

**LEMBAR**  
**HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW**  
**KARYA ILMIAH : JURNAL ILMIAH**

Judul Karya Ilmiah : Effectiveness of Spirulinaplatis Extract on Wound Area and TNF-a Levels on Blood: Experimental Studies InWistar Rats Made Artificially by VulnusScissum and Infected by Staphylococcus aureus

Jumlah Penulis : 3 Orang

Status Pengusul : OlvariaMisfa, RenniYuniarti, Yan WisnuPrajoko

Identitas Jurnal Ilmiah :

a. Nama Jurnal : Indonesian Journal of Environmental Management and Sustainability

b. Nomor ISSN : 2598-6279 / 2598-6260

c. Vol, Nomor, halaman:4,2,p: 55-58

d. Edisi : June 2020

e. Penerbit : Pascasarjana FMIPA UniversitasSriwijaya

g. DOI artikel (jika ada) : <https://doi.org/10.26554/ijems.2020.4.2.55-58>

h. Alamat web jurnal : <http://www.ijoems.com/index.php/ijems/article/view/117/71>

i. Terindeks di : sinta3

j. On line turnitin : [https://doc-pak.undip.ac.id/4827/1/TURNITIN\\_Effectiveness\\_of\\_Spirulina.pdf](https://doc-pak.undip.ac.id/4827/1/TURNITIN_Effectiveness_of_Spirulina.pdf)

Kategori Publikasi Jurnal Ilmiah : ☐ Jurnal Ilmiah Internasional/ Internasional Bereputasi\*\*  
 (beri ✓ pada kategori yang tepat) ☒ **Jurnal Ilmiah Nasional Terakreditasi (Sinta 3)**  
☐ Jurnal Ilmiah Nasional/Nasional

Hasil Penilaian *Peer Review* :

Komponen Yang Dinilai	Nilai Maksimal Jurnal Ilmiah			Nilai Akhir Yang Diperoleh
	Internasional / Internasional Bereputasi ** <input type="checkbox"/>	Nasional Terakreditasi <input type="checkbox"/>	Nasional *** <input type="checkbox"/>	
a. Kelengkapan unsur isi artikel (10%)		20 2		1,5
b. Ruang lingkup dan kedalaman pembahasan (30%)		6		5
c. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)		6		5,5
d. Kelengkapan unsur dan kualitas terbitan/ jurnal (30%)		6		5,5
<b>Total = (100%)</b>		<b>20</b>		<b>18,5</b>
<b>Nilai Pengusul =</b>			40% x 18,5 / 2 =	<b>3,7</b>

Catatan penilaian Artikel oleh Reviewer :

- Kelengkapan unsur isi artikel** : Unsur isi artikel cukup lengkap, abstrak-pendahuluan-metode-hasil-pembahasan-referensi. Abstrak ditulis tanpa diorganisir dalam template tertentu
- Ruang lingkup dan kedalaman pembahasan** : Ruang lingkup keilmuan sesuai pengusul, kedalaman pembahasan cukup karena sudah membandingkan dengan penellitian2 sebelumnya, meskipun hanya sedikit
- Kecukupan dan kemutahiran data/informasi dan metodologi**: Informasi dari data primer dengan hewan coba yang diberi perlakuan. Metode penelitian eksperimental dengan hewan coba yang terstandar dengan cukup baik.
- Kelengkapan unsur dan kualitas terbitan/ jurnal**: Jurnal nasional berbahasa Inggris terakreditasi Sinta 3, sehingga nilai maksimal 20

Semarang,  
 Reviewer 1



Prof. Dr. dr. Tri Nur Kristina, DMM, M.Kes  
 NIP. 19590527 198603 2 001  
 Bidang ilmu : Fakultas Kedokteran Undip  
 Unit kerja : Ilmu Kedokteran  
 Jabatan/pangkat : Guru Besar

**LEMBAR**  
**HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW**

**KARYA ILMIAH : JURNAL ILMIAH**

**Judul Karya Ilmiah (Artikel) :** Effectiveness of Spirulina platensis Extract on Wound Area and TNF- $\alpha$  Levels on Blood: Experimental Studies In Wistar Rats Made Artificially by Vulnus Scissum and Infected by Staphylococcus aureus

**Jumlah Penulis :** 3 Orang

**Status Pengusul :** Olvaria Misfa, Renni Yuniati, Yan Wisnu Prajoko

**Identitas Jurnal Ilmiah :** a. Nama Jurnal : Indonesian Journal of Environmental Management and Sustainability

b. Nomor ISSN : 2598-6260, 2598-6279

c. Vol, Nomor, halaman : 4 (2), p:55-58

d. Edisi : Juni 2020

e. Penerbit : Research Centre of Inorganic Materials and Complexes, FMIPA

f. Jumlah halaman : 5

g. DOI artikel (jika ada) : <https://doi.org/10.26554/ijems.2020.4.2.55-58>

h. Alamat web jurnal : <https://ijoems.com/index.php/ijems/article/view/117/71>

i. Terindeks di : Sinta 3

j. On line turnitin :

