Gambier Extract (Uncaria gambier Roxb.) as Herbal Treatment for the Oral Cavity: A Systematic Review

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Gambier Extract (Uncaria gambier Roxb.) as Herbal Treatment for the Oral Cavity: A Systematic Review

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ABSTRACT

Introduction: The disease of oral and dental that mostly affects Indonesians is dental caries, followed by periodontal tissue disease in the second place. One of the causes is the buildup of dental plaque. Dental plaque is a collection of various kinds of microorganisms on the surface of the teeth. Gambier extract is a product of the gambier plant containing polyphenol compounds that have the potential to be antioxidants and antibacterials.

Aim: The purpose of writing this systematic review is to determine the effect of gambier extract as a herbal treatment in the oral cavity.

Method: In this review systematics, article searches are carried out on google schoolar. Study published 2015-2020. 118 articles were found. 28 articles were screened, 80 articles were excluded, 25 full-text articles were assessed for eligibility and 10 full-text articles according to inclusion criteria.

Results: There were 10 articles about gambier extract as an oral herbal treatment.

Conclusion: Based on a systematic review study, Gambier extract has potential as an herbal treatment for oral health.

Keywords: *Gambier extract, Herbal Treatment, Oral cavity*

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1. INTRODUCTION

Oral and dental disease is the sixth highest health problem that is often complained of by Indonesia.[1] Basic Health Research in 2018 states that the largest proportion of dental problems in Indonesia are damaged/decayed/pain teeth (45.3%).[2]

The most common dental disease suffered by Indonesia is dental caries, followed by periodontal tissue disease in second place[3] Indonesia is a country with higher caries compared to other developing countries, namely 73% according to the 2013 Household Health Survey.[4] Periodontal has a fairly high prevalence that affects humans almost all over the world and reaches 50% of the total adult population.[5] Dental caries is a hard tissue disease caused by the activity of microorganisms in fermenting carbohydrates to form acid and lowering pH, marked by demineralization of tooth hard tissue.[6] Dental caries left too long without treatment will continue to the supporting tissues of the teeth. Periodontal disease is an inflammation that occurs in the supporting tissues of the teeth, including the alveolar bones and periodontal ligaments.[7] One of the causes of several oral diseases such as caries and periodontal disease is the buildup of dental plaque. Dental plaque is a collection of various kinds of microorganisms on the surface of the teeth. The thicker plaque on the teeth can prevent saliva from neutralizing the acidic pH of the oral cavity due to the metabolism of bacteria.[8] Bacteria can easily attach to these surfaces via adhesins (specific surface receptors). After attaching, the bacteria actively grow and synthesize the outer membrane components. [9]

Primary colonization consists of aerobic and facultative anaerobic bacteria such as Gram-positive bacteria (*Streptococcus sp.*). *Streptococcus mutans* will produce glucosyltransferase and fructosyltransferase enzymes and convert sucrose into extracellular polysaccharides in the form of glucans and fructants. Glucans are sticky so they support the attachment of bacteria to the initial colonization of plaque formation.[10] Over time, there has been a shift in the microflora from Gram-positive to Gram-negative organisms, and an increase in the heterogeneity of microbial species. Increased number of organisms in such subgingival plaques *Porphyromonas gingivalis, Prevotella intermedia, Fusobacterium nucleatum, Tannerella forsythia, Treponema denticola, Fusobacterium nucleatum* initiate periodontal infection.[9,11,12]

One of the efforts to prevent dental and oral diseases is through the development of natural treatments by utilizing extracts of gambier (*Uncaria gambier Roxb.*). Gambier is used traditionally to treat diarrhea, influenza, dysentery, stomatitis, cough, sore throat, and gingivitis. Gambier extract is a product of the gambier plant (*Uncaria gambier roxb*) containing functional compounds which are included in the polyphenol compound in Gambier, especially catechins that have potential as antioxidants and

antibacterials.[13,14,15,16]

Based on several studies on gambier, its relation to the antibacterial properties conducted by Magdalena, et al. (2015) states that gambier extract has the ability to inhibit *Escherichia coli* bacteria at 100% extract concentration, *Salmonella typhimurium* at 90% extract concentration, *Staphylococus aureus* at 90% extract concentration and *Bacillus cereus* at an extract concentration of 80%.[9] Lucida et al (2010) stated that the 7% gambier extract contained in toothpaste has optimal antimicrobial power in inhibiting the growth of *S. mutans* bacteria as the cause of dental plaque formation.[11] Based on the description above, the authors are interested in writing a systematic review of gambier extract as a herbal treatment in the oral cavity.

