

ROLE OF BROWN ALGAE (*SARGASSUM SP*) AS ANTIBACTERIAL (*PORPHYROMONAS GINGIVALIS*) IN PERIODONTAL DISEASES

DAHLIA HERAWATI¹, B. CLARA SUMANIK²

¹Department of Periodontology, Faculty of Dentistry, Gadjah Mada University, Yogyakarta, Indonesia, ²Clinical Dentistry Master Program, Periodontology, Faculty of Dentistry, Gadjah Mada University, Yogyakarta, Indonesia
Email: brendaclara73@gmail.com

Received: 22 Jan 2019, Revised and Accepted: 28 May 2019

ABSTRACT

The main cause of periodontitis is bacterial *porphyromonas gingivalis*, which is an anaerobic gram-negative bacteria and is pathogenic because it destroys periodontal tissue. Brown algae (*sargassum sp*) is widely available in Indonesia waters, especially in the water of Maluku, and contains many minerals, fatty acids, phenols, alginates, fukosantin, alkaloids, steroids, saponins, flavonoids, tannins, carbohydrates, proteins, vitamins (A, B, C, D, E) and contains high levels of iodine that can be used as an antibacterial. This literature review aims to study the role of brown algae (*sargassum sp*) as an antibacterial (*porphyromonas gingivalis*) in periodontal disease. Brown algae (*sargassum sp*) can be used in traditional medicine, food, cosmetics/beauty, pharmacy and textile industries. This review found 3 different active compounds that act as antibacterial agents: phenols, flavonoids, and tannins. Therefore, brown algae (*sargassum sp*) can be used to inhibit the growth of *porphyromonas gingivalis* bacteria. The highest antibacterial content is found in brown algae (*sargassum sp*). Brown algae (*sargassum sp*) can be used as the basic treatment of periodontitis disease because it contains antibacterial substances such as phenols, flavonoids and tannins.

Keywords: Brown alga, *Sargassum sp*, Antibacterial, Periodontal disease

© 2019 The Authors. Published by Innovare Academic Sciences Pvt Ltd. This is an open-access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>)
DOI: <http://dx.doi.org/10.22159/ijap.2019.v11s4.35272>

INTRODUCTION

Indonesia is the largest island in the world that has a very wide marine area. One of the Indonesian territories is known as the region of a thousand islands. The Maluku island is a large source of marine power and has a large amount of algae and seaweed resources. Based on the Sibolga sea expedition in 1899-1900, 555 species algae and 8,642 species of seaweed were found in the territorial of the archipelago. There are four types of algae-based on their pigments such as green algae, red algae, brown algae, and green-blue algae [1].

Sargassum sp is one species brown algae of containing phenol, iodine, alginate, and fatty acids useful as foodstuffs, pharmaceuticals, cosmetics, and textile-based materials [2]. It contains active compounds such as [3] vitamin C, steroids, tannins, phenols, and iodine that can be used as antioxidants while the active compounds like fukosantin, tannins, phenols, steroids, alkaloids, and triterpenoids can serve as an antibacterial, antiviral, and antifungal.

Referring to data based on Health Research of 2013, the national prevalence of dental health cases is 25.9%. 4 provinces have a high prevalence of oral health problems than the nation, including the Maluku province, and the most numerous is in the productive age group. Its distribution is evenly split in the countryside (5.15%) and urban area (4.35%). True tooth brushing behavior in the year 2013 shows the number 2.3% it's not many Indonesian people who can brush their teeth properly. This can enhance cases of periodontitis due to the accumulation of plaque and food debris [4].

Periodontitis occurs due to the accumulation plaque that contains organisms that colonize the plaque and secrete lipopolysaccharide (LPS) and may damage the periodontal tissues. The main cause of periodontitis is the bacteria pathogen *porphyromonas gingivalis* that is a gram-negative bacteria with detrimental effects to the periodontal tissues [5].

To anticipate the spike in cases of periodontal disease, it is necessary to utilize natural resources to suppress high rates of dental and oral pain. One of the natural resources that can be used as medicines and has antibacterial effects against periodontal disease is the brown algae *sargassum sp* [6].

This literature review aims to review the role of brown algae *sargassum sp* as an antibacterial (*porphyromonas gingivalis*) in periodontal disease.

Sargassum chocolate Alga sp.