[https://doc-pak.undip.ac.id/4827/1/TURNITIN\\_Effectiveness\\_of\\_Spirulina.pdf](https://doc-pak.undip.ac.id/4827/1/TURNITIN_Effectiveness_of_Spirulina.pdf)

**Kategori Publikasi Jurnal Ilmiah :** ☐ Jurnal Ilmiah Internasional/ Internasional Bereputasi\*\*  
(beri  $\checkmark$  pada kategori yang tepat) ☒ Jurnal Ilmiah Nasional Terakreditasi

☐ Jurnal Ilmiah Nasional/Nasional

**Hasil Penilaian Peer Review :**

Komponen Yang Dinilai	Nilai Maksimal Jurnal Ilmiah			Nilai Akhir Yang Diperoleh
	Internasional / Internasional Bereputasi **	Nasional Terakreditasi	Nasional ***	
		<input type="text"/>	<input type="text" value="20"/>	
a. Kelengkapan unsur isi artikel (10%)			2	2
b. Ruang lingkup dan kedalaman pembahasan (30%)			6	6
c. Kecukupan dan kemutakhiran data/informasi dan metodologi (30%)			6	6
d. Kelengkapan unsur dan kualitas terbitan/ jurnal (30%)			6	6
<b>Total = (100%)</b>			20	20
<b>Nilai Pengusul =</b>			40% x 20 / 2 = 4	

**Catatan penilaian Artikel oleh Reviewer :**

- Kelengkapan unsur isi artikel : Jurnal nasional berbahasa Inggris, Sinta 3, unsur lengkap dari abstrak, pendahuluan, metode, hasil pembahasan hingga daftar pustaka.
- Ruang lingkup dan kedalaman pembahasan : Penelitian tentang efektivitas ekstrak Spirulina platensis pada area luka dan darah level TNF- $\alpha$ : studi eksperimental pada tikus wistar buatan vulnus scissum dan diinfeksi Staphylococcus aureus.
- Kecukupan dan kemutakhiran data/informasi dan metodologi: Penelitian ini menggunakan rancangan randomized post-test only control group design. Pemeriksaan kadar TNF- $\alpha$  serum pada hari ke-14 menggunakan metode ELISA. Analisis data dilakukan dengan uji one way ANOVA dan dilanjutkan dengan Post Hoc Test LSD.
- Kelengkapan unsur dan kualitas terbitan/ jurnal: Terbitan lengkap memuat vol, no, tahun dan daftar isi dan terindeks di Sinta 3.

Semarang,  
Reviewer 2



Dr. Diana Nur Afifah, S.TP., M.Si

NIP. 198007312008012011

Unit kerja : Fakultas Kedokteran Undip

Bidang ilmu : Ilmu Gizi

Jabatan pangkat : Lektor Kepala



Home (<http://ijoems.com/index.php/ijems/index>) > Editorial Team

# Editorial Team

## Editor-In-Chief

Dr. rer. nat. Risfidian Mohadi, Sriwijaya University, Indonesia (Scopus ID = 55991505100) (<https://www.scopus.com/authid/detail.uri?authorId=55991505100>)

## Managing Editors

Dr. Laila Hanum, Sriwijaya University, Indonesia (Scopus ID = 57194601647) (<https://www.scopus.com/authid/detail.uri?authorId=57194601647>)

Dr. Tarmizi Taher, Sriwijaya University, Indonesia (Scopus ID = 56104271500) (<https://www.scopus.com/authid/detail.uri?authorId=56104271500>)

## Advisory International Editorial Boards

Dr. Ng Law Yong, Universiti Tunku Abdul Rahman, Malaysia (Scopus ID = 36680687200) (<https://www.scopus.com/authid/detail.uri?authorId=36680687200>)

Prof. Aldes Lesbani, Universitas Sriwijaya, Indonesia (Scopus ID = 15056199800) (<https://www.scopus.com/authid/detail.uri?authorId=15056199800>)

Dr. Roy Andreas, Universitas Jenderal Soedirman, Indonesia (Scopus ID = 56009301800) (<https://www.scopus.com/authid/detail.uri?authorId=56009301800>)

Dr. Akil Ahmad, University of KwaZulu- Natal, Durban-4041, South Africa (Scopus ID = 36022073300) (<https://www.scopus.com/authid/detail.uri?authorId=36022073300>)

Dr. Muneer Mohammed Awadh Ba-Abbad, Hadharamout University of Science and Technology, Yemen (Scopus ID = 39761137100) (<https://www.scopus.com/authid/detail.uri?authorId=39761137100>)

Dr. Koo Chai Hoon, Universiti Tunku Abdul Rahman, Department of Civil Engineering, Kajang, Malaysia (Scopus ID = 36721525200) (<https://www.scopus.com/authid/detail.uri?authorId=36721525200>)

