muchamad Yunus, Thomas V Widijatno

Antibacterial Activities of Extract n-Butanol-Methanol (1:1) Filtrat of the Fermentation Results of *Streptomyces* sp. B10 Against *Mycobacterium tuberculosis* H37Rv: An Experimental Study

Septa Devi Adetya Putri¹, Isnaeni¹, M. Faris Adrianto¹

¹Pharmaceutical Chemistry Department, Faculty of Pharmacy, Universitas Airlangga

ABSTRACT

Background: *Streptomyces* sp. is one of the sources of first choice antibiotic for tuberculosis treatment. *n*-butanol is the best solvent to extract antibacterial compound from fermented *Streptomyces* sp. isolates.

Aim: To analyze anti-tuberculosis activity of extract *n*-butanol-methanol (1:1) filtrate of the fermentation results of *Streptomyces* sp. B10 against *Mycobacterium tuberculosis* H37Rv.

Method: This was a laboratory experimental study. 3 comparisons of the type of solution were observed once a week for 3 weeks. Antibacterial activity test was analyzed from morphological observations on Ziehl-Neelsen staining, then minimum inhibitory concentration and minimum bactericidal concentration were determined.

Result: Bacterial growth began in the second week starting from a concentration of 10,50 ppm to a concentration of 1,31 ppm but a concentration of 43.000 ppm to a concentration of 5.375 ppm didn't show any bacterial growth. The results of Ziehl-Neelsen staining show a red and rod-shaped *Mycobacterium tuberculosis* H37Rv colonies at a concentration of 2.687,5 ppm to a concentration of 1,31 ppm and at a positive control. A concentration of 2.687,5 ppm was determined as minimum inhibitory concentration and a concentration of 5.375 ppm was determined as minimum bactericidal concentration.

Conclusion: Extract *n*-butanol-methanol (1:1) filtrate of the fermentation results of *Streptomyces* sp. B10 at a concentration of 2.687,5 ppm to 5.375 ppm has antibacterial activity against *Mycobacterium tuberculosis* H37Rv. This extract can be used as an antibiotic formula for tuberculosis.

Keywords: *Streptomyces* sp, *n*-butanol, tuberculosis, antibacterial activities

Introduction

After first-line anti-tuberculosis drugs were released, the number of deaths was greatly reduced¹. The characteristic of tuberculosis that rapidly resistant to drugs, and the ability of bacteria to survive is a major problem for public health². In Indonesia, the total cases that reported in 2016 were 360.565 cases.

In 2014, the prevalence of 660 per 100,000 population with a case incidence of 403 per 100,000 population³. The characteristic of *Mycobacterium tuberculosis* is the ability to make a persistent infection that requires long-term antibiotic therapy to cure tuberculosis patient⁴. Tuberculosis (TB) has become a curable disease due to the antibiotic invention⁵⁻⁶.

One genus of *Actinomycetes* which contributes most of its active metabolites to antibiotics is *Streptomyces*, this genus occupies the first position on several antibiotics⁷. Antibiotic as anti-TB were discovered in 1943, known as Streptomycin⁸.

Various strategies including bioinformatics are currently being tested to identify and improve

Corresponding Author:

Isnaeni
Pharmaceutical Chemistry Department,
Faculty of Pharmacy, Universitas Airlangga
Email: isnaenisurabaya@yahoo.com

vaccines against TB⁹. The researchers are undertaking and discovering new microorganisms which produce secondary metabolites¹⁰⁻¹¹. Domestic production of drug ingredients has not been going well, and still depends on imports ingredients¹². Five out of 15 isolates have been shown to have antibacterial activity from isolation using agricultural soil in Indonesia that planted with kale, spinach, and corn. One of the isolates known as *Streptomyces sp.* B10 which identified as *Streptomyces violaceusniger*^{13,14}. Water fraction and *n*-butanol fraction from fermented *Streptomyces sp.* B10 has antibacterial activities but the minimum inhibitory concentration remains unknown¹³. Extract filtrate of the fermentation results of *Streptomyces sp.* B10 with *n*-butanol as solvent using KLT method with eluent methanol: water produces one stain¹⁴. Extract *n*-butanol-methanol (1:1) filtrate of the fermentation results of *Streptomyces sp.* B10 showing antibacterial activity against *Escherichia coli*. *n*-butanol is a solvent which has been shown able to selectively extract antibiotic compounds from *Streptomyces* isolates with a large zone of inhibition¹⁵. Methanol is a polar solvent that is mostly used because of its efficient penetration into the cell wall, so it produces more endocellular secondary metabolites¹⁶.

