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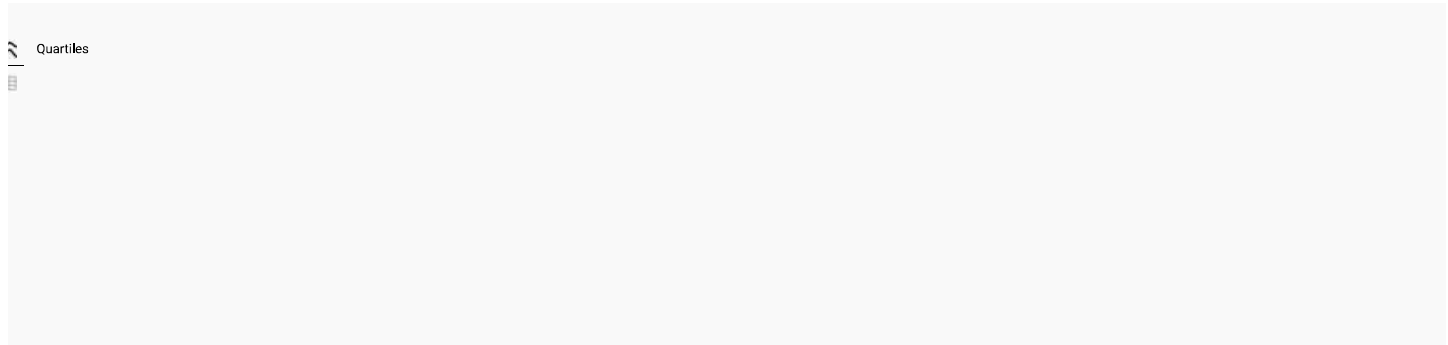
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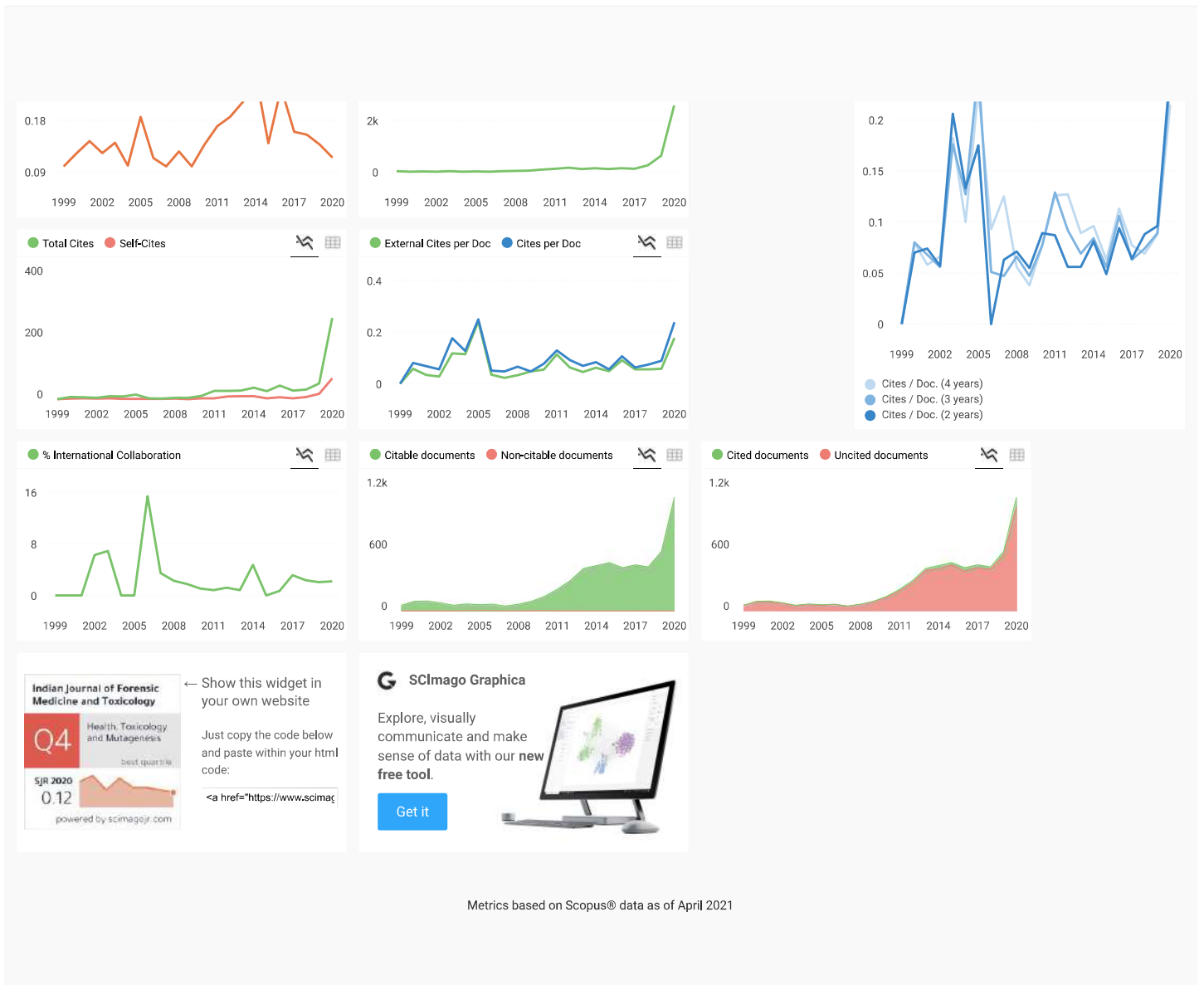
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1. Morphology of Palatal Rugae in Various Sagittal Skeletal Malocclusions in Kerala Population- A Retrospective Study ..... 1  
*Crystal Runa Soans, Azhar Mohammed, Murali PS, Mcqueen Mendonca, Prajwal Shetty, Vartika Kumari*
2. Analysis of Hospital Deaths at Tertiary Care Teaching Hospital ..... 8  
*Jeeveswararao Bagadi, Srinivasulu Pothireddy Sujan Kumar Mohanthy*
3. Study of Fingerprints in Relation to Dental Caries ..... 13  
*Maitrayee Dutta Swargiary, Bhanukul Barman*
4. Trends & Pattern in Unnatural Female Death Cases Due to Burn: A One Year Retrospective Study..... 19  
*Manjit Nayak, Saumil Merchant, Kalpesh Shah*
5. Effectiveness of Structured Exercise Programme Versus Elastic Band Exercise on Individuals with Rounded Shoulder ..... 24  
*Geetan Manoj Pathak, Khushboo Chotai, Smita Patil, Amrutkuvar Rayjade*
6. Effectiveness of Cognitive Therapy in Post-Menopausal Women ..... 29  
*Mrunal V Ghangrekar, Trupti Yadav, Amrutkuvar Jadhav, Smita Patil*
7. Effect of Meditative Movement Exercises with Breath Control on Depression in Nulliparous Women ..... 33  
*Mrunmayi Sandip Gadre, T Poovishnu Devi*
8. To Assess Dentist Knowledge About Lipid Treatment of Local Anesthetic Systemic Toxicity..... 37  
*Nitin Bhagat, Rohit Sharma, Siddharth Rawat, Sheikh Abrar, Singh Priyanka Jaiprakash*
9. Assessment of Medico- Legal Awareness of Practicing Obstetricians and Gynecologists ..... 41  
*Ajay V Patil, Rajendra Bangal*
10. Pattern of Cranio-Cerebral Injuries at a Tertiary Care Centre – A Retrospective Study ..... 45  
*Anand Patil, Tasgaonkar V N, Rakesh M Marigoudar*
11. Profile of Deaths Due to Poisoning: Autopsied at Ssims & Rc - A Cross Sectional Study ..... 49  
*Anand Patil, Rakesh M Marigoudar, Vijayakumar B. Jatti*
12. Scope of Periodontium in Forensic Science ..... 54  
*Gayathri S, Gomathi M, Nandhini V, Sumathi H R, Geetha T, Dona Samm*
13. Touch Dna as Forensic Aid: A Review ..... 58  
*Indresh Kumar Mishra, Bhoopendra Singh, Amarnath Mishra, Braja Kishore Mohapatra, Ruchika Kaushik, C Behera*
14. Flibanserin: A Miracle Drug in Management of Hypoactive Sexual Desire Disorder in Female ..... 63  
*Jeetendra Kumar Gupta, Ahsas Goyal, Kajal Thareja, Bhavini Saraf*

