

BAB V

KESIMPULAN DAN SARAN

A. Kesimpulan

Berdasarkan studi literatur uji aktivitas antibakteri lendir ikan gabus (*Channa striata*) terhadap *Pseudomonas aeruginosa*, maka dapat disimpulkan sebagai berikut:

Pertama, lendir ikan gabus (*Channa striata*) mempunyai aktivitas antibakteri terhadap *Pseudomonas aeruginosa*.

Kedua, senyawa yang berperan dalam aktivitas antibakteri lendir ikan gabus (*Channa striata*) terhadap bakteri *Pseudomonas aeruginosa* adalah *Antimicrobial peptide* (AMP) seperti; pleurocidin, defensins, cathelicidins, piscidin, dan enzim seperti; lisozim, protease, lektin.

B. Saran

Pertama, perlu dilakukan penelitian lanjutan uji aktivitas antibakteri menggunakan formulasi lendir ikan gabus (*Channa striata*).

Kedua, perlu dilakukan penelitian mengenai kandungan-kandungan senyawa spesifik dalam lendir ikan gabus (*Channa striata*).

Ketiga, perlu dilakukan isolasi senyawa-senyawa pada ikan gabus (*Channa striata*) yang berperan sebagai antibakteri.

DAFTAR PUSTAKA

- Alfarisy, M.U., 2014. Pengaruh Jenis Kelamin dan Ukuran terhadap Kadar Albumin pada Ikan Gabus (*Channa striata*). [Thesis]. Institut Teknologi Sepuluh Nopember. Surabaya.
- Alexander J., & Ingram G. 1992. *Noncellular nonspecific defense mechanisms of fish*. Ann. Rev. Fish Dis. 2(249).
- Andi N., & Indrati K. 2017. Edible Portion dan Kandungan Kimia Ikan Gabus (*Channa striata*) Hasil Budidaya Kolam di kabupaten Kutai Kartanegara Kalimantan Timur. Universitas Mulawarman Samarinda. Samarinda.
- Anderson, D.L., Hughes, D., 2010. *Antibiotic Resistance and Cost: Is It Possible to Reverse Resistance*. Nature Reviews Microbiology, 8.4. 71-260
- Andriyanto, S. 2009. *Ikan Gabus (Channa striatus) Manfaat Pengembangan dan Alternatif Teknik Budidayanya*. Pusat riset perikanan budidaya. Jakarta
- Ansar. 2010. *Pengolahan dan Pemanfaatan Ikan Gabus*. Jakarta: ISBN. Kementrian Pendidikan Nasional Direktorat Jendral Pendidikan Nonformal dan Informasi Direktorat Pendidikan Kesetaraan.
- AOAC. 2005. *Official Methods of Analysis of the Association of Official Analytical Chemist*. AOAC Inc. Washington.
- Atmojo, A.T. 2016. Media Mueller Hinton Agar. Availale at: <http://medlab.id/media-mueller-hinton-agar.html>. Diakses pada 6 November 2019.
- Aulia W., Nony P., & Rizal P. 2017. Identifikasi *Pseudomonas aeruginosa* dan Uji Sensivitas terhadap Antibiotik dari Sampel Pus Infeksi Luka Operasi di RSUD Dr. Moewardi. *Universitas Setia Budi Surakarta*. Surakarta.
- Bardan A., Nizet V., Gallo R. 2004. Antimicrobial Peptides and The Skin. *Expert Opin Biol Ther*.
- Beisswenger C, Bals R. 2005. *Functions of antimicrobial peptides in host defense and immunity*. Curr Protein Pept Sci; 6(3):255-64.
- Bernard, JJ & Gallo, RL . 2011. *Protecting the boundary: the sentinel role of host defense peptides in the skin*. Cell Mol Life Sci 68:2189–99
- [BPOM] Badan Pengawas Obat dan Makanan, 2014. *Peraturan Kepala Badan Pengawas Obat dan Makanan Republik Indonesia Nomor 13 Tahun 2014 Tentang Pedoman Uji Klinik Obat Herbal*. Kepala Badan Pengawas Obat dan Makanan Republik Indonesia