Dr. M. Lutfi Firdaus, Universitas Bengkulu, Indonesia (Scopus ID = 56426642700) (<https://www.scopus.com/authid/detail.uri?authorId=56426642700>)

Prof. Hilda Zulkifli, Sriwijaya University, Indonesia (Scopus ID = 55234932600) (<https://www.scopus.com/authid/detail.uri?authorId=55234932600>)

Dr. Muhammad Said, Sriwijaya University, Indonesia (Scopus ID = 57189487421) (<https://www.scopus.com/authid/detail.uri?authorId=57189487421>)

## Technical Editors

Neza Rahayu Palapa, Sriwijaya University, Indonesia (Scopus ID = 57204586233) (<https://www.scopus.com/authid/detail.uri?authorId=57204586233>)

### JOURNAL MENU

Aim and Scope (<http://ijoems.com/index.php/ijems/ans>)

Publication Ethics (<http://ijoems.com/index.php/ijems/pe>)

Abstracting Indexing (<http://ijoems.com/index.php/ijems/indexing>)

Manuscript Template (<http://sciencetechindonesia.com/public/site/files/Article%20Template.docx>)

Copyright Notice (<http://ijoems.com/index.php/ijems/copyright>)



Home (<http://ijoems.com/index.php/ijems/index>) > Archives (<http://ijoems.com/index.php/ijems/issue/archive>)  
> Vol. 4 No. 2 (2020): June



(<http://ijoems.com/index.php/ijems/issue/view/11>)

**DOI:** <https://doi.org/10.26554/ijems> (<https://doi.org/10.26554/ijems>)

**Published:** 2020-06-30

## Articles

### [Spirulina platensis Extract Reduces Serum TNF- \$\alpha\$ , Neutrophils, and Increases Macrophage Count in Skin Incisional Mice Model](http://ijoems.com/index.php/ijems/article/view/115) (<http://ijoems.com/index.php/ijems/article/view/115>)

Riski Dwi Utami, Tri Nur Kristina, Renni Yuniati

DOI <https://doi.org/10.26554/ijems.2020.4.2.34-38> (<https://doi.org/10.26554/ijems.2020.4.2.34-38>)  
34-38

Groups	Mean $\pm$ SD	Min-Max	p Values
X1	15.50 $\pm$ 2.429	12-19	p < 0.001
X2	19.17 $\pm$ 2.317	16-22	
C1	6.33 $\pm$ 1.862	4-9	
C2	11.17 $\pm$ 1.329	9-13	

(<http://ijoems.com/index.php/ijems/article/view/115>)

 Abstract 36 times

PDF (<http://ijoems.com/index.php/ijems/article/view/115/72>)

### Effectiveness Cream and Ointment of *Spirulina platensis* extract against amount of Fibroblas and Wound Area: Study on white rats whose skin is incised (<http://ijoems.com/index.php/ijems/article/view/116>)

Bimby Irenesia, Renni Yuniarti, Endang Mahati

DOI <https://doi.org/10.26554/ijems.2020.4.2.39-42> (<https://doi.org/10.26554/ijems.2020.4.2.39-42>)  
39-42

Post-injury day	Group	Mean	SD	p-value
Day 14	Negative control	3.83	2.229	P<0.001
	Positive control	10.33	1.506	
	S.platensis extract 0.1% cream	15.00	2.757	
	S.platensis extract 0.1% ointment	17.50	1.378	

(<http://ijoems.com/index.php/ijems/article/view/116>)

👁 Abstract 33 times

PDF (<http://ijoems.com/index.php/ijems/article/view/116/68>)

## Determinants Analysis of Public Perception of Waste Bank As An Alternative of Settlement Waste Management (<http://ijoems.com/index.php/ijems/article/view/107>)

Tri Hikmah Abdi Ningrum, Hilda Zulkifli, Rahmi Susanti

DOI <https://doi.org/10.26554/ijems.2020.4.2.43-47> (<https://doi.org/10.26554/ijems.2020.4.2.43-47>)

43-47

Education Level	Public Perception Good		Public Perception Bad		Total n	% n	p-value
	n	%	n	%			
High	43	54.4	36	45.6	79	100	0.423
Low	4	36.4	7	63.6	11	100	

(<http://ijoems.com/index.php/ijems/article/view/107>)

👁 Abstract 22 times

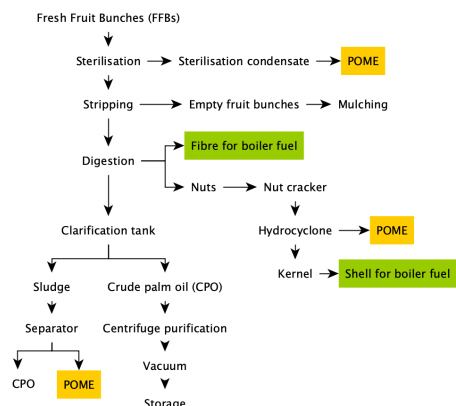
PDF (<http://ijoems.com/index.php/ijems/article/view/107/69>)

