

Effectivity of Banana Peel Extract Kepok (*Musa paradisiaca*) as An Anti-Inflammatory of Gingivitis in Rats (*Rattus norvegicus*)

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Banana peel kepok (*Musa paradisiaca*) is a waste that has not been widely utilized by the community. The waste causes many problems such as environmental pollution, emitting a foul smell and can cause disease. The whole region of Indonesia is a banana producer because Indonesia has a climate suitable for the growth of banana plants. (Hartono and Pramudyo, 2013). From data from the Central Bureau of Statistics and Directorate General of Horticulture in 2019 the number of banana production in Indonesia is 7,280,658 tons. This data illustrates the amount of waste banana peel waste wasted. Various research efforts were conducted to reveal the potential of banana peel kepok in order to be used properly. Based on the results of phytochemical screening of banana peel kepok contains compounds in the form of flavonoids, alkaloids, tannins, saponins and triterpenoids that can be used as anti-inflammatory. (Sonja and Syahril, 2018). Gingivitis is an inflammation of the periodontal tissue that can cause bleeding accompanied by swelling, redness, exudate, changes in normal contours. (Ubertalli, 2008). The causes of gingivitis are divided into three groups i.e. caused by necrosis, unrelated to plaque, and accumulation of bacteria in plaque. The bacteria that cause gingivitis are gram-negative bacteria, one of which is *Porphyromonas gingivalis*. (Eka F.P., Ratnawati H., & Rochman M., 2015).

The etiology of gingivitis is divided into two, namely the main causes and causes of predisposition. The main causes of gingivitis are the buildup of microorganisms *Porphyromonas gingivalis*, *Tannerella phosythia*, *Treponama denticola* *Actinomyces viscosus* that form a colony then form dental plaque attached to the edge of the gingiva. Secondary causes of gingivitis are local and systemic factors. Local factors include caries, failed restorations, piles of food waste, inappropriate dentures, irregular use of orthodontics and tooth arrangements, while systemic factors include nutritional factors, hormonal factors, hematology, psychological disorders and medications. Hormonal factors that become factors of predisposition gingivitis is one of which is hormonal imbalance that is the increase of endocrine hormones at puberty. An increase in endocrine hormones during puberty can lead to vasodilation of blood vessels and increased sensitivity to local irritants, such as bacterial plaque biofilms, resulting in puberty gingivitis. Puberty gingivitis is a type of gingivitis that sometimes develops in children and puberty with a mild and even very little plaque state. According to Carranza and Glickman's Clinical Periodontology (2002), gingivitis is distinguished into four based on its travel, length and spread. Acute gingivitis, is an inflammation of the gums that hurts suddenly and in a short period of time. The clinical picture of acute gingivitis is swelling derived from acute inflammation and soft gingiva. Subacute gingivitis, is a stage in gingivitis that is more severe than the condition of acute gingivitis.

Recurrent gingivitis, is an inflammation of the gums that can re-arise after cleaning with treatment or disappear spontaneously and may re-arise. Chronic gingivitis, a clinical picture of soft swelling that can form hollows when pressed that appears to infiltrate fluids and exudate inflammation. At the time of probing there is bleeding and the surface of the gingiva appears reddish. Pathogenesis of gingivitis according to Schroeder, et.al. (1997) in Reghunatanet, et.al. (2020), there are four stages of lesions that occur in the gingiva tissue. The first stage is an initial lesion, this stage develops within 2-4 days. Plaque begins to accumulate when the cleanliness of the oral cavity is not maintained. For the first few days, these plaques consist of coccus bacteria and gram-positive stems, then the next day the filament organisms, and finally spirochetes. Mild symptoms begin to occur at this stage. The second stage is early lesion, at this stage it has begun to see clinical signs of erythema that occurs due to capillary proliferation and the occurrence of vasodilation. Epithelium sulcus thins or ulceration forms. At this stage begins to occur bleeding on the probing. The third stage is an established lesion, at this stage it is referred to as chronic gingivitis because the entire blood vessel swells and is dense, while the back vessels are disturbed or damaged so that blood flow becomes slow. There is a bluish discoloration of the gingiva that occurs due to some red blood cells rupture so that hemoglobin causes the color of the inflammatory area to darken. The final stage of advanced lesions, as described by Page and Schroeder, advanced lesions are characterized as the transition stage from gingivitis to periodontitis, which occurs due to factors in the number and composition of biofilms, the host's response to inflammation, and genetic and environmental risk factors.

Banana peel kepok contains phenolic compounds, pectin, carbohydrates and other minerals. The presence of such compounds can serve as antioxidants, antibacterial and anti-inflammatory. Banana skin has higher antioxidants compared to the flesh of the fruit because banana skin contains galocatekin compounds that are a group of flavonoid compounds and serve as antioxidants (Andi et al, 2018). Ethanol extract 96% banana skin kepok shows the presence of antibacterial activity against acne-causing bacteria (*Staphylococcus epidermidis*, *Staphylococcus aureus*, *Propionibacterium acnes*) (Desy, 2017).

Flavonoids play a large role as anti-inflammatory agents, because Flavonoids in the body act to inhibit lipooxygenase enzymes that play a role in the biosynthesis of leukotriene. In addition to inhibiting the metabolism of arachidonic acid so that the production of prostaglandins can be reduced, flavonoids also inhibit the secretion of lysosome enzymes which are inflammatory mediators. As an anti-inflammatory, saponins are thought to interact with many lipid membranes. Lipid membranes such as phospholipids are precursors of prostaglandins and other inflammatory mediators. Saponins are thought to inhibit vascular permeability increase so that edema as one of the inflammatory signs does not occur.

Another bioactive compound that has the potential as an anti-inflammatory is tannins. Tannins have antioxidant activity. Antioxidants act as anti-inflammatories in various ways, namely inhibiting the production of O₂ oxidants by neutrophils, monocytes and macrophages. Inhibition of O₂ oxidant production will reduce the formation of H₂O₂ which results in the production of hypochlorite

acid (HOCl) and OH is also hampered. It also inhibits reactive oxidants such as hydroxy radicals (OH) and hypochlorite acid. (Caroline et al., 2019).

Armed with the problem of banana skin waste that has anti-inflammatory content and has not been utilized optimally, the author is interested to conduct research on The Effectiveness Test of Banana Skin Extract Kepok (*Musa paradisiaca*) as An Anti-Inflammatory of Gingivitis in Rats (*Rattus norvegicus*).

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