This study aimed to analyze the activity of extract *n*-butanol-methanol (1:1) filtrate of the fermentation results of *Streptomyces sp.* B10 against *Mycobacterium tuberculosis* H37Rv.

Method

This study was an experimental study conducted in the Microbiology Laboratory Faculty of Pharmacy Universitas Airlangga and Tuberculosis Laboratory

Institute of Tropical Disease Universitas Airlangga in 2017. Bacterial samples were *Mycobacterium tuberculosis* H37Rv and obtained from Tuberculosis laboratory Institute of Tropical Disease Airlangga University Surabaya. *Streptomyces sp.* B10 isolates were obtained from the Microbiology laboratory collection, Pharmaceutical Chemistry Department, Faculty of Pharmacy Universitas Airlangga. This study was conducted by researchers and expert lecturers

The solution consists of 3 types: extract *n*-butanol-methanol (1:1) filtrate of the fermentation results of *Streptomyces sp.* B10, 1,0 ppm rifampicin (RIF) solution and DMSO solvent, and positive control (Middlebrook7H10 medium and *Mycobacterium tuberculosis* H37Rv). Incubation temperature, pH, and incubation duration were controlled in this study. Laboratory testing procedures were carried out by using *Streptomyces sp.* B10 culture, fermentate the *Streptomyces sp.* B10, freeze dry the culture, extract the crude dry powder using *n*-butanol-methanol (1:1), evaporate the extraction, extract *n*-butanol-methanol (1:1) filtrate of the fermentation results of *Streptomyces sp.* B10, and dilute. Antibacterial activity test was analyzed from morphological observations (shape, elevation, and color) on Ziehl-Neelsen staining, then minimum inhibitory concentration was determined. The assessment was determined by researchers and expert lecturers.

Result

Extraction using *n*-butanol-methanol (1:1) produced brownish yellow colored extract filtrate that has an oil-like consistency and non-distinctive smell. The summary of results from the first week to the third week can be seen in table 1.

Table 1: Test results for antibacterial activity

No.	Materials	Lab. Code	Concentration (ppm)	Result Per Week			Descriptions
				1	2	3	
1	Extract	1	43.000	-	-	-	Inhibit the growth of <i>Mycobacterium tuberculosis</i> H37Rv (no growth)
		2	21.500	-	-	-	
		3	10.750	-	-	-	
		4	5.375	-	-	-	
		5	2.687,5	-	-	+	
		6	1.343,75	-	-	+	
		7	671,88	-	-	+	
		8	335,94	-	-	+	

Conted...

		9	167,97	-	-	+	Not inhibit the growth of <i>Mycobacterium tuberculosis</i> H37Rv (positive growth)
		10	83,98	-	-	+	
		11	41,99	-	-	+	
		12	21,00	-	-	+	
		13	10,50	-	+	+	
		14	5,25	-	+	+	
		15	2,62	-	+	+	
		16	1,31	-	+	+	
2	RIF		1,0	-	-	-	Inhibit the growth of <i>Mycobacterium tuberculosis</i> H37Rv (positive growth)
3	DMSO			-	-	+	Not inhibit the growth of <i>Mycobacterium tuberculosis</i> H37Rv (positive growth)
4	Control (+) M. tbH37Rv			-	+	+	

Note: (-): no growth (+) :Positive growth

On the first week, *Mycobacterium tuberculosis* H37Rv still has not shown any growth on Middlebrook 7H10 medium and Middlebrook 7H10 medium that contain solutions at several concentrations: 43.000 ppm, 21.500 ppm, 10.750 ppm, 5.375 ppm, 2.687,5 ppm, 1.343,75 ppm, 671,88 ppm, 335,94 ppm, 167,97 ppm, 83,98 ppm, 41,99 ppm, 21,00 ppm, 10,50 ppm, 5,25 ppm, 2,62 ppm, 1,31 ppm, likewise positive control (media and *Mycobacterium tuberculosis* H37Rv), Rifampicin (RIF) 1,0 ppm solution, and DMSO solvent. The growth of *Mycobacterium tuberculosis* H37Rv on Middlebrook 7H10 medium usually occur at the 1st-2nd week, so that observation continue for three weeks.