## II

15. Canine Width as a Means for Stature & Sex Prediction..... 70  
*Jyoti Barwa, Rattan Singh, Shipra Agarwal*
16. Introducing Micro-hardness Test in Forensic Odontology as an Aid in Solving Crimes: Multidisciplinary Approach ..... 76  
*Kuldeep Singh Shekhawat, Arunima Chauhan, Manoj Varma*
17. Effect of Plyometric Training on Vertical and Horizontal Jump in Recreational Athletes Indulging in Jumping Activities ..... 83  
*Prina Y. Patel, Trupti Yadav*
18. Risk factors in Implant Placement: A Retrospective Analysis ..... 89  
*Thilak Shetty, Shobha Rodrigues, Sharon Saldanha, Umesh Pai, Mahesh M, Puneeth Hegde, Manawar Ahmad*
19. Article Deleted ..... 94
20. Effect of Upper Body Strength Training in Spatiotemporal Parameters of Gait In Individual with Thoracic Kyphosis..... 100  
*Vinayak Sawant, Poonam Patil*
21. Factors Related to Alzheimer’s Disease, Tau Pathology in Alzheimer’s Disease: Possible Treatments for Tau Pathology ..... 106  
*Vityala Yethindra, Narsimharaj Alenur, Lakkam Saicharan*
22. Association between Running Activity and Pronated Foot Posture in East Java Puslatda Athletes ..... 115  
*Yani Christina, Indrayuni Lukitra Wardhani, Bayu Santoso*
23. Morphometry Study on Thoracic Vertebrae Pedicle with Computed Tomography Scan in Population of Surabaya, Indonesia ..... 121  
*Yoki Surya, I Ketut Martiana*
24. Awareness about Whole Slide Imaging and Digital Pathology among Pathologists - Cross Sectional Survey ..... 126  
*Sandhya Sundar, Pratibha Ramani, Herald J Sherlin, Gheena Ranjith, Abilasha Ramasubramani, Gifrina Jayaraj*
25. Alteration in Physicochemical Parameters of Soil Beneath Rabbit Carcass: Consequence of Carcass Decomposition..... 131  
*Sarabjit Singh, Madhu Bala*
26. Knowledge and Awareness of Medical Students about Injuries in Forensic Perspective ..... 139  
*Sulekha Naresh*
27. A Cross Sectional Study on the Awareness and Practice of Road Safety Measures among the Medical Students in Chennai ..... 146  
*Sushil Chakravarthy. A, Magendran J,*
28. A Study on Awareness of Breast Cancer among Nursing Students..... 152  
*Tansushree. B, Magendran.J*