## Alternative scenarios to utilise excess biogas in Palm Oil Mill (<http://ijoems.com/index.php/ijems/article/view/114>)

Novelita Wahyu Mondamina, Deni Rachmat, Mochammad Waris Tegar Laksono

DOI <https://doi.org/10.26554/ijems.2020.4.2.48-54> (<https://doi.org/10.26554/ijems.2020.4.2.48-54>)

48-54



(<http://ijoems.com/index.php/ijems/article/view/114>)

👁 Abstract 22 times

PDF (<http://ijoems.com/index.php/ijems/article/view/114/70>)

## Effectiveness of *Spirulina platensis* Extract on Wound Area and TNF- $\alpha$ Levels on Blood: Experimental Studies In Wistar Rats Made Artificially by *Vulnus Scissum* and Infected by *Staphylococcus aureus* (<http://ijoems.com/index.php/ijems/article/view/117>)

Olvaria Misfa, Renni Yuniarti, Yan Wisnu Prajoko

DOI <https://doi.org/10.26554/ijems.2020.4.2.55-58> (<https://doi.org/10.26554/ijems.2020.4.2.55-58>)

55-58

# Effectiveness of Spirulina platensis Extract on Wound Area and TNF-a Levels on Blood: Experimental Studies In Wistar Rats Made Artificially by Vulnus Scissum and Infected by Staphylococcus aureus

*by* Renni Yuniati

---

**Submission date:** 07-Aug-2020 07:00PM (UTC+0700)

**Submission ID:** 1366933632

**File name:** Artikel-Effectiveness\_of\_Spirulina.pdf (323.24K)

**Word count:** 2703

**Character count:** 14148

## Effectiveness of *Spirulina platensis* Extract on Wound Area and TNF- $\alpha$ Levels on Blood: Experimental Studies In Wistar Rats Made Artificially by Vulnus Scissum and Infected by *Staphylococcus aureus*

Olvaria Misfa<sup>1\*</sup>, Renni Yuniati<sup>2</sup>, Yan Wisnu Prajoko<sup>3</sup>

<sup>1</sup>Biomedical Sciences Department, Faculty of Medicine, Diponegoro University, Semarang, Indonesia

<sup>2</sup>Dematovenerology Department, Faculty of Medicine, Diponegoro University, Semarang, Indonesia

<sup>3</sup>Surgery Department, Faculty of Medicine, Diponegoro University, Semarang, Indonesia

\*Corresponding author e-mail: olvaria.misfa@univrab.ac.id

### Abstract

26

This research uses randomized post-test only control group design. Thirty-two (32) male Wistar rats with incised skin and infected with *S. aureus* divided into 4 groups, namely the group given *S. platensis* extract at a dose of 500 mg / kgBB / day (X1) and a dose of 750 mg / kgBB / day (X2), the negative control group was given saline solution (C1), and the positive control group was given amoxicillin 150 mg / kg orally (C2). Wound area measurements were taken on day 14 and serum TNF- $\alpha$  levels were examined on day 14 using the ELISA method. Data analysis was performed with one way ANOVA test and continued with Post Hoc Test LSD. The results showed mean size of wound closure on the 14th day in groups X1, X2, C1 and C2 is 8095.74; 6270.98; 15502.69; 11475.20 micrometer with  $p < 0.001$ . The mean TNF- $\alpha$  serum levels in the 14th day of X1, X2, C1, and C2 groups were 270.75; 222.83; 1730.33; 385.75pg / ml with  $p < 0.001$ . Post Hoc Test of wound area showed significant differences between groups. Post Hoc Test TNF- $\alpha$  levels showed significant differences between treatment groups X1 and X2 with group C1. *Spirulina platensis* extract 500mg / kgBB / day and 750 mg / kgBB / day have the smallest wound area significantly and reduce TNF- $\alpha$  levels on blood.

### Keywords

*Spirulina platensis*, antibacterial, anti-inflammatory, TNF- $\alpha$

Received: 5 June 2020, Accepted: 19 June 2020

<https://doi.org/10.26554/ijems.2020.4.2.55->

## 1. INTRODUCTION

Wounds are damage to the continuity of the skin, mucosa, and bones or other body organs caused by physical or thermal contact. Wounds that arise will cause damage to the surface so it will no longer protect the structure underneath. Infection of the wound can occur if it's contaminated by microorganisms, like bacteria and can be a port de systemic entry infection. Bacteria that often infect wounds are *Staphylococcus aureus* (Widiyanti et al., 2016; Guo and DiPietro, 2010; Dwivedi et al., 2017).