Observation at the second week shows that in a mastersolutionata concentration of 43.000 ppm to 21,00 ppm still has not shown the growth of *Mycobacterium tuberculosis* H37Rv. The solution at a concentration of 10,50 ppm to 1,31 ppm shows slight growth. The bacterial growth at a concentration of 10,50 ppm and 5,25 ppm can be seen as nebulous white dots, while at a concentration of 2,62 ppm the bacterial growth spread evenly as several small dots and at a concentration of 1,31 ppm show the most amount of growth compared to other concentrations. Positive control (media and *Mycobacterium tuberculosis* H37Rv) show a lot of growth with a white colored and slightly rough texture, in the Rifampicin (RIF) solution and DMSO still has not shown the bacterial growth. But it is not yet known whether the growth appears from *Mycobacterium tuberculosis* H37Rv or other bacteria.

At the third week, the inhibiting ability of extract *n*-butanol-methanol (1: 1) were decreasing. In a master solution at a concentration of 43.000 ppm to 5.375 ppm on Middlebrook 7H10 medium still has not shown the bacterial growth, which means at a concentration of 43.000 ppm, 21.500 ppm, 10.750 ppm, and 5.375 ppm has the inhibiting ability. Whereas at a concentration of 2.687,5 ppm to 1,31 ppm show bacterial growth. Since the first week to the third week, Rifampicin solution did not show any bacterial growth, which means Rifampicin as a standard that has the ability to inhibit *Mycobacterium tuberculosis* H37Rv growth. Whilepositive control (Middlebrook 7H10 medium and *Mycobacterium tuberculosis* H37Rv) in the second week to the third week show bacterial growth increment, this shows that *Mycobacterium tuberculosis* H37Rv can grow on selective Middlebrook 7H10 medium. But it was not yet known whether the growth appears from *Mycobacterium tuberculosis* H37Rv or other bacteria. Therefore Ziehl-Neelsen staining was undertaken to determine the bacteria that grow in each concentration.

Microscopic observation on Ziehl-Neelsen staining did not show *Mycobacterium tuberculosis* H37Rv at a concentration of 43.000 ppm; 21.500 ppm; 10.750 ppm; and 5.375 ppm, it was plain blue. Whereas at a concentration of 2.687,5 ppm; 1.343,75 ppm; 671,88 ppm; 335,94 ppm; 167,97 ppm; 83,98 ppm; 41,99 ppm; 21,00 ppm; 10,50 ppm; 5,25 ppm; 2,62 ppm; and 1,31 ppm show red, straight, slim rod shaped *Mycobacterium tuberculosis* H37Rv, with blue background.

To determine the bacterial activity in quantitative approaches, the lowest concentration that can inhibit bacterial growth was observed. At a concentration of 10.750 ppm has not shown the bacterial growth, which means this concentration has the ability to inhibit *Mycobacterium tuberculosis* H37Rv growth. At a concentration of 5,375 ppm also hasn't shown any bacterial growth, so this concentration still able to inhibit *Mycobacterium tuberculosis* H37Rv growth, but at a concentration of 2.687,5 ppm bacterial growth began to appear.

Microscopic observation on Ziehl-Neelsen staining did not show *Mycobacterium tuberculosis* H37Rv

colony at a concentration of 43.000 ppm; 21.500 ppm; 10.750 ppm and 5.375 ppm, it was plain blue. Whereas at a concentration of 2.687,5 ppm; 1.343,75 ppm; 671,88 ppm; 335,94 ppm; 167,97 ppm; 83,98 ppm; 41,99 ppm; 21,00 ppm; 10,50 ppm; 5,25 ppm; 2,62 ppm and 1,31 ppm show red, straight, slim rod-shaped *Mycobacterium tuberculosis* H37Rv, with blue background. So that the Minimum Inhibitory Concentration (MIC) from extract *n*-butanol-methanol (1:1) filtrate solution of the fermentation results of *Streptomyces* sp. B10 against *Mycobacterium tuberculosis* H37Rv is 2.687,7 ppm. While the concentration of 5,375 ppm is the highest concentration that still able to kill the bacteria (MBC).