2. SEARCH METHODS

Sources of data in this study come from online databases that present scientific articles in PDF format, such as: google scholar and PubMed. Results were identified from journal searches from 14-21 December 2020. The inclusion criteria of this systematic review were: 1) Articles published from 2015-2020. 2) An article that examines gambier extract as a herbal treatment for the oral cavity. 3) Scientific articles available online. This systematic review excludes articles that do not discuss gambier extract as an oral herbal treatment and articles that are not accessible for free. The data search was conducted systematically using the keywords "*Gambier Extract*" and "*Oral Cavity Herbal Materials*" in Indonesian and English. A manual search was also carried out on references from each journal relevant to this research.

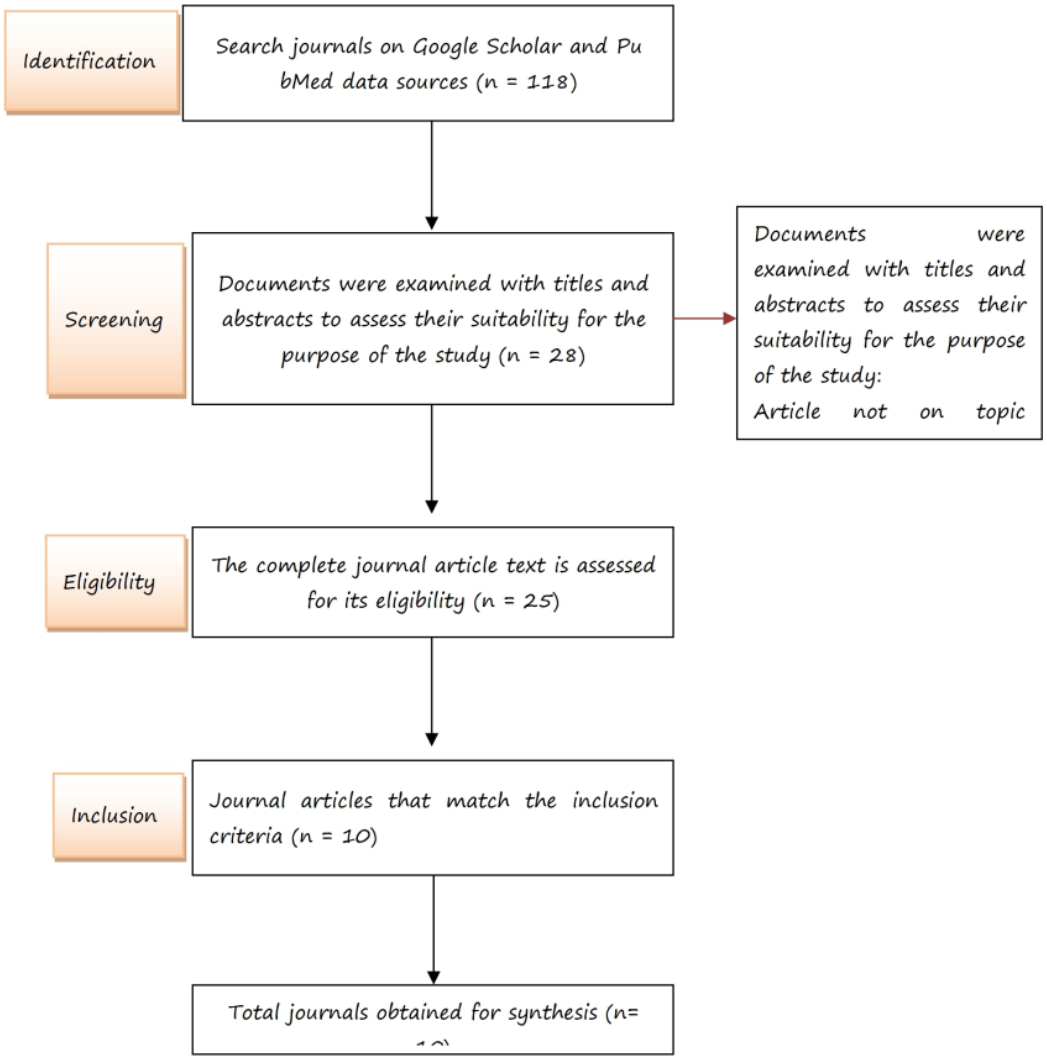


Figure 1. The flow chart of the journal tracking to be synthesized

3. RESULTS

After eliminating duplicated articles, the titles and abstracts of each article were analyzed resulting in an exclusion of 90 articles and 10 articles were then included in the analysis.

Table 1. Article on Gambier Extract as an Oral Herbal Treatment

No.	Authors	Year	Title	Conclusion
1.	Siti Rusdiana Puspa Dewi, Anna Pratiwi, Theodorus[17]	2018	*The Effect of Gambier Extracts (Uncaria Gambier [Roxb.]) as Antiseptic on Gingival Wound in Rats*	The number of bacterial colonies decreased significantly after being given gambier extract ointment. So, ethyl acetate gambier extract has an effect as an antiseptic on the gingival mucosal wound of Wistar strain white rats depending on the dose.
2.	Munira[18]	2020	Combination Antibacterial Activity Test of Betel Leaf Extract and Areca Nut and Gambier against *Streptococcus mutans*	The combination of betel leaf (*Piper betle L.*) and areca nut (*Areca catechu L.*) and gambier (*Uncaria gambier Roxb*) can inhibit the growth of *Streptococcus mutans*. The difference in extract concentration in the combination extract can affect the bacterial inhibition activity.
3.	Zola Efa Harnis, Aldrina Ginting, Christica Illsanna, Bunga Rimnta Barus, Linda Margata[19]	2020	Gambier Mouthwash Formulation and Effectiveness Test against *Staphylococcus aureus* Bacteria	Based on the results of this study, it can be concluded that Gambier mouthwash can inhibit the growth of *Staphylococcus aureus* bacteria at concentrations of 5%, 10%, and 15%.
4.	Rifdah Afifah Rahmat[20]	2020	Potential of Combination Toothpaste Formulation with Ethanol Extract of Betel Leaf (*Piper Betle L.*), Areca Nut (*Areca Catechu*), Gambier (*Uncaria Gambier*) in Inhibiting the Growth of *Staphylococcus Aureus* Bacteria	Antibacterial herbal toothpaste with the active treatment combination of ethanol extract of betel leaf, areca nut and gambier can inhibit the growth of one of the dental plaque bacteria, namely *Staphylococcus aureus*. This combination has a synergistic effect which is characterized by the inhibition zone formed which is larger than the inhibition zone of each material.
