

## Evaluation Of Antioxidant Activity Of Oxalis Corniculata - An In Vitro Study

Research Article

Sowmya<sup>1</sup>, Nivedhitha MS<sup>2\*</sup>

<sup>1</sup> Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India.

<sup>2</sup> Professor and Head, Department of Conservative Dentistry and Endodontics, Clinical Genetics Lab, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai - 600077, India.

### Abstract

**Introduction:** Oxidative stress is a very important characteristic feature of many diseases thereby releasing many free radicals by oxidation of the molecules. The generation of free radicals cause deleterious effects on the body in general and on dentition in particular. The effect of free radicals is harmful in a way that it can cause gingival inflammation, can compromise the bonding capacity of bonded restorations and so on. Hence it is important to counteract the effects of free radicals.

Antioxidants play a vital role in counteracting the harmful effects of free radicals. They act by scavenging the free radicals and reducing their activity. Antioxidants are abundantly available in natural products. Herbs especially are of paramount significance in delivering medicinal values. The advantages of herbs are availability, non immunogenic, ease of preparation. One such herb is Oxalis corniculata.

**Aim:** The aim of this study is to evaluate the antioxidant activity of Oxalis corniculata.

**Materials and Methods:** The Oxalis corniculata plant material was dried at room temperature and powdered using a grinding machine. About 1 gm of powder was soaked in ethanol for 72hrs and extracted using Soxhlet extraction. For DPPH scavenging activity ethanol solution of plant extracts at different concentrations (25–200 µg/ml) was mixed with 0.8 ml of 100 mM TrisHCl buffer adjusted to pH 7.4. DPPH (500 µM in 1.0 ml ethanol) solution was added to the test mixture to the test tubes. Absorbance of the resulting solution was measured at 517 nm UV-Visible Spectrophotometer.

**Results:** The results indicated that Oxalis corniculata has potent antioxidant activity but it was not superior to Ascorbic acid.

**Conclusion:** Within the limitations of the study, it can be seen that Oxalis corniculata has a potential to be used as an antioxidant in dentistry.

**Keywords:** Antioxidant Activity; DPPH Assay; Oxalis Corniculata.

### Introduction

Reactive oxygen species/ free radicals that are generated during various dental treatments cause deleterious effects on the tooth structure.[1] Hence it is important to eliminate these free radicals to alleviate adverse effects caused by them.[2] The common sources of free radicals emanating from dental therapy are bleaching agents, dental cements, metals in restoration, and certain intracanal medicaments. [3]

We have seen many studies advocating the use of antioxidants in

order to eliminate these free radicals.[4] Antioxidants are known to destroy the free radicals by preventing their formation or promoting their decomposition and also inhibit lipid peroxidation thereby reducing the tissue damage.[5] The most commonly known antioxidants are Vitamin A, Vitamin C, Vitamin E, flavonoids.[2] Naturally occurring herbs are also known to contain quite a few antioxidant properties. Herbs and plants have been a rich source of medicinal values throughout human history.[6] The advantages of using herbs are their ease of availability, biocompatibility, probable lower immunogenicity. One such naturally occurring herb is Oxalis corniculata.[3]

#### \*Corresponding Author:

Nivedhitha MS,  
Professor and Head, Department of Conservative Dentistry and Endodontics, Clinical Genetics Lab, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai - 600077, India.  
Tel: 9840912367  
E-mail: nivedhitha@saveetha.com

**Received:** May 04, 2021

**Accepted:** July 29, 2021

**Published:** August 02, 2021

**Citation:** Sowmya, Nivedhitha MS. Evaluation Of Antioxidant Activity Of Oxalis Corniculata - An In Vitro Study. *Int J Dentistry Oral Sci.* 2021;8(8):3620-3623.  
doi: <http://dx.doi.org/10.19070/2377-8075-21000740>

**Copyright:** Nivedhitha MS<sup>©</sup>2021. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Oxalis corniculata is a small perennial creeping herb which belongs to the family Oxalidaceae. It is distributed across various parts of the world.[7] The herb is known for its various ethnomedicinal properties.[8] Oxalis herb is known to contain flavonoids, tannins, ascorbate and other volatile oils.[9] Various studies on this herb have shown that this herb has antibacterial, anti-inflammatory, antiscorbutic effects.[10] The beneficial aspects of this herb can be translated into dentistry where it can be used as a medicament or post bleaching to immediately reverse the compromised bond strength of enamel and thereby facilitate the bonding of composite to bleached enamel.[11]

Previously our team has a rich experience in working on various research projects across multiple disciplines[12-26]. Now the growing trend in this area motivated us to pursue this project.