The wound healing process is complex, beginning with the response to injury to restore the function and integrity of the damaged tissue (Pawar et al., 2013). This process consists of the stages of inflammation, proliferation, and remodeling. Wound healing can be hampered by local and systemic factors. The contaminated wound by bacteria affected to inflammatory cytokines, such as TNF- $\alpha$  (Guo and DiPietro, 2010). To accelerate wound healing with bacte-

rial infection requires antibacterial administration (Dwivedi et al., 2017; Agra et al., 2013). In addition to the use of antibiotics. Currently, the use of natural or herbal ingredients as an antibacterial is widely used as an alternative therapy.

Several studies of plant extracts have been proven to have an antibacterial effect and accelerate the healing process of wound infections in mice including the leaves of Bangkong (*Pongamiapinnata*), red betel leaf (*Piper crocatum* Ruiz & Pav), *Bowdichia virgulioide*, *Sida cordifolia*, and *Ficus benghalensis* (Widiyanti et al., 2016; Dwivedi et al., 2017; Pawar et al., 2013; Agra et al., 2013).

Some micro strains blue algae have extracellular and intracellular metabolites with various biological activities, including anti-inflammatory and other antibacterial activities (Usharani et al., 2015). One of the microalgae that have this potential is *Spirulina* sp. *Spirulina platensis* is micro-blue green algae, filamentous cyanobacteria with many bioactive compounds namely proteins, lipids, carbohydrate, and minerals (zinc, magnesium, manganese, selenium), pigments



(phycocyanin,  $\beta$ -carotene), riboflavin, tocopherol and  $\alpha$ -linoleate. (Widiyani et al., 2016; Guo and DiPietro, 2010)

Several studies in India have shown the antibacterial effect of *Spirulina platensis*. According to Usharani et al, *Spirulina platensis* extract inhibits growth in gram-positive bacteria (*Streptococcus pyogenes*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, and *Bacillus cereus*); and gram-negative bacteria (*Proteus mirabilis*, *Klebsiella pneumoniae*, *Shigella flexneri*, and *Salmonella typhi*) (Usharani et al., 2015). Chakraborty et al. (2010) showed that the water extract of *S. platensis* gave inhibitory zone results with the largest diameter in the culture of *Staphylococcus aureus*. Bioactive metabolite compounds that are contained by *Spirulina platensis* that grow on the Karimun Jawa beach are also expected to play an antibacterial and anti-inflammatory role.

## 2. EXPERIMENTAL SECTION

### 2.1 *Spirulina platensis* Extract

The extract used in this study was *S. platensis* powder US FDA registration number 15594742028 and CERES number 500GA1200043 (9241). *S. platensis* powder was macerated in 95% ethanol solution with a concentration of 1:10 (one part of *S. platensis* powder macerated in 10 parts ethanol 95% solution). The maceration process is carried out for five days in a glass container. Then stirred every day to ensure uniformity of the maceration process. After five days, the solution was filtered with Whatman Grade 1 filter paper and evaporated using a rotary evaporator at ethanol boiling point until a thick extract was obtained. This *S. platensis* extract was used as an ingredient in further tests, which are explained further below.

### 2.2 Animal used in Experiment

Thirty-two male Wistar rats aged 2-3 months with a body-weight of 100-200 grams were acclimatized for 7 days. The experimental animals were randomly divided into 4 groups and incised along 2 cm with a depth of 0.25 cm and infected by *S. aureus* bacteria. Group I was given *Spirulina platensis* extract orally at a dose of 500 mg / kgBW. Treatment for group II was 750 mg / kgBW for 14 days, and the negative control group was given 0.9% saline solution, and the positive control group was given amoxicillin 150 mg / kg orally.

### 2.3 Incision Procedure

The rat was anesthetized with 0.1 cc of ketamine, then the back of the rat was shaved 3 cm x 2.5 cm and made an incision using a 2 cm long scalpel and a depth of 0.25 cm. A scalpel was held using the handle on the right hand by forming an angle of 30 – 40° with skin. The incision is made by pulling the scalpel towards the caudal. Wounds are infected with *S. aureus* bacteria, then allowed to stand for 36-48 hours until infection occurs.

### 2.4 Serum levels of TNF- $\alpha$

Serum levels of TNF- $\alpha$  were taken from rat retroorbital blood vessel on the 14th day and regulated by the ELISA method. In this study using the Rat TNF- $\alpha$  ELISA kit (catalog no. E-EL-R0019: Elab Science Biotechnology, Texas, USA)

### 2.5 Analysis Data

The wound area 14-day was measured by Imageraster software 3. The test used in this study is the One Way Anova test to see differences in wound area and TNF- $\alpha$  levels in the four treatment groups. The magnitude of the difference in wound area and TNF- $\alpha$  levels in each group were further analyzed using the Post Hoc LSD Test. The significance value in this study is if the analyzed variable has a p-value <0.05. All statistical analyzes were carried out using the SPSS 25 program.