5.	Siti Rusdiana Puspa Dewi, Muhammad Totong Kamaluddin, Theodorus, Rindit Pambayun[21]	2016	*Anticariogenic Effect of Gambier (Uncaria Gambier [Roxb.]) Extract on Enamel Tooth Surface Exposed by Streptococcus mutans*	As much 60% gambier extract has the ability to reduce micropores due to the presence of catechin antibacterial activity which can inhibit the activity of the glucosyltransferase enzyme and inhibit the extracellular glucan polysaccharides, thus preventing the attachment of *Streptococcus mutans* to the enamel.
6.	Irfan, Yayun Siti Rochmah, Moh Yusuf, Grahita Aditya[22]	2015	The effectiveness of Gambier (*Uncaria Gambier Roxb*) leaves to reduce halitosis caused by plaque	Gambier leaf decoction is effective against halitosis caused by plaque. In the three levels of Volatile Sulfur Compound, all of them experienced a decrease in the halitosis index after gargling with gambier leaves.
7.	Irvan Herdiana, Nur Aji[23]	2020	Fractionation of Betel Leaf Extract and Gambier Extract and Antibacterial Test for *Streptococcus mutans*	The inhibition of betel leaf extract and gambier extract against *Streptococcus mutans* bacteria is very strong at concentrations of 10%, 15%, and 20%.
8.	ER Zaina, R W Ashadi, and Paridah[24]	2015	Antimicrobial Effectiveness Test on Gambier Leaf Extract (*Uncaria Gambier Roxb.*) And Green Betel Leaf (*Piper Betle Linn.*) Against *Streptococcus mutans, Escherichia Coli* and *Candida albicans*	The traditional gambier leaf extract and the block gambier extract were not effective in inhibiting microbial growth because the traditional way the catechins and catechutaneous acid present in gambier were not fully extracted. Betel leaf extraction can inhibit the growth of *Streptococcus mutans* and *Escherichia coli* with a minimum concentration level of 25%. The results of testing the activity of gambier extracts and green betel leaves did not show any anti-yeast activity which was indicated by no formation of the inhibition zone diameter in the *Candida albicans* culture medium.
9.	Lucia Yauri, Ellis Mirawati[25]	2020	Effectiveness of Gargling with Gambier Boiled Water on Changes in Plaque Index in Dental Nursing Students Health Polytechnic of the Ministry of Health Makassar	Effectiveness of Gargling with Gambier Boiled Water on Changes in Plaque Index in Dental Nursing Students Health Polytechnic of the Ministry of Health Makassar
10.	Suraini, Chairani and Enlita[26]	2015	Antifungal Activity Test of Gambier Extract (*Uncaria gambier roxb*) against *Candida albicans* by In Vitro	Candida albicans can cause infection of the skin and/ or mucous membranes in the mouth, which can affect both children and adults. From the results of the study it can be concluded that the ethanol extract of gambier (*Uncaria gambier Roxb*) has an antifungal effect against the fungus Candida albicans in vitro. The higher the concentration of the ethanol extract of gambier, the lower the growth of *Candida albicans.*