- Bragadeeswaran, S. & Thangrat, 2011. Hemolytic and antibacterial studies on skin mucus of eel fish, *Anguilla anguilla* Linnaeus, 1758. *Asian J. Biol. Sci.*, 4: 272-276.
- Breitenbach B., Marcelino S., Felix O., Moural., Viana. 2008. Lectins as antimicrobial agents. *Journal of Applied Microbiology* ISSN 1364-5072. Brazil.
- Brocal I., Falco A., Mas V. 2006. Stable expression of bioactive recombinant pleurocidin in a fish cell line. *Appl Microbiol Biotechnol.*72:1217–28.
- Brooks, GF., Carrol KC, Butel JS, Morse, and all., 2013. *Mikrobiologi Kedokteran*. Ed 25. Penerbit Buku Kedokteran EGC: Jakarta.
- Casadei E., Wang T., Zou J. 2009. Characterization of three novel beta-defensin antimicrobial peptides in rainbow trout (*Oncorhynchus mykiss*). *Mol Immunol.*46: 3358–66.
- Chen J., Lin W., Lin T. 2009. A fish antimicrobial peptide, tilapia hepcidin th2-3, shows potent antitumor activity against human fibrosarcoma cells. *Peptides* 30: 1636–42
- Chia T., Wu Y., Chen J. 2010. *Antimicrobial peptides* (AMP) with antiviral activity against fish nodavirus. *Fish Shellfish Immunol.*28:434–9.
- Choncha M. 2004. Appolipoprotein A-I and A-II are potentially important effectors of innate immunity of the teleost fish *Cyprinus carpio*. *Eur J Biochem.* 271:2984-2990.
- Cowin A. 2006. Role of the Actin Cytoskeleton in Wound Healing and Scar Formation. *Primary Intention* 14 (1): 39-42
- Cole A., Weis P., Diamond G. 1997. Isolation and characterization of pleurocidin, an antimicrobial peptide in the skin secretions of winter flounder. *J Biol Chem.*272:12008–13.
- Cuesta A., Meseguer J., Esteban M. 2008. The antimicrobial peptide hepcidin exerts an important role in the innate immunity against bacteria in the bony fish gilthead seabream. *Mol Immunol* 45:2333–42
- Cuesta A., Meseguer J., Esteban M. 2011. Molecular and functional characterization of the gilthead seabream α -defensin demonstrate its chemotactic and antimicrobial activity. *Mol Immunol.*48:1432–8.
- Dahlan, C. K., A. M. Z. Mat jais., A. M. Ahmad., D. Akim dan A. Adam. 2011. Jakarta. *Amino and fatty acid composition in Haruan traditional extract (HTE)*. JPB Kelautan dan Perikanan vol. 10, No. 1, Hal. 37-44.

- Darmadi. 2008. *Infeksi Nosokomial: Problematika dan Pengendaliannya*. Jakarta: Salemba Medik.
- Douglas S., Patrzykat A., Pytyck J. 2003. Identification, structure and differential expression of novel pleurocidins clustered on the genome of the winter flounder, *Pseudopleuronectes americanus* (Walbaum). *Eur J Biochem.*270:3720–30
- Davis W., & Stout T. 1971. *Disc Plate Method of Microbiological Antibiotic Assay*. *Applied Microbiology*. 22 (4): 659-665.
- Denyer, S.P., Hodges, N.A., Gorman, S.P., 2004. Hugo and Russell's *Pharmaceutical Microbiology*, seventh edition, Blackwell Science.
- (DepKes RI) Departemen Kesehatan Republik Indonesia. (1985). Farmakope Indonesia. Edisi IV. Jakarta : Depkes RI
- Dhanaraj M., Haniffa M., Arun S., Muthu C., Manikandaraja D. and James Milton M. 2009. Antibacterial Activity of Skin and Intestinal Mucus of Five Different Freshwater Fish Species Viz., *Channa striatus*, *C. micropeltes*, *C. marulius*, *C. Punctatus* and *C. gachua*. *Malaysian Journal of Science*. Malaysia.
- Fernandes J., Kemp G., Molle M. 2002. Anti-microbial properties of histone H2A from skin secretions of rainbow trout, *Oncorhynchus mykiss*. *Biochem J* .368(Pt 2):611–20.
- Fernandes JMO, Molle G, Kemp GD et al. 2004. Isolation and characterisation of oncorhyncin II, a histone H1-derived antimicrobial peptide from skin secretions of rainbow trout, *Oncorhynchus mykiss*. *Dev Comp Immunol* 28: 127–38
- Gam, L-H., C-Y. Leow dan S. Baie., 2006. Proteomic analysis of snakehead fish (*Channa striata*) tissue. *Malaysian journal of Biochemistry and Molecular Biology*. 14(1): 25-32.
- Gandjar, I. & Rohman, A. 2007. Kimia Farmasi Analis. *Pustaka Pelajar*. Yogyakarta.
- Ganz T. 2003. Defensins: Antimicrobial Peptides of Innate Immunity. *Nat Rev Immunol*.
- Gary A., Jinky A., and Airha G. 2018. Antimicrobial Activity of Epidermal Mucus from Top Aquaculture Fish Species against Medically-Important Pathogens. *Polytechnic University of the Philippines*. Filipina.
- Gufron, H. & Kordi, K. 2010. *Budidaya akuatik untuk pangan, kosmetik, dan obat-obatan*. Lyli publisher. Yogyakarta