Table 2: Observation result of Minimum Inhibitory Concentration (MIC)

No.	Materials	Lab. Code	Concentration (ppm)	Result Per Week			Description
				1	2	3	
1	Extract	1	43.000	-	-	-	Inhibit the growth of <i>Mycobacterium tuberculosis</i> H37Rv (no growth)
		2	21.500	-	-	-	
		3	10.750	-	-	-	
		4	5.375	-	-	-	
		5	2.687,5	-	-	+	Not inhibit the growth of <i>Mycobacterium tuberculosis</i> H37Rv (appear growth)
		6	1.343,75	-	-	+	
		7	671,88	-	-	+	
		8	335,94	-	-	+	
		9	167,97	-	-	+	
		10	83,98	-	-	+	
		11	41,99	-	-	+	
		12	21,00	-	-	+	
		13	10,50	-	+	+	
		14	5,25	-	+	+	
		15	2,62	-	+	+	
		16	1,31	-	+	+	
2	RIF		1,0	-	-	-	Inhibit the growth of <i>Mycobacterium tuberculosis</i> H37Rv (no growth)
3	DMSO			-	-	+	Not inhibit the growth of <i>Mycobacterium tuberculosis</i> H37Rv (appear growth)
4	Control (+) M.tbH37Rv			-	+	+	

Note: (-) : no growth (+) : appear growth

The microscopic observation did not show *Mycobacterium tuberculosis* H37Rv colony at a concentration of 43.000 ppm; 21.500 ppm; 10.750 ppm and 5.375 ppm, it was plain blue. Whereas at a concentration of 2.687,5 ppm; 1.343,75 ppm; 671,88 ppm; 335,94 ppm; 167,97 ppm; 83,98 ppm; 41,99 ppm; 21,00 ppm; 10,50 ppm; 5,25 ppm; 2,62 ppm and 1,31 ppm show red, straight, slim rod-shaped *Mycobacterium tuberculosis* H37Rv, with blue background.

Discussion

Extract *n*-butanol-methanol (1:1) filtrate solution of the fermentation results of *Streptomyces sp.* B10 has antibacterial activity against *Mycobacterium tuberculosis* H37Rv. *n*-butanol is the selective solvent that can extract antibiotic compounds from *Streptomyces sp.* with a large zone of inhibition¹⁵. Ethanol extract has potent ability to inhibit bacterial growth, both gram-positive and gram-negative bacteria¹⁷. Methanol is a polar solvent that mostly used because of its efficient ability to penetrate into the cell wall, so it produces more endocellular secondary metabolites¹⁶. Several isozymes show high substrate specificity and various homogeneity from *Streptomyces sp.* Cell extract for several types of alcohol¹⁸.

Dilution using this extract can support the attack against *Mycobacterium tuberculosis* (TB). Since *Mycobacterium tuberculosis* has a high acquisition to drug resistance, new drug discovery to put into tuberculosis regimen is required¹⁹. *Streptomyces* potential for expressing foreign proteins indicate that *Streptomyces* can be a useful vector in designing new TB vaccine. Streptomycin is the first antibiotic that attacks *Mycobacterium tuberculosis* by mootherapy, so it leads to generate resistance. The mechanism of action of streptomycin is inhibiting mycobacterial protein synthesis in ribosomes. Resistance arises when mutations appear on rRNA and protein-encoding genes. ATCC27294 strains are sensitive toward the activity of streptomycin, rifampin, ethambutol, and isoniazid and ATCC35820 strains are resistant to streptomycin. Several mutated genes are evidenced to cause drug resistance^{20,21}. The clinical trials of streptomycin show a good outlook to suppress TB. Although patient improved compared to the patient without therapy (considered as the first randomized controlled clinical trial), recurrence occurs in many patients and organisms are found to be resistant to streptomycin²².

The concentration ranges from 2,687.5 ppm to 5,375 ppm effective against *Mycobacterium*. Antibacterial activity against *Mycobacterium tuberculosis* H37Rv occurs at a concentration of 2.687,5 ppm, which is determined as Minimum Inhibitory Concentration (MIC). Whilst the concentration of 5.375 ppm is determined as Minimal Bactericidal Concentration (MBC), which is the lowest concentration that able to kill bacteria. This result shows that antibacterial activity increased as the

increasing extract *n*-butanol-methanol (1:1) filtrate solution of the fermentation results of *Streptomyces sp.* B10 concentration, because the extract in this study has not become an antibacterial pure compound.

There are few things as consideration for further research: further analysis with separation of active compounds from *Streptomyces sp.* B10 using TLC bioautography method or other separation methods, further identification to find out another pure compound as antibacterial that produced by *Streptomyces sp.* B10, and limiting concentration range from 5.375 ppm to 2.687,5 ppm for antibacterial activity test and MIC determination.

