

CHAPTER 1 INTRODUCTION

1.1. Research Background

The most common disease seen in small animal practice is periodontal disease (Gorrel, 2008). In general, periodontics is a science that targets the study of the periodontium on the diagnosis, prevention and treatment of periodontal disease to restore and promote periodontal health. A set of joining structures to the teeth which provides support and protection is called periodontium. These joining structures are gingiva, cementum, alveolar bone and periodontal ligament (Pieri *et al.*, 2012).

Besides, in small animal veterinary medicine, periodontal disease is also classified as the number one health problem. Periodontal disease can contribute to both local and systemic disorders. Oronasal fistulas, class II perio-endo lesions, pathologic fractures, ocular problems, osteomyelitis and increased incidence of oral cancer are examples of local consequences of periodontal disease while the systemic consequences on the other hand are hepatic, pulmonary, cardiac and renal diseases (Niemiec, 2008).

Periodontal disease is defined as a condition that affects the periodontium which include the structures that surround the teeth which plays a role to protect and provide support to it. Periodontal disease is an infectious disease whereby more than 80% of dogs are affected (Pieri *et al.*, 2012). According to a study on periodontal health status in a colony of 109 cats, 13% of cats suffers aggressive periodontitis as disease is also common in cats (Girard *et al.*, 2009). Subsequently, according to a study conducted in United States about periodontal disease in human stated that approximately 48% of adults suffer chronic periodontitis where it is a

common disease which may occur in most age groups world-wide. Other than that, 70% moderate and advanced periodontitis reported in that country (Albandar, 2005).

Based on the severity of disease, periodontitis is further classified into mild, moderate and severe periodontitis respectively. Then, according to its extent, periodontitis is classified into focal, localized and generalized (Peralta, 2017). This disease is also divided into four stages namely gingivitis only followed by early periodontitis, moderate periodontitis and advanced periodontitis. Periodontal disease contributes to systemic disorders for instance cardiovascular disease and therefore affects and modifies the haematological parameters of animals (Aiello and Moses, 2016, Caparossi *et al.*, 2010, Cowan *et al.*, 2018 and Kinane *et al.*, 2017,). This haematological parameters modifications can also be seen through histopathology analysis like the clinical inflammatory reactions of the periodontal tissue (Ionel *et al.*, 2015). This can provide a useful framework which helps in constructing an understanding the periodontal disease pathogenesis (Hasan and Palmer 2014).

Treatment which is commonly used in periodontal disease is Chlorhexidine (CHX) 0.2% irrigation as it has a wide-spectrum antimicrobial activity and biocompatibility. Chlorhexidine however has a few disadvantages namely discolouration of teeth and tongue, oral mucous burning sensation and dryness of mouth (Alhaarbi *et al.*, 2017). Other than that, tetracycline hydrochloride can also be used to treat periodontal disease as adjunctive treatment to scaling and root planning (Fernandes *et al.*, 2010). However, antibiotics can cause discolouration of

teeth, not being economical and not very safe to use during pregnancy. The attention towards using chemical treatments shifted to using medicinal plants when problems with chemical agents and safety concerns increased (Alhaarbi *et al.*, 2017). An alternative to this is to practice using herbal treatments (Badole *et al.*, 2016).

Lemongrass *Cymbopogon citratus* (DC.) Stapf besides antibacterial property, it also exhibit anti-inflammatory property which is essential in this research's parameter whereby lemongrass contain active ingredients like geranial and neral which are the mixture of monoterpene aldehydes stereoisomers of citral (Shah *et al.*, 2011, Han and Parker, 2017). Gas chromatography-mass spectrometry of lemongrass *Cymbopogon citratus* (DC.) Stapf revealed that the two major active ingredient percentage which are geranial and neral are 42.2% and 31.5% respectively (Boukhatem *et al.*, 2014).