The purpose of this study is to evaluate the antioxidant activity of Oxalis corniculata.

### Materials And Methods

#### Extract preparation

The Oxalis corniculata plant material was dried at room temperature and powdered using a grinding machine. About 1 gm of powder was soaked in ethanol for 72hrs and extracted using Soxhlet extraction. The extract was collected and concentrated under reduced pressure in a rotary evaporator. The extract was kept in a refrigerator at a temperature below 10°C until use.

#### DPPH Assay

For DPPH scavenging activity ethanol solution of plant extracts at different concentrations (25–200 µg/ml) was mixed with 0.8 ml of 100 mMTrisHCl buffer adjusted to pH 7.4. DPPH (500 mM in 1.0 ml ethanol) solution was added to the above mixture to the test tubes. The mixture was shaken vigorously and incubated for 30 min at room temperature. Absorbance of the resulting solution was measured at 517 nm UV-Visible Spectrophotometer (Labomed). All the assays were carried out in triplicates. The ascorbic acid was used as a standard antioxidant in this method. Percentage of DPPH scavenging activity was determined.

#### Statistical Analysis

Results will be expressed as mean ± S.E.M. Statistical significance was determined by one-way analysis of variance (ANOVA), followed by a Dunnett’s multiple-comparison test with 95% confidence intervals. P values less than 0.05 were considered significant.

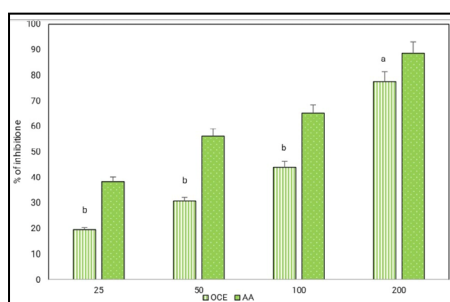
### Results And Discussion

The results of this study showed that Oxalis corniculata has potent antioxidant activity but not superior to that of the control Ascorbic acid. The results obtained were statistically significant. The percentage of radical scavenging activity for the herb Oxalis corniculata was highest at the highest concentration. (77.5±5.3) [Table 1]. On comparing the percentage of inhibition of the free

**Table 1. Results are expressed as Mean±SEM. \*\*\*p<0.001 statistically significant as compared with Negative control. bp<0.01; ap<0.05 statistically significant as compared with ascorbic acid. OCE- Oxalis corniculataethanolic extract. IC50 of OCE – 113.37µg/ml.**

Sample	Conc (µg/ml)	Abs	% of Inhibition
		At 517 nm	
OCE	25	0.412 ± 0.19	19.53 ± 1.2 <sup>***b</sup>
	50	0.354 ± 0.03	30.8 ± 2.2 <sup>***b</sup>
	100	0.286 ± 0.15	44.1 ± 2.4 <sup>***b</sup>
	200	0.115 ± 0.11	77.5 ± 5.3 <sup>***a</sup>
Ascorbic acid	2	0.315 ± 0.28	38.4 ± 1.5 <sup>***</sup>
	4	0.224 ± 0.18	56.25 ± 2.4 <sup>***</sup>
	6	0.178 ± 0.09	65.2 ± 3.5 <sup>***</sup>
	8	0.058 ± 0.03	88.6 ± 4.7 <sup>***</sup>
Negative control		0.512 ± 0.18	0.0 ± 0.0

**Figure 1. This graph depicts the percentage of DPPH radical scavenging action. Results are expressed as Mean±SEM. bp<0.01; ap<0.05 statistically significant as compared with ascorbic acid. OCE- Oxalis corniculataethanolic extract; AA- Ascorbic acid.**



radical activity at highest concentration, Ascorbic acid showed higher percentage of inhibition than *Oxalis corniculata*. [Figure 1]