4. DISCUSSION

Gambier is an export-oriented plantation commodity, which

is widely grown in West Sumatera (Figure 2).[17,18] Gambier extract (*Uncaria gambier*) is a type of herbal substance like sap that is extracted from the leaves and twigs of the gambier plant (Figure 3).[19] After going through the extraction process, the gambier shape becomes like a cookie with a white, yellow, or brownish color. The main components contained in Gambier consist of catechins (7-33%), catechin tannic acid (20-55%), and quercetine.[20]

Figure 2. Gambier plant
Source: (Amos et al, Gambier Post Harvest Technology. BPPT Press: Jakarta, 2004.27-30)[20]

Figure 3. Extract Gambier.
Source: (Chabib L, Triastuti A, Irianti RD. Formulation of Gambier Extract (Uncaria gambier Roxb) Suction Tablets with Arabic Gum Binder Material Variations. Traditional Medicine Magazine.2010: 15(2); 75-79)[21]

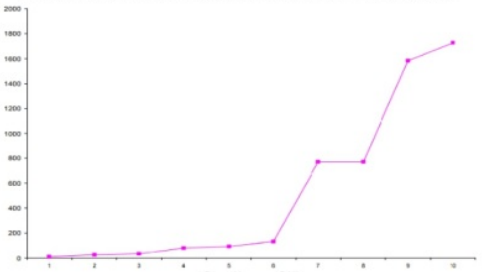
These catechins are flavonoids that are naturally produced by plants and can be found in green tea, black tea and in food plants such as gambier, cocoa, grapes, and other fruits, have a sweet taste and can turn into catechin tannates (giving them a taste bitter) if there is heating for a long time or with an alkaline solution.[21,22,23,24,25] Flavonoids in the body have benefits for protecting cell structures, increasing the effectiveness of vitamin C, anti-inflammatory, antibiotics, and preventing bone loss. [26,27,28]
Gambier is an extract that contains polyphenol compounds.[29,30] The polyphenol compounds contained in this gambier extract are catechins which are known to have biological activity as anitmicrobial and antioxidant.[31,32,33,34,35] Its ability as an antibacterial is due to polyphenols easily bind to other organic compounds, especially proteins through a denaturation process by disrupting protein function and destroying cell walls and deactivating enzymes. The formation of complex compounds causes the function and role of these compounds to decrease and even cause leakage and cell death. [36,37,38,39,40]
Based on research conducted by Harniz ZE, et al., It was found that the pH value of the Gambier mouthwash was outside the optimum pH range for bacterial growth, so the gambier mouthwash formulation could inhibit the growth of bacteria in the oral cavity, especially the *Staphylococcus aureus* bacteria. Based on this research, it is also known that the diameter of the bacterial inhibition zone will increase with an increase in the concentration of the tested gambier; F1=without gambier; F2= 5gr/ml; F3=10gr/ml; F4=15gr/ml (Figure 4).[41] Mouthwash is a liquid or cleaning solution and mouth freshener that contains active substances or compounds, which can eliminate bad breath, prevent the formation of plaque, caries and gingivitis.[42]