- Haniffa M., Viswanathan S., Jancy D., Poomari K., and Manikandan S. 2014. Antibacterial studies of fish mucus from two marketed air-breathing fishes: *Channa striatus* and *Heteropneustes fossilis*. *International Research Journal of Microbiology*. India.
- Harti M. 2015. *Mikrobiologi Kesehatan: Peran Mikrobiologi dalam Bidang Kesehatan* (1st Edition Ed). (E. Risanto, Ed). Penerbit Andi.
- Harvey, D. 2000. *Modern Analytical Chemistry*. The McGraw-Hill Companies., Inc.USA.
- Hellio C., Bremer G., Pons A., Bourgougnon N. 2000. Inhibition of the development of microorganisms (bacteria and fungi) by extracts of marine algae from Brittany (France). *Appl Microbiol Biotech*. 54:543-549.
- Hoeflich K., Ikura M. 2002. Calmodulin in Action: Diversity in Target Recognition and Activation Mechanism. *Cell Press* 108: 739-742.
- Izadpanah A., Gallo R. 2005. *Antimicrobial peptides*. *J Am Acad Dermatol*. 52:381-8.
- Jawetz, Melnick, & Adelberg's. 2004. *Mikrobiologi Kedokteran*. Edisi 23. Jakarta: Penerbit Buku Kedokteran EGC.
- Jawetz, Melnick, & Adelberg's. 2007. *Mikrobiologi Kedokteran*. Edisi 23. Alih Bahasa Aryandhito Widhi Nugroho *et al.*, Editor Edisi Bahasa Indonesia Hartanto, H., *et al.* Jakarta: EGC
- Jawetz, Melnick, & Adelberg's. 2012. *Mikrobiologi Kedokteran*, Alih Bahasa Aryandhito Widhi Nugroho *et al.*, Editor Edisi Bahasa Indonesia Adityaputri Edisi 25. EGC. Jakarta.
- Jin J., Zhou L., Wang Y. 2010. Antibacterial and antiviral roles of a fish-defensin expressed both in pituitary and testis. *Plos One*.
- Kasper, D. L., Hauser, S. L., Jameson, J. L., Fauci A., Longo, D. L., & Loscalzo, J., 2015, *Harrison's Principles of Internal Medicine* 19th Ed., The McGrawhill Companies, United States of America.
- Kobajashi T., Moh Nur I., Ahmad M., Sarnia. Profil asam lemak ikan gabus (*Channa striata*) Asap yang Diproduksi dari Kabupaten Konawe Sulawesi Tenggara. Universitas Halu Oleo. Sulawesi.
- Kuppulakshmi C., Prakash M., Gunasekaran G., Manimegalai G., Sarojini S. 2008. Antibacterial properties of fish mucus from *Channa striata* and *Cirrhinus mrigala*. *Annamalai University Annamalai Nagar*. India.