Ascorbic acid is a standard, naturally occurring and most commonly known antioxidant.[27] It has various applications in medicine and dentistry.[28] Hence this antioxidant was chosen as a control against *Oxalis corniculata*. [29] *Oxalis corniculata* is known for its antimicrobial, anti diarrhoeal, anti inflammatory, anthelmintic and various other properties. Hence the benefits of this herb can be utilised in dentistry.[1, 30]

Post bleaching the bond strength of enamel and dentin is usually compromised.[31] This is due to the action of free radicals that are generated from the bleaching materials- Hydrogen peroxide, Carbamide peroxide.[32, 33] Hence it would be cumbersome to bond composite to the bleached surface.[34] Therefore it is important to reverse the compromised bond strength of enamel and dentin and facilitate restoration of composite to the bleached surface.[35]

In a study done by Ahmed et al, the results showed that methanolic extract of *Oxalis corniculata* had potent flavonoid content which exhibited antioxidant activity.[36, 37] In another study conducted by Borah et al in 2012, the antioxidant activity of *Oxalis corniculata* in three different solvents was evaluated using various antioxidant assays.[38] The results showed that there was no statistically significant difference between the three solvents used but *Oxalis corniculata* retained its antioxidant activity.[39]

In another study conducted by Swami et al, they found out that a bioactive component named Embellin was responsible for the antioxidant activity of *Oxalis corniculata* both in vitro and in vivo. [40, 41] Kathiriya in her study revealed that *Oxalis corniculata* possessed antioxidant and antitumor properties. [42]

In the present study, the antioxidant activity of *Oxalis corniculata* has been evaluated using DPPH assay. DPPH is a stable free radical that can accept or donate an electron so as to form a diamagnetic molecule [43] (Oktay et al., 2005; Nakayama, 1994). During the process, the colour of the radical changes from purple colour to pale yellow colour indicating the presence of antioxidant activity. The DPPH radical shows maximum absorbance at 517nm.

The results from the present study showed that there is a statistically significant difference between the herb activity and Ascorbic acid (Control). Table 1 represents the percentage of inhibition at various concentrations. The bar graph (Figure 1) demonstrates the percentage of DPPH radical scavenging action. It can be inferred from the graph that *Oxalis corniculata* has antioxidant activity but not superior to that of Ascorbic acid. However, more studies should be conducted to arrive at a definitive conclusion. Our institution is passionate about high quality evidence based research and has excelled in various fields [16, 44-53].

## Conclusion

Within the limitations of the study, it can be seen that *Oxalis corniculata* has a potential to be used as an antioxidant in dentistry.