29.	Assessment of the Feedback Questionnaire from Students for a Weekend Lecture .....	158
	<i>Vishal Marwaha, Anu Sasidharan, Greeshma C.R</i>	
30.	Assessment and Examination of Female Rape Victims and Their Genital Injuries .....	164
	<i>Yamini Patil, Sanjay Kumar Patil</i>	
31.	Visum Et Repertum in the Evidencing Process of Rape in Indonesia.....	167
	<i>Arief Budiono, Wilma Silalahi, Ayesha Hendriana Ngestiningrum, Wafda Vivid Izziyana, Suparji Sofyan Wimbo Agung Pradnyawan, I Nyoman Putu Budiarta</i>	
32.	Effectiveness of Conventional Physiotherapy Exercises Versus Kinesiotaping in Recreational Football Players with Plantar Fasciitis.....	172
	<i>Pratiksha Rahane, Khushboo Chotai, Amrutkuvar Rayjade, Smita Patil</i>	
33.	Metanalysis of Qualitative and Quantitative improvement in Active Rehabilitation of Post ACL Repair or Reconstruction .....	179
	<i>Radhika Chintamani</i>	
34.	Effectiveness of Lifestyle Modification in Late Adolescent Females with Normal BMI Polycystic Ovarian Syndrome.....	185
	<i>Snehal Walmik Hukire, T. Poovishnu Devi</i>	
35.	Study of Profile of Sexually Related Unnatural Deaths .....	190
	<i>Siddaramanna T C, Dileep Kumar R, Girish Chandra Y P, Shailesh V Parate, Harish S</i>	
36.	Knowledge and Awareness about Medical Ethics among Medical Practitioners in a Teaching Medical College and Hospital, Chennai .....	194
	<i>Subhashree Bangaru, Magendran. J</i>	
37.	Effectiveness of Bosu Ball Exercises Versus Thera Band Exercises on Core Stabilization and Balance Performance.....	200
	<i>Rasika A. Sawant, Khushboo Chotai, Smita Patil, Amrutkuvar Rayjade</i>	
38.	A Novel Method of Establishing the Identity of an Individual by Analyzing the Pattern & Volume of the Frontal Sinus Using Computerized Tomogram – A Retrospective Cross Sectional Study.....	207
	<i>R. Harshada, Nalini Aswath</i>	
39.	Study of Adverse Drug Reactions (ADRs) Occurring with the Drug Use in a Tertiary Hospital .....	214
	<i>R. Selvaraj, Abhay P.Betala</i>	
40.	Pattern of Homicidal Deaths at Raichur District Region – A Retrospective Study.....	218
	<i>Ravishankar M G, Sunil Kumar Kainoor, Suraj, S Sharmila,</i>	
41.	Chronic Alcoholism and Drug Abuse Behavior: A Menace to Society- A Research Study .....	223
	<i>Rajesh Kumar Baranwal, Pradeep Yadav, Sanjeet Kumar</i>	
42.	Role of Physiotherapy on Quality of Life in Stroke Survivors – A Systematic Review .....	226
	<i>Kanase Suraj B, G.Varadharajulu, Pragati V. Salunkhe, Mayuri D.Burungale</i>	
43.	Effect of Goal Oriented Exercises Versus Combined Physiotherapy Intervention on Functional Independence in Subject With Traumatic Brain Injury .....	231
	<i>Pragati V Salunkhe, Suraj B Kanase</i>	



287. Thiophene-Cyclic and Sulfazane Derivatives (Preparation, Spectral Analysis, the Behavior in Organic Solvents, Microbial Testing)..... 1662  
*Jalal Hasan Mohammed, Alaa Jawad Kadhim, Nagham Mahmood Aljamali*
288. Diagnostic test of Brief Peripheral Neuropathy Screen as Distal Sensory Polyneuropathy-HIV Diagnostic Tool..... 1670  
*Joko Rudyono, Mudjiani Basuki, Erwin Astha Triyono*
289. Relation of Homocysteine With Malondialdehyde and Dyslipidemia in Type 2 Diabetic Patients with Coronary Artery Diseases..... 1676  
*Khalid Shaalan Sahab, Ali S. Mahmoud Al-Saadi*
290. Determination of Some Biomarkers that affect in Behaviors of Autism Spectrum Disorder Individuals in Iraq..... 1681  
*L. Basim M. Ali, Iqbal Jasim Badr Alasadi, Sameerah Ahmed Zearah*
291. Detection of VT1 and VT2 genes in *Escherichia coli* isolated from Diarrhea Patients in AL-Anbar, Iraq using PCR Sequencing..... 1687  
*Laheeb Rajab Hamad, Muthanna Hamid Hassan, Abdalwahab Bdewi Hussain*
292. Correlation between the Duration of Ethambutol Therapy and the Toxic Optic Neuropathy Occurene in Patients with Multidrug-Resistance Tuberculosis..... 1694  
*Muhammad Hamdan, Eko Wahono R., Kurnia Kusumastuti, Laily Irfana*
293. Macrophage Activity and Histopathological Differences of Lung Tissue on Sequential Co-infections of Heligmosomoides Polygyrus Nematode on Mycobacterium Tuberculosis Infection..... 1699  
*Laksmi Wulandari, Muhammad Amin, Soedarto, Gatot Soegiarto, Kenji Ishiwata*
294. Nurses' Knowledge Regarding Pneumonia in Children Under Five Years of Age at Pediatric Wards in Kirkuk Teaching Hospitals ..... 1705  
*Luay Amjed Mahmood Al-Waly, Mohammed Ahmed Sultan Al-Wily, Radhwan Hussein Ibrahim*
295. The Effectiveness Comparison of Desloratadine and Loratadine in Reducing Total Nasal Symptom Score and the Level of Interleukin 4 in the Nasal Secretions of Allergic Rhinitis Patients ..... 1711  
*Luh Putu Dhena Purwaningsih, Dwi Reno Pawarti, Bakti Surarso*
296. Prevalence of Dermatophytes Fungal Infection among Different Gender ..... 1717  
*Luma T. Ahmed, Zahraa A. Darweesh, Wathiq M. Hussain*
297. Risk Factors of the Elderly Falling in Public Hospitals: A Systematic Review Study..... 1723  
*Masoumeh Otaghi, Zahra Mohammad-Niakan, Sanaz Aazami, Ali Khorshidi*
298. Effect of Web-Based Early Diagnosis of Dental and Oral Diseases with Validity Level of Dentist Final Diagnosis in Public Health Center, Makassar, Indonesia ..... 1728  
*Masriadi, Dolly Indra, Harlinda*
299. Association between Intelligence Level and Handicap Degree in Epilepsy Patients..... 1736  
*Meity Meiliyanny Beslar, J. Eko Wahono, Isti Suharjanti, Paulus Sugianto, Riani Wisnujono*
300. Effect of Glutamine Before Gets Cisplatin on Aif and Bcl-2 in the Evidence of Apoptosis Cell Tubulus Proximal in Rats Kidney of Rattus Norvegicus Strain Wistar..... 1742  
*Michael Lumintang, Endang Joewarini, Sunarni Zakaria, Gunawan Widodo, Imam Susilo*