Conclusion

Extract *n*-butanol-methanol (1:1) filtrate of the fermentation results of *Streptomyces sp.* B10 has antibacterial activity against *Mycobacterium tuberculosis* H37Rv. This indicates that this extract can be used as an alternative antibiotic formula to fight tuberculosis.

Ethical Clearance: This research has gone through ethical tests and permits from Faculty of Pharmacy Universitas Airlangga

Conflict of Interest: The author reports no conflict of interest of this work.

Source of Funding: This study is done with individual funding

REFERENCES

1. Departemen Kesehatan RI. "Pharmaceutical care". [Internet]. 2005. Available from: http://binfar.depkes.go.id/dat/lama/1309242859_YANFAR.PC%20T%0AB_1.pdf
2. Manaf Al Matar, Husam Al Mandealb, Işıl Varc, Begüm Kayard FK. New drugs for the treatment of *Mycobacterium tuberculosis* infection. *Biomed Pharmacother.* 2017;91:546–58.
3. WHO. Indonesian TB situation Update 2017 [Internet]. 2018. Available from: <http://www.searo.who.int/indonesia/topics/tb/en/>
4. Anastasia S. Kolyva and Petros C. Karakousis. Old and New TB Drugs: Mechanisms of Action and Resistance, Understanding Tuberculosis

- New Approaches to Fighting Against Drug Resistance, Pere-Joan Cardona. 2012;
5. Tasha Smith, Kerstin A. Wolff and LN. Molecular Biology of Drug Resistance in Mycobacterium tuberculosis. *Curr Top Microbiol Immunol.* 2013;374:53–80.
 6. Sridevi, K., dan Dhevendaran K. “Streptomycetes From Marine Seaweeds : Their Antimicrobial And Antibiotic Potential”. *Int J Appl Biol Pharm Technol.* 2014;5(4):74–9.
 7. Procópio, R. E., Silva, I. R., Martins, M. K., Azevedo, J. L., dan Araújo J, M. “Antibiotics Produced by Streptomyces.” *Brazilian J Infect Dis.* 2012;16(5):466–71.
 8. Yassien, M. A., Abdallah, H. M., El-Halawany, A. M., dan Fatani AAM, J. “Anti-Tuberculous Activity of Treponemycin Produced by a Streptomyces Strain MS-6-6 Isolated from Saudi Arabia”. *Molecules.* 2015;p.2576–2590.
 9. Arzuaga NO, Vila Granda A, Gómez JC, San Miguel ME, Bourzac JF, Hernández YL, Elías LópezAL, Pólux CR, Mesa LG, Hernández-Pando R D. The use of Streptomyces for immunization against mycobacterial infections. *Hum Vaccin.* 2011;7(9):934–40.
 10. Sembiring, L., dan Goodfellow M. “Ecological Approach to Unravel Streptomycete Diversity as an Unsurpassed Sources of Natural Bioactive Products”. *J IPB.* 2008;2(2):49–56.
 11. Primm, T.P. dan Franzblau, S.G. “Recent Advances in Methodologies for the Discovery of Antimycobacterial Drugs”. *Curr Bioact Compd.* 2007;3(3).
 12. Kementerian DJK dan AK, Kesehatan RI. Upaya Kemandirian Produksi Bahan Baku Obat Indonesia. *Bul Infarkes Ed II Jakarta.* 2016;
 13. Fairuz, D., Isnaeni, Nasution, N. E. S. FMW. “Antibacterial Activity Of Buthanol Extract From Free Cell Fermentation Broth Of Streptomyces B-10 Against Escherichia coli ATCC 25922.” Universitas Airlangga; 2016.
 14. Isnaeni, Kusumawati, I., Warsito, M. F., Darmawati, A., Mertaniasih NM. “Antimicrobial Activity Of Streptomyces spp. Isolates From Vegetable Plantation Soil”. *J Biol Res.* 2016;2(21).
 15. Adlhani, E., Mahsunah, A. H. Y. “Uji Aktivitas Senyawa Antibiotika Yang Dihasilkan Oleh Aktinomisetes Endofit Streptomyces bacillaris AY999817 Dari Batang Tanaman Urang Aring”. *J Teknol Ind.* 2012;2(1).
 16. Hidayati N. “Isolasi Dan Penetapan Kadar Senyawa Antifungal PMethoxybenzylidene P-Aminophenol Dari Akar Acacia Mangium [Isolation And Concentration Determination Of Antifungal Compound P-Methoxybenzylidene P-Aminophenol From Acacia Mangium Root]”. *J Pemuliaan Tanam Hutan.* 2012;6(2):117–30.
 17. U. S. Mishra, A. Mishra, R. Kumari, P. N. Murthy and BSN. Antibacterial Activity of Ethanol Extract of *Andrographis paniculata*. *Indian J Pharm Sci.* 2009;71(4):436–8.
 18. Nishimura M, Kohno K, Nishimura Y, Inagaki M DJ. Characterization of two isozymes of coniferyl alcohol dehydrogenase from *Streptomyces* sp. *Biosci Biotechnol Biochem.* 2011;75(9):1770–7.
 19. C. Sao Emani, M. J. Williams, I. J. Wiid, B. Baker CC. Compounds with Potential Activity against *Mycobacterium tuberculosis*. *Antimicrob Agents Chemother* [Internet]. 2019;62(4). Available from: <https://aac.asm.org/highwire/citation/16605/download>
 20. Ruiz P, Rodríguez-Cano F, Zerolo FJ CM. Investigation of the in vitro activity of streptomycin against *Mycobacterium tuberculosis*. *Microb Drug Resist.* 2002;8(2):147–9.
 21. Jagielski T, Ignatowska H, Bakula Z, Dziewit Ł, Napiórkowska A, Augustynowicz-Kopeć E et al. Screening for Streptomycin Resistance-Confering Mutations in *Mycobacterium tuberculosis* Clinical Isolates from Poland. *PLoS One.* 2014;9(6).
 22. Gillespie SH. “Evolution of Drug Resistance in *Mycobacterium tuberculosis*: Clinical and Molecular Perspective.” *Antimicrob Agents Chemother.* 2019;46(2):267–74.