- Kusmayati & Agustini N. 2007. *Uji Aktivitas Senyawa Antibakteri dari Mikroalga (Porphyridium cruentum)*. Biodiversitas 8: 48-53.
- Lambongadil, G.P., Reo, A.R & Onibala, H. 2014. Studi Mutu Produk Ikan Japuh (*Dussumieria acuta* C.V.) Asap Kering Industri Rumah Tangga Di Desa Tumpaan Baru Kecamatan Tumpaan. Fakultas Perikanan dan Ilmu Kelautan. *Universitas Samratulangi*. Sulawesi Utara. Manado.
- Lay-Harn G., Chiuan L., Saringat B. 2005. Amino Acid Composition of Snakehead Fish (*Channa striatus*) of Various Sizes Obtained at Different Times of the Year. *Universiti Sains Malaysia*. Malaysia.
- Leung, Y., & Foster, S. 1996. *Encyclopedia of Common Natural Ingredients Used in Food, Drugs and Cosmetics*. Ed ke-2. New York.
- Locke, T., Sally, K., Andrew, W., Rory, M., 2013. *Microbiology Infections Diseases*. Indeks, Jakarta.
- Madigan, M.T., J.M. Martinko, & J. Parker. 2009. *Biology of Microorganism*. New York: Prentice Hall International.
- Maier V., Dorn K., Gudmundsdottir B. 2008. Characterisation of cathelicidin gene family members in divergent fish species. *Mol Immunol* 45:3723–30.
- Majid. 2009. Senyawa Antibakteri dan Mekanisme kerjanya. <http://majidundip.blogspot.com/2009/08/senyawa-antibakteri-dan-mekanisme.html>. Diakses pada tanggal 19 November 2019.
- Melani D., Lilik E., Imam T. 2013. *The Addition of EDTA (ethylenediaminetetraacetic acid) with Egg White Lysozyme Extracts as The Antimicrobial Activity on Salmonella sp and Staphylococcus aureus*. [Skripsi]. Brawijaya University. Malang.
- Misnadiarly, & Djajaningrat, Husjain. 2014. *Mikrobiologi untuk Klinik dan Laboratorium*. Jakarta : Rineka Cipta
- Moll R., Divo M., Langbelin L. 2008. The Human Keratins: Biology and Pathology. *Histochemical Cell Biology*. 129: 705-733.
- Nemeth E., Ganz T. 2006. Regulation of Iron Metabolism by Hepcidin. *Annu Rev Nutr*.
- Nielsen, S. 2003. *Introduction to Food Analysis*. Plenum Publisher. New York.
- Ningsih., Lukman, Nurna. 2009. *Asuhan Keperawatan pada Klien dengan Gangguan System Muskuloskeletal*. Jakarta : Salemba Medika.

- Noga E., Silphaduang U. 2003. Piscidins: a novel family of peptide antibiotics from fish. *Drug News Perspect.* 16:87–92.
- Noga E., Fan Z., Silphaduang U. 2001. *Histone-like proteins from fish are lethal to the parasitic dinoflagellate Amyloodinium ocellatum.* *Parasitology* 123(Pt 1):57–65.
- Nurtitus. 2009. *Analisa Bahan Makanan dan Pertanian.* Liberty. Yogyakarta
- Odianti, G.T. 2010. Aktivitas Antibakteri Alfa Mangostin Kulit Buah Manggis (*Garcinia mangostana* L.) terhadap *Staphylococcus aureus* dan *Pseudomonas aeruginosa* Multiresisten Antibiotik. [Skripsi]. *Universitas Muhamadiyah Surakarta.* Surakarta.
- Pasupuleti M. 2009. Structural, Functional and Evolutionary Studies of Antimicrobial peptides. Doctoral Dissertation. Lund: Lund Faculty of Medicine.
- Patrzykat A., Gallant J., Seo J. 2003. Novel antimicrobial peptides derived from flatfish genes. *Antimicrob Agents Chemother.* 47: 2464–2470
- Pelczar M.J., Chan E.C. 2003. *Dasar-Dasar Mikrobiologi.* Hadjoetomo. Ed. Jakarta. Universitas Indonesia Press.
- Pratiwi. 2008. *Mikrobiologi Farmasi.* Jakarta: Erlangga
- Radji, M., 2011, *Buku Ajar Mikrobiologi Panduan Mahasiswa Farmasi dan Kedokteran*, 107, 118, 201-207, 295, Jakarta, Buku Kedokteran EGC.
- Raihana, N., 2011, Profil Kultur dan Uji Sensitivitas Bakteri Aerob dari Luka Operasi di Bangsal Bedah RSUP Dr M. Djamil Padang, Universitas Andalas.
- Rohman, A. 2009. *Kromatografi Untuk Analisis Obat.* Graha Ilmu. Yogyakarta.
- Samaranayaka A. G. P. and Li-Chan E. C. Y. 2011. Food-Derived Peptidic antioxidants: A Review of Their Production, Assesment, and Potential Applications. *Journal of Functional Foods.*
- Santos A., Napole T., Bezerra R., Carvalho E., Correia M., Paiva P., and Coelho L. 2013. Strategies to obtain lectins from distinct sources. In *Advances in Medicine and Biology* ed. *Nova Science Publishers.* New York.
- Scocchi M., Pallavicini A., Salgaro R. 2009. The salmonid cathelicidins: a gene family with highly varied C-terminal antimicrobial domains. *Comp Biochem Physiol B Biochem Mol Biol.* 152:376–81.