## XXII

301. Association between Soluble Contents CD40 Ligand (sCD40L) and Acute Coronary Syndrome (ACS) . 1747  
*Mirza Elita, Muhammad Aminuddin, Jusak Nugraha*
302. The Potential Role of Radiology in Diagnosis of Traumatic Versus Non-Traumatic Cerebral Hemorrhages for Medicolegal Application ..... 1753  
*Mohamed Khairy, Dina A. Shokry, Ehab Abdelhaleem, Reham Nafad Elbendary*
303. Comparison of Saffron versus Fluoxetine in Treatment of Women with Premenstrual Syndrome: A Randomized Clinical Trial Study ..... 1760  
*Mohammad Nemat-Shahi, Atefeh Asadi, Mahbobeh Nemat-Shahi, Davood Soroosh, Shakiba Mozari, Hamidreza Bahrami-Taghanaki , Mahsa Mehrpour*
304. Comparison of the Effects of Passiflora Incarnata and Piroxicam in opioids withdrawal-Induced Myalgia and Anxiety: A randomized Clinical Trial..... 1766  
*Mohammad Nemat-Shahi, Seyyed Mehdi Mir Mohammadi , Davood Soroosh, Atefeh Asadi , Samaneh Nakhaee, Mahsa Mehrpour*
305. Hematological Changes in Blood of Smokers of Cigarettes and Nargyle..... 1771  
*Mohammed S. Hussain, Nuhad Mohammed Hamid, Mohammed Qais Al-Ani, Belal K. Muden, Mustafa J. Hamad-Allah, Omer H. Sweed, Suror S. Sabbar*
306. Correlation between Hyperglycemia Stress and Short-Term Memory Function in Thrombotic Stroke Patients..... 1777  
*Muhammad Hamdan, Riani Wisnujono, Yudha Haryono, Abdulloh Machin, Dian Puspitarini*
307. The Difference between hs-CRP and Serum IL-6 Levels in Patients with Glaucoma and Non Glaucoma 1782  
*Muhammad Riduan, Endang Retnowati Kusumowidagdo, Nurwasiz*
308. The Risk Factors Effect of Knee Osteoarthritis Towards Postural Lateral Sway ..... 1787  
*Muhammad Siddik, Ratna Darjanti Haryadi*
309. Microbial Risk Assessment (MRA) As a Method of Assessment for Drinking Water Refill in Pattinggaloang District of Makassar City ..... 1793  
*Alfina Baharuddin, Muhammad Ichsan*
310. Association of Early Nutritional Status with the Clinical Severity in Patients with Acute Stroke ..... 1799  
*Myrna Ika Purnama, M. Hasan Machfoed, J. Eko Wahono R*
311. The Legal Protection of Well-Known Service Trademark (The Case of Inter-Continental Vs The Intercontinental)..... 1804  
*Nanda Riwanto, Agung Sujatmiko*
312. Determining the Quality of Services Provided in Delivery Room at Ayatollah Kashani Hospital (Jiroft, Iran) from the Perspective of Clients Using Service Quality Model (SQM) During Spring 2019 . 1809  
*Narges Mahyapour Lori, Hourie Taheri Sarvetomin, Mahdiyeh Ahmadi, Sareh Mehni, Neda Dastyar*
313. Correlation between Serum & Urinary Placental Protein (Pp13) in Pre-eclamptic Women at their Third Trimester ..... 1814  
*Nesreen Ahmed Nasser, Rayah Sulaiman Baban, May Fadhil Al- Habib, Risala A. Ali Jameel*

# Macrophage Activity and Histopathological Differences of Lung Tissue on Sequential Co-infections of *Heligmosomoides Polygyrus* Nematode on *Mycobacterium Tuberculosis* Infection

Laksmi Wulandari<sup>1,2</sup>, Muhammad Amin<sup>1</sup>, Soedarto<sup>3</sup>, Gatot Soegiarto<sup>2,4</sup>, Kenji Ishiwata<sup>5</sup>

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## Abstract

**Background:** Tuberculosis is a chronic infection caused by *Mycobacterium tuberculosis*, a facultative intracellular parasite, that can be eliminated by cellular immunity played by macrophages. It has become a debate whether the co-infection of nematodes will affect the immune response of macrophages towards mycobacterium infection.