## 3. RESULTS AND DISCUSSION

All samples used had an average body weight almost the same between groups until the 14th day (Table 1). Mice lived until the end of the study and terminated at the end of the study.

The analysis showed significant differences in wound area between the negative control group and the treatment group who were given *Spirulina platensis* extract at a dose of 500 mg / kgBB / day and a dose of 750 mg / kgBB / day (as Table 2). A significant difference was also shown between the positive control group and the group given *Spirulina platensis* extract at a dose of 500 mg / kgBB / day, a dose of 750 mg / kgBB / day, and the negative control group.

The analysis test showed a significant difference in TNF- $\alpha$  levels between the negative control group and the treatment group that was given *S. platensis* extract at a dose of 500 mg / kgBB / day and a dose of 750 mg / kgBB / day. However, there was no significant difference between the positive control group and the treatment group who were given *S. platensis* extract at a dose of 500 mg / kgBB / day and a dose of 750 mg / kgBB / day.

The wound healing process is a complex process consisting of the stages of inflammation, proliferation, and remodeling. Bacterial contamination of the wound can cause prolongation of the inflammatory phase. One of the bacteria that often contaminates wounds is *Staphylococcus aureus*. In this study, it was shown that *Spirulina platensis* extract that given to mice which made an incision and was infected by *S. aureus* could accelerate wound closure seen from the wound area of each study group. The smallest area of wound is the group who were given *Spirulina platensis* extract at a dose of 750 mg / kgBB / day on the 14th day.

*S. aureus* infection in wounds can affect wound healing. (Guo and DiPietro, 2010) Treatment of *S. aureus* infection depends on the type of disease and the presence or absence of drug-resistant strains (Taylor and Unakal, 2019). In addition to treatment with antibiotics, phytotherapy is

**Table 1.** Wound area (micrometer) day 14

Group	The mean	SD	Value of p	
Negative control	15502.69	1406.07	P <0.001	
Positive control	11475.2	1395.73		
S.platensis extract	8095.74	346.97		
500 mg/kg bodyweight/day				
S.platensis extract	6270.98	1229.47		
750 mg/kg bodyweight/day				

**Table 2.** Serum levels of TNF- $\alpha$  for day 14 treatment

Group	The mean	SD	Value of p	
Negative control	1730.33	344.82	P <0.001	
Positive control	385.75	236.17		
S.platensis extract	270.75	121.91		
500 mg/kg bodyweight/day				
S.platensis extract	222.83	115.94		
750 mg/kg bodyweight/day				

also a treatment option that has been widely used, one of which is by using *S. platensis*.

Compounds that act as antibacterial in *S. platensis* include phenols, flavonoids, and saponins. Phenol activity will kill bacteria by damaging the permeability of bacterial cell walls. Flavonoids will interfere with bacterial growth, eventually killing bacteria with form extracellular protein complexes and dissolved proteins on the cell wall. While saponin compounds will damage the cytoplasmic membrane of bacteria (Vonshak, 1997; Chakraborty et al., 2010; Quader et al., 2013).

Usharani et al and Biswajit et al has been reported that *Spirulina platensis* extract has an antibacterial effect against *S. aureus* bacteria (Usharani et al., 2015; Chakraborty et al., 2010). In addition, Pauzi et al's research also shows that *S. platensis* extract wound healing activity and potential as a therapy for chronic wounds. *Spirulina platensis* has compounds that act as antibacterial, including phenols, flavonoids, and saponins. In bacterial contamination, wounds can occur prolongation of the inflammatory phase due to endotoxins from bacteria that cause an increase in proinflammatory cytokines, one of which TNF- $\alpha$  (Widiyani et al., 2016). *Staphylococcus aureus* bacteria is one of the agents that can contaminate the wound.

This study shows that there is a decrease in serum levels on TNF- $\alpha$  which given *Spirulina platensis* extract to mice made an incision and was infected by *S. aureus* on the 14th day. The lowest decreased serum levels of TNF- $\alpha$  founded in the group that given *S. platensis* extract dose of 750 mg / kg / day. Previous studies conducted by Syeda et al showed that the extract *S. platensis* dose of 500 mg / kg / day has an anti-inflammatory effect on acute and chronic

inflammation. Besides, studies in diabetic-induced mice by Fariba et al. Showed that extracts of *S. platensis* in doses of 20 and 30 mg / kgBB reduced levels of TNF- $\alpha$ , IL-6, ASL, ALT, glucose, lipid parameters, and malondialdehyde. (Koru, 2012)

In the process of wound healing, the release of proinflammatory cytokines, including TNF- $\alpha$ , IL-6, and IL-1, plays an essential role in the inflammatory phase. (Syarina et al., 2015) The inflammatory phase will prolong when the wound is contaminated by bacteria. Prolongation of the inflammatory period occurs due to the release of endotoxin which causes an increase in proinflammatory cytokines, one of them is TNF- $\alpha$ . If the increase in proinflammatory cytokines continues, the wound will become chronic and fail to heal.