Indian Journal of Public Health Research & Development

EXECUTIVE EDITOR

Vidya Surwade

Associate Professor, Dr Baba Saheb Ambedkar, Medical College & Hospital, Rohinee, Delhi

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 D Ade** (*Professor*)
Community Medicine Department, SVIMS, Sri Padamavati Medical College, Tirupati,
Andhra Pradesh.
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**, PhD Medical Sociology, *Associate Professor*,
Swami Vivekananda Subharti University Meerut UP 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: Quarterly
(Four issues per volume)

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

©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

CALL FOR SUBSCRIPTIONS

About the Journal

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. The frequency is Monthly. It deals with all aspects of Public Health including Community Medicine, Public Health, Epidemiology, Occupational Health, Environmental Hazards, Clinical Research, 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 (ISSN) serial number and is indexed with Index Copernicus (Poland). It is also brought to notice that the journal is being covered by many international databases.

Subscription Information

Journal Title	Print Only
Indian Journal of Public Health Research & Development	₹ 9,000/=

Note for Subscribers

- Advance payment required by cheque/demand draft/bank Transfer in the name of "Institute of Medico-Legal Publications" payable at New Delhi.
- Cancellation not allowed except for duplicate payment.
- Claim must be made within six months from issue date.
- A free copy can be forwarded on request.

Bank Details

Name of Account: Institute of Medico-Legal Publications Pvt Ltd

Bank: HDFC Bank

Branch: Sector-50, Noida-201 301

Account Number: 09307630000146

Type of Account: Current Account

MICR Code: 110240113

RTGS/NEFT code: HDFC0000728

Our Contact Info:

Institute of Medico-Legal Publications

Logix Office Tower, Unit No. 1704, Logix City Centre Mall, Sector- 32, Noida-201 301 (Uttar Pradesh)

Phone: +91 120 429 4015; Mobile: +91 997 188 8542

Email: editor.ijphrd@gmail.com | Website: www.ijphrd.com

●
Published, Printed and Owned: Dr. R. K. Sharma

Printed: Printpack Electrostat, G-2, Eros Apartment, 56-Nehru Place, New Delhi-110019

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

Editor: Dr. R. K. Sharma, Mobile: +91 997 188 8542



ForFreeChoice Institute

Palm Oil Is Life New Episode:

ForFreeChoice Institute

OPEN

Indian Journal of Public Health Research and Development

discontinued in Scopus

11

Country [India](#) - SIR Ranking of India

Subject Area and Category [Medicine](#)
Public Health, Environmental and Occupational Health