**Objective:** To reveal macrophage activity and histopathological difference of lung tissue in sequential co-infection of *Heligmosomoides Polygyrus* towards *Mycobacterium tuberculosis* infection.

**Method:** This study used 49 mice divided into 7 treatment groups with *Mycobacterium tuberculose* infection by inhalation and *Heligmosomoides polygyrus* orally within 8 and 16 weeks, and observed by immunohistochemical staining.

**Result:** Infection for 8 weeks showed polarization of macrophages towards M1 macrophage, whereas in 16 weeks, the macrophage polarization more towards M2 macrophages, supported by histopathological changes of lung tissue: peribronchiolitis, perivaskulitis, alveolitis, and granuloma formation with counts of acid-resistant germs +3. There was a difference of expression of arginase1 to each group ( $p < 0.001$ ) and there was a difference of T CD4+ Th1 lymphocyte ( $p < 0.001$ ).

**Conclusion:** There is a difference in macrophage activity in lung tissue; however, it does not cause different levels of histopathological changes in lung tissue and does not affect the immune response to *Mycobacterium tuberculosis* infection.

**Keywords:** *Heligmosomoides polygyrus*, *Mycobacterium tuberculosis*, macrophage, Immunohistochemistry

## Introduction

Tuberculosis (TB) is a chronic infection caused by *Mycobacterium tuberculosis*. According to WHO report in early 2012, it is estimated that 8.7 million individuals in the world suffer from TB infection

especially in developing and low income countries <sup>1</sup>. Most areas of the country with high TB incidence and low BCG vaccination effectiveness are also areas of high prevalence of worm infections <sup>2-4</sup>. Worm infections cause changes in the immune response that harm the body's defenses against TB infection <sup>5,6</sup>.

Each year, there are 8.7 million new TB cases, with a mortality rate of around 1.4 million per year <sup>1</sup>. *Mycobacterium tuberculosis* is a paracitic intracellular facultative bacillus <sup>7</sup>. An appropriate immune response to

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eliminate TB is cellular immunity played by macrophages; CD4<sup>+</sup> T-lymphocytes that secrete IFN- $\gamma$ ; CD8<sup>+</sup> T lymphocytes that eliminate infected macrophages with TB germs; as well as Tgd lymphocytes. This response requires a strong Th1 type cytokine. In contrast, worm infections stimulate the activation of eosinophil cells, mast cells, basophile cells, and IgE formation, which are Th2-type immune responses<sup>8</sup>. The dominant Th2-type immune response suppresses the Th1 type immune response through suppression by IL-4<sup>9</sup>.

Sequential research is certainly not ethical in human populations, because it can only be conducted with the standard model of nematode worm infection in mice that is *Heligmosomoides polygyrus*, and *Mycobacterium tuberculosis* sequentially. To describe the chronicity of a worm infection requires an interval of infection for at least 8 weeks<sup>10</sup>. Chronic worm infection is known to trigger the onset of regulatory T cells (Treg)<sup>11,12</sup>. Treg may affect the balance of Th1 and Th2 immune responses. Th1-Th2 balance will also affect macrophage function in overcoming mycobacteria infection<sup>13,14</sup>. If it is proven that chronic infection of the worms stimulates the onset of Treg cells that are capable of altering the balance of Th1 - Th2 type immune responses and macrophage functional activity, then the debate about the effect of worm infection on histopathological changes in TB infection will be resolved. This study aimed to identify the effect of sequential co-infection of *Heligmosomoides polygyrus* nematodes on pulmonary histopathological changes in *Mycobacterium tuberculosis* infection<sup>15</sup>.

## Method

The research was conducted for 6 (six) months at Experimental Animal Cage of the Clinical Parasitology Division, Faculty of Medicine, Universitas Brawijaya and in Bacteriology Laboratory of Tuberculosis Infection Study Group of Tropical Diseases Institution, Universitas Airlangga, Surabaya, Indonesia. The research sample used 49 male (*Mus musculus*) mice of wild type aged 8-12 weeks with body weight of 30-35 grams. The sample was divided into 7 groups consisting of: a group infected with tuberculosis (TB) for 8 weeks (M.tb8), a group infected with TB (*Mycobacterium tuberculosis*) for 16 weeks (M.tb16), a group infected with a worm (*Heligmosomoides polygyrus*) for 8 weeks (H.pg8), a group infected with a worm (*Heligmosomoides polygyrus*) for 16 weeks (H.pg16), the group of mice treated with helminth co-infection (*Heligmosomoides polygyrus*) followed by TB infection (*Mycobacterium*

*tuberculosis*) (H.pg + M.tb), a group of mice treated with TB co-infection (*Mycobacterium tuberculosis*) followed by a helminth infections (*Heligmosomoides polygyrus*) (M.tb + H.pg), as well as control group without infection treatment<sup>16</sup>. Prior to conducting the research, the researchers conducted ethical test (151-KE) at the Faculty of Veterinary Medicine, Univeristas Airlangga, Surabaya, Indonesia.