Brown algae, usually known as grass sea type chocolate, is contained throughout the waters of Indonesia archipelago and has been known to humans since before Masehi around 2700. At that time, the Chinese have been utilizing algae as one of the early makers of traditional medicines. Early centuries Masehi, approximately 65 y, the Romans utilized algae as a raw material for cosmetics, in line with the progress of human science pioneered by the countries of Western Europe are characterized by the development of the use of algae as material for organic fertilizer and a raw material manufacturer's glass. Algae has been known and utilized since the old-time but the use and cultivation effort only began at the end century to-17. The pioneers of this business are China and Japan [7].

Algae are known as pioneer plants in Latin known as Phyton, while in Indonesia they're known as Algae. Algae is part of the fillum Thallophyta that is divided into 7 divisions, namely: 1. Eglenophyta, 2. Chlorophyta, 3. Crysophyta, 4. Cyanophyta, 5. Phaeophyta, 6. Pyroophyta, 7. Rhodophyta. Algae are plants that do not have roots, stems, and leaves that have characteristics of this fillum, marine algae belong to the division of Thallophyta which means plants that have talus, consists of four classes, namely: Chlorophyceae, Phaeophyceae, Rhodophyceae, Myxophyceae [8].

The form of morphology Thalus is various, among others, round, flat, tube, flat, like the tube, and hair. There are arranged uni- and multi-cellular, branching talus there dichotomous (branched two continuous), pectinate (one side), pinnate (bifurcated along main talus or alternating tube), ferticilate (branches spin on the axis) of various talus plants, some soft as gelatin, some are hard because they contain calcareous, soft as cartilaginous, and filamentous (spongiosis). They are rich in mineral content that is necessary in the human body. A100 grams sample of algae contains 54.3-73.8% of carbohydrates, 0.35-5.9% of protein as well as calcium, sodium, solution ester, vitamins (A,B,C,D,E) and iodine content [9].

Sargassum is part of a group of brown algae in the Thallophyta division, Phaeophyceae class, order Fucales, family sargassacea, genus *Sargassum*, species *Sargassum sp*. In the world, there are 400 species of brown algae while in Indonesia there are 15 species of *sargassum* [2].

According to [10], brown algae *sargassum sp* is one type of seaweed that contains many chemicals and can potentially be used and

developed for food and medicine industries. The chemical content of *Sargassum* sp. can be accessed through a natural drying method that can produce large amounts of phenol compounds.

That *Sargassum* sp. can be used as an anticholesterol, antibacterial, anti-tumor, anti-cancer, antifouling, anti-virus, antioxidants [3].

Bacteria porphyromonas gingivalis

Bacteria *Porphyromonas gingivalis* is a flora found in the oral cavity that plays a role in periodontal disease, halitosis, oral cancer as well as systemic conditions such as diabetes mellitus and heart disease [11]. Bacteria can be a pathogen in case of decreased function of the body's defense system and increase number of bacteria in the oral cavity [12].

Porphyromonas gingivalis can induce the occurrence of gingivitis and periodontitis [11]. The elements that affect the virulence of

Porphyromonas gingivalis are protease synthesis called gingipain and lipopolysaccharide. Gingipain can change the environmental conditions in the mouth to improve oral pH for growth of gram-negative anaerobic bacterial and interferes with oral cavity flora [13].

Gingipain can activate cytokines during inflammation, such as necrosis tumors factor (TNF) and interleukin-6 (IL-6) that can trigger the onset of the inflammation [5].

Porphyromonas gingivalis may lead to halitosis [14]. The term halitosis used to describe the smell that comes from the mouth caused by a Volatile sulfur compound (VSC) produced by natural bacterial activity in the oral cavity [15]. *Porphyromonas gingivalis* is an anaerobic gram-negative bacteria in the oral cavity that can produce methyl mercaptan [16]. LPS *Porphyromonas gingivalis* can cause an inflammatory response and trigger an increase in lipid metabolism so that the lipoprotein level is increased [5].

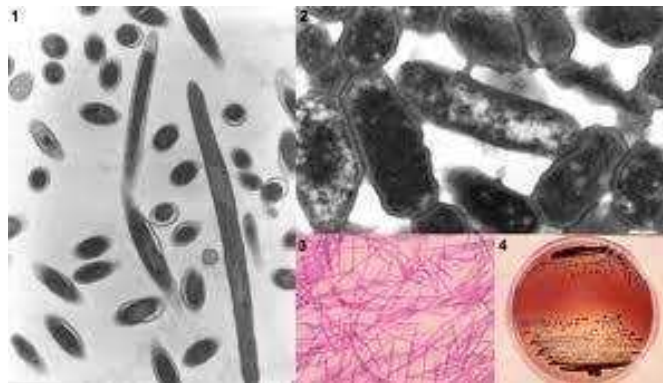


Fig. 1: bacterial *Porphyromonas gingivalis* and other bacteria that live in periodontal tissue

Porphyromonas gingivalis is an anaerobic gram-negative coccobacillus bacteria in the oral cavity associated with damaged periodontal tissue. These bacteria are often found in the sub-gingiva regions and persistent in the reservoir on the surface of the tongue and tonsils. Product-bacterial toxin products cause periodontal tissue damage *Porphyromonas gingivalis* indirectly [11].