Publisher [R.K. Sharma, Institute of Medico-Legal Publications](#)

H Index

Publication type Journals

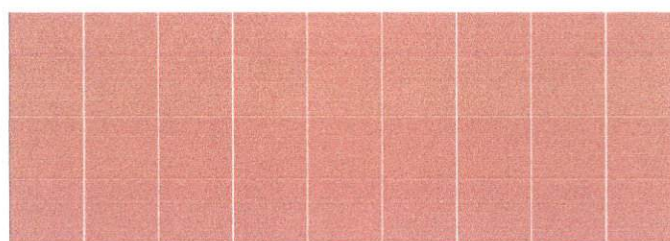
ISSN 09765506, 09760245

Coverage 2010-2019

Scope Information not localized

[Join the conversation about this journal](#)

Quartiles



Public Health, Environmental and Occupational Health

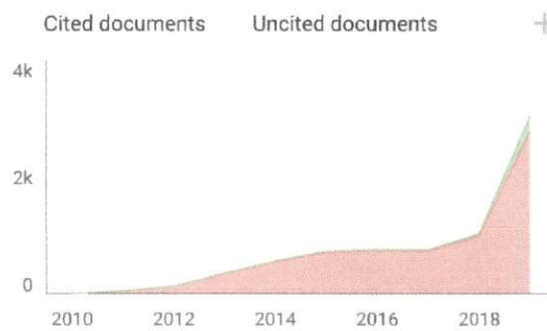
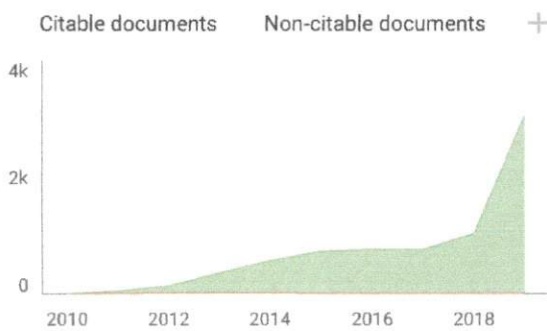
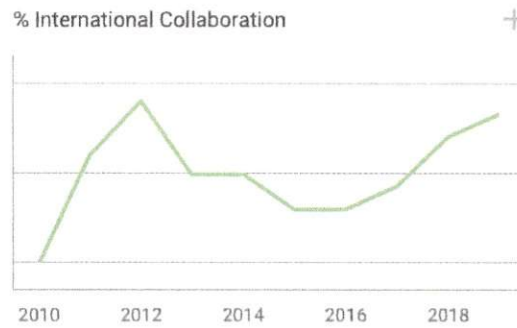
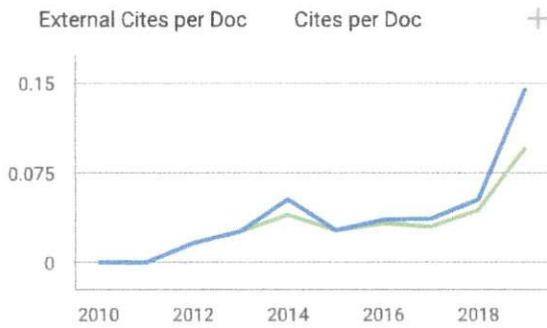
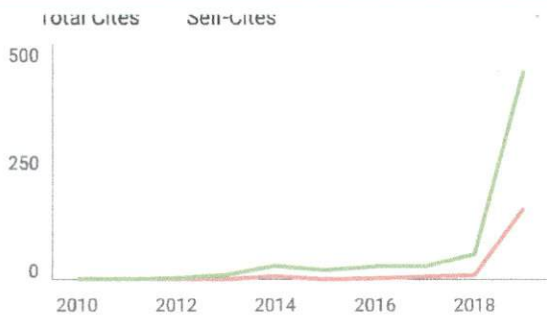
2011 2012 2013 2014 2015 2016 2017 2018 2019

SJR



Citations per document

Total Citations C-Index



Indian Journal of Public Health Research and...



← Show this widget in your own website

Just copy the code below and paste within your html code:

`<a href="https://www.scima`

Think Tank

Palm Oil Is Life New Episode:

ForFreeChoice Institute

OPEN

H **Hariyono** 3 weeks ago

my article has been published in the period of June 2020 but has not been indexed on scopus, please explain

reply