## Result

The activity of alternatively activated macrophage (AAM $\emptyset$ ) also known as M2 macrophage was characterized by the expression of Arginase1 protein. It was explained that macrophages with brown cytoplasm and Arginase1 protein were blue (arrows) and seen with a 400x light magnification microscope. Group 1: *H. polygyrus* infection for 8 weeks; group 2: *H. polygyrus* infection for 16 weeks; group 3: *H. polygyrus* infection for 16 weeks + *M. tuberculosis* for 8 weeks; group 4: infection of *M. tuberculosis* for 16 weeks + *H. polygyrus* for 8 weeks; group 5: 16 weeks of tuberculosis infection; group 6: *M. tuberculosis* infection for 8 weeks (figure 2). The level of Arginase 1 expression by macrophages in lung tissue showed in Table 1.

Histopathologic features and iNOS expression rates indicated that *M. tuberculosis* infection for 8 weeks resulted in infiltration of large amounts of macrophages into the infected lung tissue of mice and most of the macrophages infiltrating the tissue express iNOS (macrophage M1) activated in the atmosphere of Th1 cytokine. In infection with *M. tuberculosis* for 16 weeks, the number of macrophages that infiltrated the lung tissue was relatively decreased, and the level of iNOS expression in the macrophage group (4) whereas, histopathological features and levels of Arginase 1 expression indicated that M2 macrophages were also present in lung tissue, either in *M. tuberculosis* infection for 8 weeks or for 16 weeks. However, the level of Arginase1 expression by macrophages in mice for 8 weeks of *M. tuberculosis* infections (Fig. 3.-D) was lower than in the 16 weeks group of *M. tuberculosis* infections (Figure 3.-E).

To ascertain whether the duration of *M. tuberculosis* infection affected the level of expression of iNOS and Arginase1 by macrophages in lung tissue, MANOVA test was performed. From the statistical calculation, Box's Test of Equality of Covariance Matrices obtained p value = 0.148 (p >0.05) which means homogeneous

data. From the Multivariate Test table on Hotelling's Trace,  $p = 0.00$  ( $p < 0.05$ ) showed that the duration of *M. tuberculosis* infection significantly affected the level of expression of iNOS and Arginase1 by macrophages in lung tissue.

**Histopathological Changes of Lung Tissue**

The calculated percentage of T CD4<sup>+</sup> Th1 lymphocytes in peripheral blood showed a significant difference ( $p = 0.000$ ). The percentage of CD4<sup>+</sup> T1 T lymphocytes in the highest lung tissue was found in *M. tuberculosis* infection for 8 weeks ( $4.508 \pm 0.947$ ) and then decreased in *M. tuberculosis* infection for 16 weeks ( $2.058 \pm 0.845$ ). The group treated with the last co-infection in the form of *M. tuberculosis* infection had a significantly higher percentage of CD4<sup>+</sup> Th1 T

lymphocytes than the opposite co-infection. In addition to assessing histopathologic changes in pulmonary tissue, it was also calculated the acid-resistant *M. tuberculosis* bacteria in the lung tissue sieves preparation stained with Ziehl Neelsen staining (Table 1).

There was a correspondence between germination scores and histopathological lung rate change scores, wherein *H. polygyrus* co-infection did not affect acid-resistant bacteria count nor the rate of histopathological changes of lung tissue. The correlations between polarization of macrophage activity in lung tissue (ie, iNOS or Arginase1 expression) with histopathologic lung tissue change rate (ie Dormans scale score and acid-resistant bacteria count) were evaluated by Spearman test (Table 2).

**Table 1. Levels of arginase expression1 by macrophages and the number of *M. tuberculosis* in lung tissue**

Group	Arginase1 Expression		CDC/ATS	p
	Mean±SD	Min-Max		
H.pg 8	19.20±0.45c	19.00-20.00	-	0.000
H.pg 16	23.40±1.14d	22.00-25.00	-	
H.pg + M.tb	10.00±1.41 b	9.00-12.00	+3	
M.tb + H.pg	25.00±2.00d	23.00-28.00	+3	
M.tb 16	25.20±1.64d	24.00-27.00	+3	
M.tb 8	8.80±0.45b	8.00-9.00	+3	
Control	3.80±0.45a	3.00-4.00	-	

Note: H.pg = *H. Polygyrus* infection; M.tb = *M. tuberculosis* infection; 8 and 16: infection for 8 and 16 weeks; The letters a, b, c, d: indicate that groups with the same letter marks have insignificant differences, whereas groups with different letter marks have significant differences.

**Table 2. The correlation between macrophage activity and histopathologic changes**

Correlation between variables	r	p
iNOS and Dormans scores	0.523	0.001 *
Arginase1 and Dormans score	0.312	0.068
iNOS and acid-resistant bacteria count	0.723	0.000 *
Arginase1 and acid-resistant bacteria count	0.228	0.188
Dormans score and acid-resistant bacteria count	0.875	0.000 *
iNOS and Arginase1	0.058	0.739

\* $p < 0.05$

## Discussion

In this study, we found an increase in the percentage of Th1 lymphocytes in lung tissue and in peripheral blood that correlated strongly with levels of IFN- $\gamma$  cytokines in peripheral blood serum. The increase occurred in *M. tuberculosis* infection for 8 weeks which then 'subside' at the time of infection lasted up to 16 weeks. Our results are consistent with the results of several other researchers who found that elevated IFN- $\gamma$  levels were primarily obtained in the early stages of the infection especially after the second week post infection<sup>17</sup>. The mobilized lymphocytes accumulate at the site of infection, proliferate and secrete cytokines, especially IFN- $\gamma$ . Protective immune responses to *M. tuberculosis* are more necessary for the role of Th1 type cytokines. Th1 type cytokines, including IFN- $\gamma$ , are required not only to activate macrophages but also to assist the activity of CD8<sup>+</sup> T lymphocytes<sup>17,18</sup>.