- Shahriza S., Zunnurain J., Mohd N., Hong, Nursyuhaida. 2019. Mucus Protein Composition of Wild *Channa striata* (Perciformes: Channidae) from Peninsular Malaysia. *Journal of Innovations in Pharmaceutical Biological Sciences*. Malaysia.
- Siegrist, J., (2010). *Pseudomonas a Communicative Bacteria*. Microbiology Focus, Vol 2(4)
- Silphaduang U., Colorni A., Noga E. 2006. Evidence for widespread distribution of piscidin antimicrobial peptides in teleost fish. *Dis Aquat Organ*. 72:241–52
- Sinaga, T.P, M.F. Rahadjo dan Djaja Subardja, S. 2000. *Bioekotogi Ikan Gabus (Channa striata) pada Aliran Sungai Banjarn Purwokerto*. Prosiding Seminar Nasional Keanekaragaman Sumber Daya Hayati Ikan. Hal. 133-140.
- Singh B., Arora S., Agrawal P., Gupta S. 2011. Hepcidin: a Novel Peptide Hormone Regulating Iron Metabolism. *Clin Chim Acta*.
- Soedarto. 2015. *Mikrobiologi Kedokteran*. Jakarta: CV. Sagung Seto.
- Subramanian R., Azmawi M.Z., Sadikun A. 2008. In Vitro α -glucosidase and α -amylase Enzym Inhibitory Effects of *Andrographis Paniculata* Extract Andrografolid. *Acta Biochimica Polonia*. Vol.55 2, hal 391-398.
- Sulviana A., Puspawati N., Rizal M. 2017. Identifikasi *Pseudomonas aeruginosa* dan Uji Sensitivitas terhadap Antibiotik dari Sampel Pus Infeksi Luka Operasi di RSUD Dr. Moewardi. *Universitas Setia Budi Surakarta*. Surakarta.
- Suriawiria U. 2005. *Mikrobiologi Dasar*. Jakarta: Papas Sinar Sinanti
- Soeseno, S., 1988. *Budidaya Ikan dan Udang dalam Tambak*. PT. Gramedia. Djakarta; 179.
- Sulistyaningrum, R., 2016, Pola Resistensi Bakteri terhadap Antibiotik pada Penderita Pneumonia di Rumah Sakit X Periode Agustus 2013 – Agustus 2015 [Skripsi], Surakarta, Fakultas Farmasi, Universitas Muhammadiyah Surakarta.
- Tati N., Muhammad F., Desniar. 2018. Aktivitas Inhibitor protease dari Ekstrak Karang Lunak, Asal perairan Pulau Panggang Kepulauan Seribu. *Departemen Teknologi Hasil Perairan*. Bogor.
- Todar K. 2012. *Online Textbook of Bacteriology*. <http://textbookofbacteriology.net/pseudomonas.html>. Diakses 12 November 2019