Figure 4. The average diameter of the inhibition zones of

each extract Gambir against bacteria *Staphylococcus aureus.*
Source: (Harnis ZE, Ginting A, Illsanna C, Barus BR, Margata L. Gambier mouthwash formulation and effectiveness test against Staphylococcus aureus bacteria. 2020: 3(1); 38-47)[41]

Similar research results were also mentioned by Widiyarti G et al that from the overall stability test results of mouthwash showed that, the mouthwash from gambier extract containing 0.01% active catechin compounds was a mouthwash that had the smallest particle size of 11.9 nm, with a pH 7,394, active as an antioxidant and antibacterial.[43]

Figure 5. The particle size of mouthwash 1-10 with catechin content of 0.01-0.1%.
Source: (Widiyarti G, Sundowo A, Angelina M. Manufacture of Oral Nutraceutical Preparations from Gambier Extract. Indonesian Journal of Pharmaceutical Sciences.2014:



12(2);145-153)[43]
Gambier extract is widely used as a herbal treatment to reduce halitosis. Halitosis is breath odor through the air that comes from oral and non-oral.[44] One way that can be done to prevent or reduce halitosis is by using traditional herbal treatments.[45] This is in accordance with the research conducted by Irfan et al, showing that levels of Volatile Sulfur Compound (VSC), namely hydrogen sulfide (H2S), have the highest average reduction of 100%, methyl mercaptan (CH3SH) has a high average decrease. second is

43% and dimethylsulfide (CH3SCH3) has the lowest decrease, namely 24%.[46] This decrease in VSC levels is because the catechins in gambier are able to inhibit the formation of insoluble glucans from sucrose by Gluosyltransferase which plays an important role in the formation of plaque.[47] These gases are the result the production of the activity of bacteria in the mouth which is an odorous and volatile compound.[48,49,50,51,52]

Gambier extract has also been tested in vitro to inhibit the growth of the fungus Candida albicans. Candida albicans can cause infection of the skin and / or mucous membranes in the mouth, which can affect children and adults..[49] Based on research conducted by Suraini et al, it was shown that there was a decrease in the number of Candida albicans fungal colonies along with the increase in the concentration of the ethanol extract of gambier and was strengthened by the results of statistical analysis. The higher the ethanol extract concentration of gambier, the lower the growth of the *Candida albicans*.[50,53,54,55]

5. CONCLUSION

Based on a systematic review study, Gambier extract has potential antibacterial, antioxidant, and anti-fungal agents in its use as a herbal treatment for oral health.

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ORIGINALITY REPORT

%13	%9	%8	%4
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PRIMARY SOURCES

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2	Submitted to Academic Library Consortium Student Paper	%2
3	www.gssrr.org Internet Source	%1
4	Ki-Yeol Kim, ShengJin Li, Jeong-Dan Cha, Xianglan Zhang, In-Ho Cha. "Significance of molecular markers in survival prediction of oral squamous cell carcinoma", Head & Neck, 2012 Publication	%1
5	Suharso, Tiand Reno, Teguh Endaryanto, Buhani. "Modification of Gambier extracs as green inhibitor of calcium carbonate (CaCO 3) scale formation", Journal of Water Process Engineering, 2017 Publication	%1
6	Ayub Irmadani Anwar, Andi Zulkifli. "The influence of demonstration method education in	%1

	the knowledge of tooth brushing in children age 10–12 years", Enfermería Clínica, 2020 Publication	
7	jurnal.ugm.ac.id Internet Source	<%1
8	Evi Lusiana, Nia Savitri Tamzil, Desi Oktarina. "The Efficacy of Cinnamon Extract (Cinnamomum burmannii) on Reducing Staging Acute Kidney Injury in Ischemia Reperfusion (IR) Model", Bioscientia Medicina : Journal of Biomedicine and Translational Research, 2020 Publication	<%1
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