## References

- [1]. Rajendran R, Kunjusankaran RN, Sandhya R, Anilkumar A, Santhosh R, Patil SR. Comparative evaluation of remineralizing potential of a paste containing bioactive glass and a topical cream containing casein phosphopeptide-amorphous calcium phosphate: An in vitro study. *Pesqui Bras Odontopediatria ClinIntegr*. 2019 Oct 10;1-10.
- [2]. Patel S, Hans MK, Chander S, Ahluwalia AS. Antioxidants in Endodontics: A Strategic Review. *J ClinDiagn Res*. 2015 May;9(5):ZE12-5. Pubmed PMID: 26155593.
- [3]. Tewari RK, Kapoor B, Mishra SK, Kumar A. Role of herbs in endodontics. *J Oral Res Rev*. 2016 Jul 1;8(2):95.
- [4]. Aksakalli S. Antioxidants in dentistry: Review of literature. *Dentistry*. 2013;4(1):2161-1122.
- [5]. Nandakumar M, Nasim I. Comparative evaluation of grape seed and cranberry extracts in preventing enamel erosion: An optical emission spectrometric analysis. *J Conserv Dent*. 2018 Sep-Oct;21(5):516-520. Pubmed PMID: 30294113.
- [6]. Rajakeerthi R, Nivedhitha MS. Natural Product as the Storage medium for an avulsed tooth—A Systematic Review. *Cumhur. Dent. J*. 2019 Jun 11;22(2):249-56.
- [7]. Manohar MP, Sharma S. A survey of the knowledge, attitude, and awareness about the principal choice of intracanal medicaments among the general dental practitioners and nonendodontic specialists. *Indian J Dent Res*. 2018 Nov-Dec;29(6):716-720. Pubmed PMID: 30588997.
- [8]. Raghavendra MP, Satish S, Raveesha KA. Phytochemical analysis and antibacterial activity of *Oxalis corniculata*; a known medicinal plant. *My science*. 2006;1(1):72-8.
- [9]. Teja KV, Ramesh S, Priya V. Regulation of matrix metalloproteinase-3 gene expression in inflammation: A molecular study. *J Conserv Dent*. 2018 Nov;21(6):592-6.
- [10]. Badwaik H, Singh MK, Thakur D, Giri TK, Tripathi DK. The botany, chemistry, pharmacological and therapeutic application of *Oxalis corniculata* Linn-a review. *Int. J. Phytomedicine*. 2011 Jan 1;3(1):01.
- [11]. Popay I. *Oxalis corniculata* (creeping woodsorrel). Available from: <http://dx.doi.org/10.1079/cpc.38154.20210099889>
- [12]. Govindaraju L, Gurunathan D. Effectiveness of Chewable Tooth Brush in Children-A Prospective Clinical Study. *J ClinDiagn Res*. 2017 Mar;11(3):ZC31-ZC34. Pubmed PMID: 28511505.
- [13]. Christabel A, Anantanarayanan P, Subash P, Soh CL, Ramanathan M, Muthusekhar MR, et al. Comparison of Pterygomaxillary disjunction with osteotomy separation in isolated Le Fort I osteotomies: a prospective, multi-centre, triple-blind, randomized controlled trial. *Int J Oral Maxillofac Surg*. 2016 Feb;45(2):180-5. Pubmed PMID: 26338075.
- [14]. Soh CL, Narayanan V. Quality of life assessment in patients with dentofacial deformity undergoing orthognathic surgery--a systematic review. *Int J Oral Maxillofac Surg*. 2013 Aug;42(8):974-80. Pubmed PMID: 23702370.
- [15]. Mehta M, Deeksha, Tewari D, Gupta G, Awasthi R, Singh H, et al. Oligonucleotide therapy: An emerging focus area for drug delivery in chronic inflammatory respiratory diseases. *ChemBiol Interact*. 2019 Aug 1;308:206-215. Pubmed PMID: 31136735.
- [16]. Ezhilarasan D, Apoorva VS, Ashok Vardhan N. Syzygiumcumini extract induced reactive oxygen species-mediated apoptosis in human oral squamous carcinoma cells. *J Oral Pathol Med*. 2019 Feb;48(2):115-121. Pubmed PMID: 30451321.
- [17]. Campeau PM, Kasperaviciute D, Lu JT, Burrage LC, Kim C, Hori M, et al. The genetic basis of DOORS syndrome: an exome-sequencing study. *Lancet Neurol*. 2014 Jan;13(1):44-58. Pubmed PMID: 24291220.
- [18]. Sneha S. Knowledge and awareness regarding antibiotic prophylaxis for infective endocarditis among undergraduate dental students. *Asian J Pharm Clin Res*. 2016 Oct 1:154-9.
- [19]. Christabel SL, Linda Christabel S. Prevalence of type of frenum attachment and morphology of frenum in children, Chennai, Tamil Nadu. *World J Dent*. 2015 Oct;6(4):203-7.
- [20]. Kumar S, Rahman R. Knowledge, awareness, and practices regarding biomedical waste management among undergraduate dental students. *Asian J Pharm Clin Res*. 2017;10(8):341.
- [21]. Sridharan G, Ramani P, Patankar S. Serum metabolomics in oral leukoplakia and oral squamous cell carcinoma. *J Cancer Res Ther*. 2017 Jul 1;13(3):556-61.
- [22]. Ramesh A, Varghese SS, Doraiswamy JN, Malaiappan S. Herbs as an antioxidant arsenal for periodontal diseases. *J IntercultEthnopharmacol*. 2016 Jan 27;5(1):92-6. Pubmed PMID: 27069730.
- [23]. Thamaraiselvan M, Elavarasu S, Thangakumaran S, Gadagi JS, Arthie T.