Phycocyanin compounds and  $\beta$ -carotene is a phytochemical that acts as an anti-inflammatory in *S. platensis*. Phycocyanin will inhibit the formation of TNF- $\alpha$  by suppressing expression cyclooxygenase-2 (COX-2). While  $\beta$ -carotene will inhibit prostaglandins and nitric oxide which will suppress expression iNOS, COX-2, TNF- $\alpha$  and IL1 $\beta$  (Swain et al., 2017). *S. platensis* extracts have an anti-inflammatory effect. However, it does not show significant differences with the control group based on the average serum levels of TNF- $\alpha$  on the 14th day. An increase in *S. platensis* extract dose is expected to reduce serum levels of TNF- $\alpha$  significantly when compared to the positive control group.

#### 4. CONCLUSIONS

*Spirulina platensis* extract in a dose of 500 mg / kg / day and 750 mg / kg / day had the smallest wound area significantly compared to the group given physiological solutions and

those given oral antibiotics. Whereas *S. platensis* extract dose of 500 mg / kgBB / day and dose of 750 mg / kgBB / day had significantly decreased blood serum levels of TNF- $\alpha$  compared with the group given physiological solution. However, there was no significant difference in the reduction in blood serum levels of TNF- $\alpha$  between the groups presented a dose of 500 mg / kgBB / day and a dose of 750 mg / kgBB / day with positive control.

## REFERENCES

- Agra, I. K., L. L. Pires, P. S. Carvalho, E. A. Silva-Filho, S. Smaniotto, and E. Barreto (2013). Evaluation of wound healing and antimicrobial properties of aqueous extract from *Bowdichia virgilioides* stem barks in mice. *Anais da Academia Brasileira de Ciências*, **85**(3); 945–954
- Chakraborty, B., R. P. Jayaswal, and P. P. Pankaj (2010). Evaluation of antibacterial activity of *Spirulina platensis* extracts against opportunistic pathogen model. *Drugs*, **8**(9); 2435–2465
- Dwivedi, D., M. Dwivedi, S. Malviya, and V. Singh (2017). Evaluation of wound healing, anti-microbial and antioxidant potential of *Pongamia pinnata* in wistar rats. *Journal of traditional and complementary medicine*, **7**(1); 79–85
- Guo, S. a. and L. A. DiPietro (2010). Factors affecting wound healing. *Journal of dental research*, **89**(3); 219–229
- Koru, E. (2012). Earth food *Spirulina* (*Arthrospira*): production and quality standarts. *Food additive*; 191–202
- Pawar, R. S., P. K. Chaurasiya, H. Rajak, P. K. Singour, F. A. Toppo, and A. Jain (2013). Wound healing activity of *Sida cordifolia* Linn. in rats. *Indian journal of pharmacology*, **45**(5); 474
- Quader, S. H., S. U. Islam, A. Saifullah, M. F. U. Majumder, and J. Hannan (2013). In-vivo studies of the anti-inflammatory effects of *Spirulina platensis*. *The Pharma Innovation*, **2**(4)
- Swain, S. S., S. K. Paidesetty, and R. N. Padhy (2017). Antibacterial, antifungal and antimycobacterial compounds from cyanobacteria. *Biomedicine & Pharmacotherapy*, **90**; 760–776
- Syarina, P. N. A., G. Karthivashan, F. Abas, P. Arulselvan, and S. Fakurazi (2015). Wound healing potential of *Spirulina platensis* extracts on human dermal fibroblast cells. *EXCLI journal*, **14**; 385
- Taylor, T. A. and C. G. Unakal (2019). *Staphylococcus aureus*. In *StatPearls [Internet]*. StatPearls Publishing
- Usharani, G., G. Srinivasan, S. Sivasakthi, and P. Saranraj (2015). Antimicrobial activity of *Spirulina platensis* solvent extracts against pathogenic bacteria and fungi. *Advances in Biological Research*, **9**(5); 292–298
- Vonshak, A. (1997). *Spirulina platensis arthrospira: physiology, cell-biology and biotechnology*. CRC Press
- Widiyani, A., H. Maheswari, and M. Effendi (2016). Effect of Red Betel Leaf Extract (*Piper crocatum* Ruiz & Pav) Against Healing of Incision Wounds Infected by *Staphylococcus aureus* in Male Sprague-Dawley Rats. *FMIPA-UnPAK*

# Effectiveness of Spirulina platensis Extract on Wound Area and TNF-a Levels on Blood: Experimental Studies In Wistar Rats Made Artificially by Vulnus Scissum and Infected by Staphylococcus aureus