Worm infection induces the emergence of T regulatory lymphocytes (CD4<sup>+</sup> CD25<sup>+</sup> Foxp3<sup>+</sup>) in both the intestinal tract, peripheral blood and lung tissue. T regulatory activity can be assessed from elevated levels of IL-10 and TGF- $\beta$  cytokines in peripheral blood serum, as well as T regulatory lymphocyte percentage in intestinal tissue, lung tissue and peripheral blood. Similarly, the findings of the Th1 and Th2 lymphocyte immune responses, the T regulatory lymphocyte response were only found in the worms infection group for up to 8 weeks. When the infection has lasted up to 16 weeks, the activity and the role of T regulatory lymphocytes also decreased<sup>19</sup>.

Activation of T regulatory lymphocytes apparently also occurs in *M. tuberculosis* infections, especially in infections lasting up to 8 weeks<sup>20</sup>. Thus, it can be concluded that the time interval between the infection of the nematode worms and tuberculosis, as well as the observation will greatly affect the outcome of the co-infection<sup>18</sup>. The success of the macrophage immune response is influenced by the balance of iNOS and Arginase expression<sup>21</sup> which describes the direction of polarization of macrophage activity. Worm infections induce Th2-type immune responses, such as IL-4 and IL-13, leading to macrophage polarization into M2 macrophages expressing Arginase1. The purpose of M2 macrophage activation is to evoke an anti parasitic response and repair tissue damage<sup>22</sup>. In the group who received the last co-infection treatment of *M. tuberculosis*, the Arginase1 expression decreased

whereas iNOS expression increased sharply<sup>23</sup>.

This can be explained through several arguments that sequential infection of *M. tuberculosis* and *H. polygyrus* at intervals of 8 weeks does not affect the balance of T lymphocyte activity in lung tissue, sequential infection of *M. tuberculosis* and *H. polygyrus* at intervals of 8 weeks does not affect the ability of macrophages to generate an appropriate immune response for *M. tuberculosis* infection in lung tissue, and histopathological changes occurring in lung tissue due to *M. tuberculosis* infection are slowly changing and evolving changes that cannot be detected in the observation process for 8 or 16 weeks<sup>24</sup>.

Immune responses to *M. tuberculosis* often fail to eliminate germs because germs are able to use several ways to circumvent the host's immune response, among others by inhibiting the maturation and acidification of the phagosome, inhibiting the fusion of phagosome and lysosome, and escaping from the phagosome<sup>25</sup>. It triggers macrophages to work together with CD4<sup>+</sup> and CD8<sup>+</sup> T lymphocytes to form granulomas that aim to isolate *M. tuberculosis*<sup>7</sup>. However, *M. tuberculosis* can still survive in macrophages and beyond macrophages in granulomas<sup>26</sup>. Thus, granulomas are retained for long periods of time through delayed-type hypersensitivity (DTH) responses requiring Th1 lymphocyte competence. If there is a significant decrease in immune response as well as in patients with HIV-AIDS macrophage, it can decay that allows dissemination of *M. tuberculosis*<sup>27</sup>.

## Conclusion

There is a difference in macrophage activity in lung tissue; however, it does not cause different levels of histopathological changes in lung tissue and does not affect the immune response to *Mycobacterium tuberculosis* infection.

**Conflict of Interest:** There is no conflict of interest.

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**Ethical Clearance:** This study was approved by Ethical Commission of Health Research (151-KE) at the Faculty of Veterinary Medicine, University of Airlangga, Surabaya, Indonesia.

## References

1. Organization WH. Global tuberculosis report 2013. World Health Organization; 2013.
2. Fine PEM. Variation in protection by BCG:

- implications of and for heterologous immunity. *Lancet*. 1995;346(8986):1339–45.
3. Lipner EM, Gopi PG, Subramani R, Kolappan C, Sadacharam K, Kumaran P, et al. Coincident filarial, intestinal helminth, and mycobacterial infection: helminths fail to influence tuberculin reactivity, but BCG influences hookworm prevalence. *Am J Trop Med Hyg*. 2006;74(5):841–7.
  4. Elias D, Britton S, Kassu A, Akuffo H. Chronic helminth infections may negatively influence immunity against tuberculosis and other diseases of public health importance. *Expert Rev Anti Infect Ther*. 2007;5(3):475–84.
  5. Resende Co T, Hirsch CS, Toossi Z, Dietze R, Ribeiro-Rodrigues R. Intestinal helminth co-infection has a negative impact on both anti-Mycobacterium tuberculosis immunity and clinical response to tuberculosis therapy. *Clin Exp Immunol*. 2007;147(1):45–52.
  6. Potian JA, Bhatt K, Liu Z, Gause W, Salgame P. Helminthic infection enhances susceptibility to tuberculosis in a murine coinfection model (43.31). *Am Assoc Immunol*; 2007.
  7. Todar K. *Mycobacterium tuberculosis and Tuberculosis*. Online text B Bacteriol Madison, Wisconsin. 2008;
  8. Yazdanbakhsh M, van den Biggelaar A, Maizels RM. Th2 responses without atopy: immunoregulation in chronic helminth infections and reduced allergic disease. *Trends Immunol*. 2001;22(7):372–7.
  9. Coffman RL. Origins of the TH 1-TH 2 model: a personal perspective. *Nat Immunol*. 2006;7(6):539.
  10. Dewi DNSS, Mertaniasih NM, Soedarsono, Ozeki Y, Artama WT, Fihiruddin, et al. Characteristic profile of antibody responses to PPD, ESAT-6, and CFP-10 of Mycobacterium tuberculosis in pulmonary tuberculosis suspected cases in Surabaya, Indonesia. *Brazilian J Infect Dis* [Internet]. 2019;23(4):246–53. Available from: <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85071075326&doi=10.1016%2Fj.bjid.2019.07.001&partnerID=40&md5=a7c6ffae5c5e5dd2d7766bed23f2a2b1>
  11. Finney CAM, Taylor MD, Wilson MS, Maizels RM. Expansion and activation of CD4+ CD25+ regulatory T cells in Heligmosomoides polygyrus infection. *Eur J Immunol*. 2007;37(7):1874–86.
  12. McSorley HJ, Harcus YM, Murray J, Taylor MD, Maizels RM. Expansion of Foxp3+ regulatory T cells in mice infected with the filarial parasite Brugia malayi. *J Immunol*. 2008;181(9):6456–66.
  13. Stout RD, Suttles J. Functional plasticity of macrophages: reversible adaptation to changing microenvironments. *J Leukoc Biol*. 2004;76(3):509–13.
  14. Vega MA, Corbi AL. Human macrophage activation: too many functions and phenotypes for a single cell type. *Immunologia*. 2006;25(4):248–72.
  15. Purkan P, Ihsanawati I, Natalia D, Syah YM, Retnoningrum DS, Siswanto I. Molecular Analysis of katG Encoding Catalase-Peroxidase from Clinical Isolate of Isoniazid-Resistant Mycobacterium tuberculosis. *J Med Life* [Internet]. 2018;11(2):160–7. Available from: <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85057095123&partnerID=40&md5=732b3f3881c846ea0b7900da14adbbf4>
  16. Kurniawati S, Soedarsono S, Aulanni'am A, Mertaniasih NM. Single nucleotide polymorphism of EccB5 gene of Mycobacterium tuberculosis complex isolates from suspected pulmonary TB patients in Surabaya Indonesia. *African J Infect Dis* [Internet]. 2018;12(2):37–42. Available from: <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85049312057&doi=10.21010%2Fajid.v12i2.6&partnerID=40&md5=2fa3874a183ce518f4e6f82339c124eb>
  17. Vesosky B, Flaherty DK, Turner J. Th1 cytokines facilitate CD8-T-cell-mediated early resistance to infection with Mycobacterium tuberculosis in old mice. *Infect Immun*. 2006;74(6):3314–24.
  18. Salgame P, Yap GS, Gause WC. Effect of helminth-induced immunity on infections with microbial pathogens. *Nat Immunol*. 2013;14(11):1118.
  19. Hewitson JP, Grainger JR, Maizels RM. Helminth immunoregulation: the role of parasite secreted proteins in modulating host immunity. *Mol Biochem Parasitol*. 2009;167(1):1–11.
  20. Shafiani S, Dinh C, Ertelt JM, Mogueche AO, Siddiqui I, Smigiel KS, et al. Pathogen-specific Treg cells expand early during mycobacterium tuberculosis infection but are later eliminated in response to Interleukin-12. *Immunity*. 2013;38(6):1261–70.
  21. Cambier CJ, Takaki KK, Larson RP, Hernandez RE, Tobin DM, Urdahl KB, et al. Mycobacteria

- manipulate macrophage recruitment through coordinated use of membrane lipids. *Nature*. 2014;505(7482):218.
22. Stempin CC, Dulgerian LR, Garrido V V, Cerban FM. Arginase in parasitic infections: macrophage activation, immunosuppression, and intracellular signals. *Biomed Res Int*. 2009;2010.
  23. Cervi L, MacDonald AS, Kane C, Dzierszinski F, Pearce EJ. Cutting edge: dendritic cells copulsed with microbial and helminth antigens undergo modified maturation, segregate the antigens to distinct intracellular compartments, and concurrently induce microbe-specific Th1 and helminth-specific Th2 responses. *J Immunol*. 2004;172(4):2016–20.
  24. Dormans J, Burger M, Aguilar D, Hernandez-Pando R, Kremer K, Roholl P, et al. Correlation of virulence, lung pathology, bacterial load and delayed type hypersensitivity responses after infection with different *Mycobacterium tuberculosis* genotypes in a BALB/c mouse model. *Clin Exp Immunol*. 2004;137(3):460–8.
  25. Kaufmann SHE. How can immunology contribute to the control of tuberculosis? *Nat Rev Immunol*. 2001;1(1):20.
  26. McCune RM, Feldmann FM, McDermott W. Microbial persistence: II. Characteristics of the sterile state of tubercle bacilli. *J Exp Med*. 1966;123(3):469–86.
  27. Mbow M, Santos NSS, Camara M, Ba A, Niang A, Daneau G, et al. HIV and Tuberculosis co-infection impacts T-cell activation markers but not the numbers subset of regulatory T-cells in HIV-1 infected patients. *Afr J Lab Med*. 2013;2(1).





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DIUSULKAN, MAKA DENGAN INI MENYATAKAN BAHWA :**

- PENELITIAN BERJUDUL** : Pengaruh Ko Infeksi Sekuensial Nematoda  
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