Bacterial gram-negative tissue material that is acting as membrane vesicles, this material among others is lipopolysaccharide, lipids, proteins that act as signals for the hosts to know how big and kind bacteria dental plaque that cause hosts respond directly or indirectly [16].

Response directly what if the product induces gingival cells to secrete the glycoprotein as chemokine and interleukin a reaction indirectly when the bacteria causing the cells stimulated to produce glycoproteins which will further stimulate other cells. LPS from gram-negative bacteria capable of causing destruction of alveolar bone by activating osteoclast cells, this bacterium can damage the integrity of the gingival epithelial layer [13].

Resistance germ antibiotics cause an infection that is difficult to overcome so many researchers have found antibacterial drugs that are safe for consumption and have low toxic levels. One of the natural ingredients that can be used for treatment is algae containing tannins, saponins, phenols, flavonoids, iodine, steroids etc. that serves as antibacterial, anti-virus, anti-fungal, and antioxidants [17].

Periodontal diseases

Periodontal disease is a disease in the ligament periodontal tissue, namely the gingiva, and the buffer network connecting teeth and bones alveolar. Diseases often found in periodontal tissues are gingivitis and periodontitis. Gingivitis is an inflammation of the gums caused by bacteria with symptoms such as color change in gums and swollen gums that bleed easily. Gingivitis is reversible which can be returned to healthy gingiva by salting plaque and the toothbrush regularly.

The signs of periodontitis are as follows: gingival inflammation, pocket formation, loss of attachment, halitosis and bitterness in the mouth, gingival recession, loss of alveolar bone resorption [13].

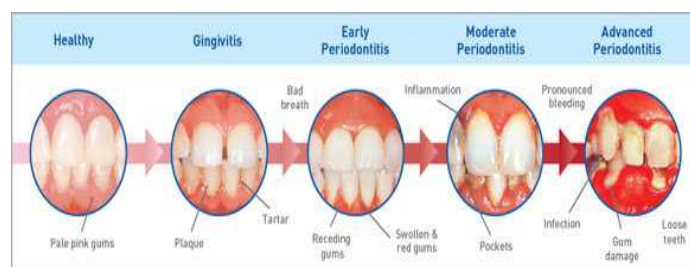


Fig. 2: Periodontal disease stages

Classification of periodontal disease: gingivitis: an induced gingival disease where this condition can occur in periodontal tissue without

attachment loss. In people with gingivitis, the number of bacteria will increase and the role of the host defense system will affect the type of

bacteria changes. Plaque teeth on gingivitis dominated by gram-negative bacteria, periodontitis: an inflammatory reaction of periodontal tissue due to a periodontopathic bacterial invasion that colonizes on dental

plaque. The composition of plaque bacteria on the tooth is more dominated by the gram-negative anaerobic, which is the cause of soft dental periodontal tissue damage as well as the alveolar bone tissue.