Lemongrass *Cymbopogon citratus* (DC.) Stapf has been cultivated as medicinal purpose in different countries around the globe. In a recent research, lemongrass is found to be effective against diverse range of gram-positive and gram-negative bacteria as it has antibacterial properties. Due to the contemporary issues on antibiotic resistance, a study on lemongrass was conducted to study its antibacterial properties (Naik *et al.*, 2010). Lemongrass *Cymbopogon citratus* (DC.) Stapf helps to inhibit the growth of several periodontal pathogens like *Actinomyces naeslundii* and *Porphyromonas gingivalis* which are resistant to tetracycline hydrochloride (Warad *et al.*, 2013). According to Han and Parker in a research conducted in 2017, lemongrass helps in inhibiting inflammation and promotes tissue remodelling process. Due to its wide benefit in dental and medical field, lemongrass

Cymbopogon citratus (DC.) Stapf can be used to treat various problems of oral health (Kumar and Gurunathan, 2019).

1.2. Problem Statement

According to the above research background, the problem statement of this research is to evaluate whether lemongrass *Cymbopogon citratus* (DC.) Staph extract irrigation of different concentrations given supra-gingiva twice a day of lower front incisors affect the hematological profile and histopathological aspects of periodontium of male rats (*Rattus norvegicus*)?

1.3. Research Purpose

The purpose of this research is to evaluate whether or not lemongrass *Cymbopogon citratus* (DC.) Staph extract irrigation of different concentrations given supra-gingiva twice a day of lower front incisors affect the hematological profile and histopathological aspects of periodontium of male rats (*Rattus norvegicus*).

1.4. Benefits of Research

1.4.1. Theoretical benefits

The theoretical benefits of this research are to provide contemporary information regarding the effect of lemongrass *Cymbopogon citratus* (DC.) Staph on the treatment of periodontal disease in animals and to emphasize the importance of using herbal oral hygiene which brings great benefits on the overall health of animals.

1.4.2. Practical benefits

The practical benefits of this research is to dispense references for further research on the effect of lemongrass *Cymbopogon citratus* (DC.) Staph extract irrigation on the treatment of periodontal disease.

1.5. Theoretical Basis

The number one health problem in small animal patients is periodontal disease (Lund *et al.*, 1999). Periodontal disease are numerous group of clinical where the process of inflammatory reaction is induced and results in destruction of attachment apparatus, loss of supporting alveolar bone and eventually losing teeth if it is left untreated. In recent studies, interest on the relationship between periodontal disease and systemic diseases are increasing. Etiologically, bacterial plaque, microbial by-products and host immune response is the focus of periodontal disease. Besides, polymicrobial infection with variable microbial patterns results in chronic periodontitis while aggressive periodontitis involves fast loss of attachment and bone destruction (Guthmiller and Novak, 2002). Periodontal disease generally consist of two stages namely gingivitis and periodontitis (Pieri *et al.*, 2012).

Periodontitis not only affect the local oral cavity but it leads to systemic consequences (D'Aiuto *et al.*, 2005). The attention towards using chemical treatments shifted to using medicinal plants when problems with chemical agents and safety concerns increased (Alhaarbi *et al.*, 2017). Lemongrass *Cymbopogon citratus* (DC.) Stapf can be used to treat various problems of oral health due to its benefits in the field of dentistry and medicine (Kumar and Gurunathan, 2019).

Lemongrass *Cymbopogon citratus* (DC.) Stapf has chemical compositions which varies geographically. The registered compounds in lemongrass are hydrocarbon terpenes, alcohol, ketones, esters and aldehydes. Lemongrass contains mainly citral which is a mixture of two stereoisomeric monoterpenic aldehydes, trans isomer geranial which is dominant over the neral isomer. Therefore, lemongrass has different types of effects which are beneficial namely antibacterial, anti-inflammation, antioxidant, antidiarrheal, antifilarial, antifungal, anti-amebic, and anti-malarial (Kumar and Gurunathan, 2019, Shah *et al.*, 2011).

In the animal kingdom, rodents, rabbits, pigs, dogs, and nonhuman primates have widely been used as a model for periodontitis. These models have contribute a lot in the world of biological sciences especially periodontology. However, each of these models comes with advantages and disadvantages. Induced periodontal disease method in animal model are placing bacterial plaque retentive ligature in the gingival sulcus of teeth. (Oz and Puleo, 2011).

1.6. Hypothesis

Lemongrass *Cymbopogon citratus* (DC.) Stapf extract irrigation of different concentrations given supra-gingiva twice a day of lower front incisors affect the hematological profile and histopathological aspects of periodontium of male rats (*Rattus norvegicus*).