- Ulandari, A., D, Kurniawan, A. S. Putri., 2011. *Potensi Protein Ikan Gabus (channa striata) dalam Mencegah Kwashiorkor pada Balita di Provinsi Jambi*. Fakultas Kedokteran. Universitas Jambi.
- Ulfa A., Suarsini M., Irawati H., dan Muhdhar A. 2016. Isolasi dan Uji Sensitivitas Merkuri pada Bakteri dari Limbah Penambangan Emas di Sekotong Barat Kabupaten Lombok Barat. *Proceeding Biology Education Conference*. 13(1): 161-167.
- Utami, ER.2011. *Antibiotika, resistensi, dan Rasionalitas Terapi*. Fakultas Sains dan teknologi UIN Maliki. Malang.
- Van der M., Adamek M., Gonzalez S. 2012. Molecular cloning and expression of two β -defensin and two mucin genes in common carp (*Cyprinus carpio* L.) and their up-regulation after β -glucan feeding. *Fish Shellfish Immunol* 32:494–501.
- Vengkades Rao., Kasi Marimuthu, Timalata Kupusamy. 2015. Defense properties in the epidermal mucus of different freshwater fish species. *Department of Biotechnology*. India.
- Villarroel F., Bastias A., Casado A. 2007. Apolipoprotein A-I, an antimicrobial protein in *Oncorhynchus mykiss*: evaluation of its expression in primary defence barriers and plasma levels in sick and healthy fish. *Fish Shellfish Immunol* 23:197–209.
- Wahyu W., Happy N., Anik M., Adharyan I., Verly H. 2020. Short Communication: Proximate analysis, amino acid profile and albumin concentration of various weights of Giant Snakehead (*Channa striata*) from Kapuas Hulu, West Kalimantan, Indonesia. *Universitas Brawijaya Malang*. Malang.
- Waluyo, L. 2004. *Mikrobiologi Umum*. UPT. Penerbitan Universitas Muhamadiyah Malang. Malang.
- Waluyo, L. 2010. *Mikrobiologi Umum*. UPT. Penerbitan Universitas Muhamadiyah Malang. Malang.
- Weber, M., & de Beaufort L,F., 1993. *The Fishes of The Indo-Australian Archipelago*, 4 E.J. Brill : 196 – 200.
- Yeong W., Xavier R., Marimuthu K. 2010. Screening of antibacterial activity of mucus extract of Snakehead fish, *Channa striatus* (Bloch). *AIMST University Batu*. Malaysia.
- Zasfloff M. 2002. Magainins, a class of antimicrobial peptides from *Xenopus* skin. Isolation, characterization of two active forms, and partial cDNA sequence of a precursor. *Proc Natl Acad Sci USA*;84:5449-5453.

Zou J., Mercier C., Koussounadis A. 2007. Discovery of multiple beta-defensin like homologues in teleost fish. *Mol Immunol.*44:638–47.

L

A

M

P

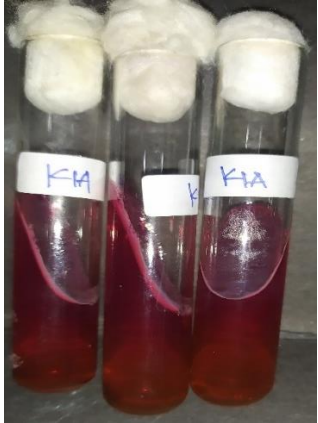
7

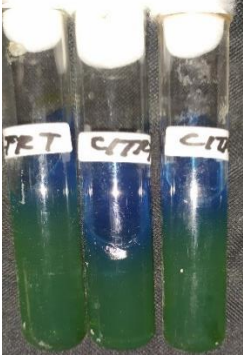
R

A

N

Lampiran 1. Hasil uji biokimia bakteri *Pseudomonas aeruginosa*

Uji	Foto
SIM	
KIA	
LIA	

CITRAT	
--------	--

Lampiran 2. Foto alat-alat yang digunakan



Inkubator



Oven



Autoklaf



Tabung reaksi



Kapas lidi steril



Cawan petri



Gelas ukur



Mikroskop