## ORIGINALITY REPORT

16%

SIMILARITY INDEX

5%

INTERNET SOURCES

9%

PUBLICATIONS

8%

STUDENT PAPERS

## PRIMARY SOURCES

1

Submitted to Universitas Airlangga

Student Paper

2%

2

Zahra Heidari, Bita Moudi, Hamidreza Mahmoudzadeh Sagheb, Mehrnoosh Moudi.  
"Association of TNF- $\alpha$  Gene Polymorphisms with Production of Protein and Susceptibility to Chronic Hepatitis B Infection in the South East Iranian Population", Hepatitis Monthly, 2016

Publication

1%

3

Submitted to Politeknik Negeri Sriwijaya

Student Paper

1%

4

Nirmal Renuka, Abhishek Guldhe, Radha Prasanna, Poonam Singh, Faizal Bux.  
"Microalgae as multi-functional options in modern agriculture: current trends, prospects and challenges", Biotechnology Advances, 2018

Publication

1%



5	Submitted to St. Mary's College Twickenham Student Paper	1 %
6	Da Hye Song, Gyeong-Ji Kim, Kang-Hyun Chung, Kwon Jai Lee, Jeung Hee An. "Ormosanine from Akebia quinata suppresses ethanol-induced inflammation and apoptosis and activates antioxidants via the mitogen activated protein kinase signaling pathway", Journal of Functional Foods, 2018 Publication	1 %
7	"Antibacterial Drug Discovery to Combat MDR", Springer Science and Business Media LLC, 2019 Publication	1 %
8	<a href="https://repositori.usu.ac.id">repositori.usu.ac.id</a> Internet Source	1 %
9	Submitted to Universiti Malaysia Pahang Student Paper	1 %
10	Sukanya Bhowmick, Aninda Mazumdar, Amitava Moulick, Wojtech Adam. "Algal metabolites: An inevitable substitute for antibiotics", Biotechnology Advances, 2020 Publication	1 %
11	<a href="http://www.thieme-connect.com">www.thieme-connect.com</a> Internet Source	1 %

12	Albenise Santana Alves Barros, Helison Oliveira Carvalho, Igor Victor Ferreira dos Santos, Talisson Taglialegna et al. "Study of the non-clinical healing activities of the extract and gel of <i>Portulaca pilosa</i> L. in skin wounds in wistar rats: A preliminary study", Biomedicine & Pharmacotherapy, 2017 Publication	1%
13	Septyaningrum Putri Purwoto, Adi Pranoto, Hartono Hartono, Sugiharto Sugiharto. "Moderate Intensity Training By Listening To Music Decreases Interleukin-6 Levels In Rats", STRADA Jurnal Ilmiah Kesehatan, 2020 Publication	1%
14	Submitted to Endeavour College of Natural Health Student Paper	<1%
15	<a href="http://www.tandfonline.com">www.tandfonline.com</a> Internet Source	<1%
16	Submitted to Sheffield Hallam University Student Paper	<1%
17	<a href="http://complete.bioone.org">complete.bioone.org</a> Internet Source	<1%
18	<a href="http://corescholar.libraries.wright.edu">corescholar.libraries.wright.edu</a> Internet Source	<1%

19

Submitted to BPP College of Professional  
Studies Limited

Student Paper

&lt;1 %

20

[www.israbat.ac.ma](http://www.israbat.ac.ma)

Internet Source

&lt;1 %

21

Maria Liduína Maia de Oliveira, Diana Céla  
Sousa Nunes-Pinheiro, Adriana Rocha Tomé,  
Érika Freitas Mota et al. "In vivo topical anti-  
inflammatory and wound healing activities of the  
fixed oil of *Caryocar coriaceum* Wittm. seeds",  
*Journal of Ethnopharmacology*, 2010

Publication

&lt;1 %

22

Submitted to Tikrit University

Student Paper

&lt;1 %

23

[pesquisa.bvsalud.org](http://pesquisa.bvsalud.org)

Internet Source

&lt;1 %

24

Alghamdi , Reham Khlaf Jamaan. "Effect of  
*Corchorusolitorius* Leaves Aqueous Extract on  
Carbon Tetra Chloride-Induced Acute  
Hepatotoxicity in Rats = تأثير المستخلص المائي لأوراق  
الملوخية على التسمم الكبدي الحاد المحدث برابع كلوريد الكربون في  
الفئران", King Abdulaziz University : Scientific  
Publishing Centre, 2020

Publication

&lt;1 %

25

[hdl.handle.net](http://hdl.handle.net)

Internet Source

&lt;1 %

26

jurnal.stahnmpukuturan.ac.id  
Internet Source

<1 %

27

Arezki Bitam, Ourida Aissaoui. "Spirulina platensis, oxidative stress, and diabetes", Elsevier BV, 2020  
Publication

<1 %

Exclude quotes      On  
Exclude bibliography      On

Exclude matches      Off



# Effectiveness of Spirulina platensis Extract on Wound Area and TNF-a Levels on Blood: Experimental Studies In Wistar Rats Made Artificially by Vulnus Scissum and Infected by Staphylococcus aureus

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4