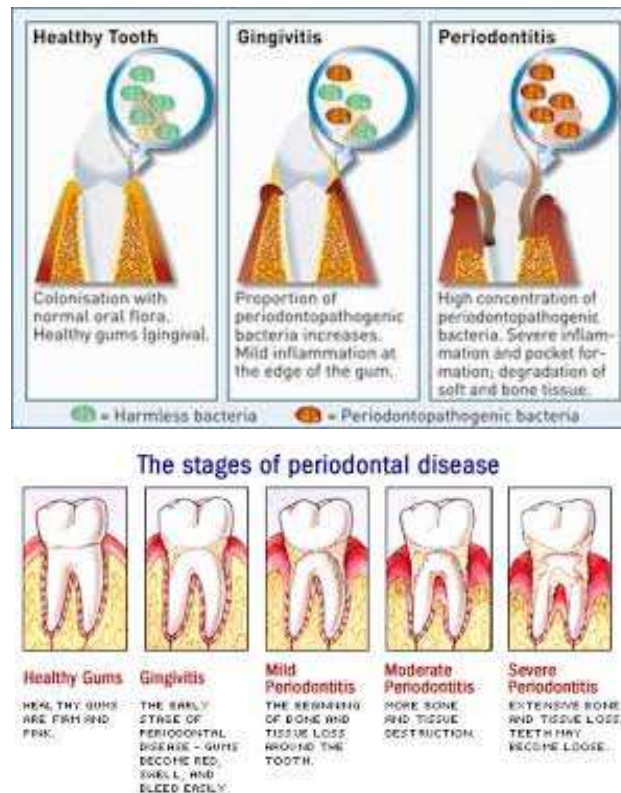


Fig. 3: Stage of periodontal disease

Factors that may result in the risk of periodontitis: tobacco/smoking: the most significant risks associated with the development of periodontitis, other than that smoking can lower levels of success treatment of periodontitis, hormonal changes in women, these changes can make the gums more sensitive, diabetes, this disease can cause periodontitis, recurrent drug consumption, such as epilepsy and partial remedy, heart medications. May affect the moisture of the mouth because saliva has a protective effect on the gums and teeth, certain diseases such as AIDs, cancer, and other disease treatments affect the health of the gums, genetic susceptibility, some people are more susceptible to periodontal disease [18].

CONCLUSION

Brown algae (sargassum sp) can be used as the basic treatment of periodontitis because it contains antibacterial substances such as phenols, flavonoids, tannins and vitamins (A, B, C, D, E).

ACKNOWLEDGMENT

We thank our colleagues from Faculty of Dentistry Gadjah Mada University who provided insight and expertise that greatly assisted the review, although they may not agree with all of the interpretations/conclusions of this paper.

AUTHORS CONTRIBUTIONS

All the authors have contributed equally

CONFLICT OF INTERESTS

There are no conflict of interest in this study

REFERENCES

- July Compassion KS, Wirawan IG, Haryani WS, Widajat W. Aktivitas antioxidants several species of seaweed (seaweeds) commercial bali. Seminar Fak National Agriculture and LPPMI; 2009. p. 1-2.
- Kharkongor D, Ramanujam P. Research article diversity and compliance components of subaerial algae communities in forests areas of Menghalaya, India. Int J Biodiversity 2014;456202:1-10.
- Newman MG. Carranza's clinical periodontology. 11th ed Missouri: Elsevier Inc, Scaling and Giving Tetracycline to Chronic Periodontitis Sufferers Surabaya Indonesia; 2012.
- Perez MJ, Falque E, Domingues H. Antimicrobial action of compounds from marine seaweed a review. Marine Drugs 2016;14:1-38.
- Data and information center of the Ministry of Health RI tahun. Riset Health Basic 2007 and 2013; 2014.
- Taheri A. Antotoxic and activity in some Iranian seaweed species from Cabahar. Iranian J Fisheries Sci 2016;15:802-17.
- Rosina A. Bacteria in the mouth health hazard. Health information of healthy tooth and mouth health center; 2017.
- Dewi PS, Damajanti AC, Pangemanan J. Power test of brown algae bacteria (*padina australis*) on *in vitro porphyromonas gingivalis* bacterial growth. e-Gigi J 2016;4:52.
- Ji Hyun, O Kim J, Lee Y. Anti-inflammatory and anti-diabetic effects of brown seaweeds in high-fat diet-induced obese mice. Nutr Res Pract 2016;10:42-8.
- Mufida R. Herbal and dental health knowledge relations. Dentika Dent J 2013;13:115-9.
- Neshya RP, Diana L, Rashad MI. Effects of sargassum chocolate algae extract as Bcl-2 *in vitro* protein suppressor in hela cells. FKUB Health Magazine 2014;1:317-23.
- Ministry of Health RI. Parameter of the general standard of extra drug plants. Direktorat Supervision of Traditional Drugs, Jakarta; 2000.
- Carranza FA, Newman MG, Takei HH, Klokkevold PR. Clinical periodontology. 11th ed. Philadelphia: WB Saunders company; 2008. p. 495-9.

14. Khotima K, Darius BB, Sasmito. Test activity of chocolate algae active compound (sargassum fillipendula) as antioxidant. THPI Student J Universitas Brawijaya Malang 2013;1:10-20.
15. Manson JD. The Periodontal Teaching Book. Jakarta: Hippocrates; 2013.
16. Widowati, LAB Susanto M, Puspita V. Potentiaity of using spreading sargassum species from jepara Indonesia as a interesting source of antibacterial and antioxidant. Bali; 2013. p. 118.
17. Suparmi SA. Mengenal potential seaweed: the study of seaweed resource utilization from industry and health aspects, sultan agung. XLIV 2009;94:96.
18. Bathla, Shalu. Periodontics sRevisited, JP Medical Ltd; 2012.