- Comparative clinical evaluation of coronally advanced flap with or without platelet rich fibrin membrane in the treatment of isolated gingival recession. *J Indian SocPeriodontol*. 2015 Jan;19(1):66-71.
- [24]. Thangaraj SV, Shyamsundar V, Krishnamurthy A, Ramani P, Ganesan K, Muthuswami M, et al. Molecular Portrait of Oral Tongue Squamous Cell Carcinoma Shown by Integrative Meta-Analysis of Expression Profiles with Validations. *PLoS One*. 2016 Jun 9;11(6):e0156582. Pubmed PMID: 27280700.
- [25]. Ponnulakshmi R, Shyamaladevi B, Vijayalakshmi P, Selvaraj J. In silico and in vivo analysis to identify the antidiabetic activity of beta sitosterol in adipose tissue of high fat diet and sucrose induced type-2 diabetic experimental rats. *ToxicolMech Methods*. 2019 May;29(4):276-290. Pubmed PMID: 30461321.
- [26]. Ramakrishnan M, Shukri M. Fluoride, Fluoridated Toothpaste Efficacy And Its Safety In Children-Review. *Int. J. Pharm. Res.*. 2018 Oct 1;10(04):109-14.
- [27]. Azeem RA, Sureshbabu NM. Clinical performance of direct versus indirect composite restorations in posterior teeth: A systematic review. *J Conserv Dent*. 2018 Jan;21(1):2-9.
- [28]. Juvekar A, Sakat S, Wankhede S, Juvekar M, Gambhire M. Evaluation of antioxidant and anti-inflammatory activity of methanol extract of *Oxalis corniculata*. *Planta Med*. 2009 Jul;75(09):PJ178.
- [29]. Poorni S, Srinivasan MR, Nivedhitha MS. Probiotic *Streptococcus* strains in caries prevention: A systematic review. *J. Conserv. Dent.*. 2019 Mar;22(2):123-8.
- [30]. Alam MB, Hossain MS, Chowdhury NS, Mazumder M, Haque ME, Islam A. In vitro and in vivo antioxidant and toxicity evaluation of different fractions of *Oxalis corniculata* Linn. *J PharmacolToxicol*. 2011 May 1;6(4):337-48.
- [31]. MalliSureshbabu N, Selvarasu K, V JK, Nandakumar M, Selvam D. Concentrated Growth Factors as an Ingenious Biomaterial in Regeneration of Bony Defects after Periapical Surgery: A Report of Two Cases. *Case Rep Dent*. 2019 Jan 22;2019:7046203. Pubmed PMID: 30805222.
- [32]. Plotino G, Buono L, Grande NM, Pamejjer CH, Somma F. Nonvital tooth bleaching: a review of the literature and clinical procedures. *J Endod*. 2008 Apr 1;34(4):394-407.
- [33]. Janani K, Sandhya R. A survey on skills for cone beam computed tomography interpretation among endodontists for endodontic treatment procedure. *Indian J Dent Res*. 2019 Nov-Dec;30(6):834-838. Pubmed PMID: 31939356.
- [34]. Govindaraju L, Neelakantan P, Gutmann JL. Effect of root canal irrigating solutions on the compressive strength of tricalcium silicate cements. *Clin Oral Investig*. 2017 Mar;21(2):567-571. Pubmed PMID: 27469101.
- [35]. Shahi M, Velugu GR, Choudhary E. Comparative evaluation of the effect of 10%, 20%, and 30% guava seed extract on reversing compromised resin bond strength after enamel bleaching in 120 min, 10 min, and 5 min: An in vitro study. *J Conserv Dent*. 2020 Jan-Feb;23(1):66-70. Pubmed PMID: 33223645.
- [36]. Ramarao S, Sathyanarayanan U. CRA Grid - A preliminary development and calibration of a paper-based objectivization of caries risk assessment in undergraduate dental education. *J Conserv Dent*. 2019 Mar-Apr;22(2):185-190. Pubmed PMID: 31142991.
- [37]. Ahmed D, Zara S, Baig H. In vitro analysis of antioxidant activities of *Oxalis corniculata* Linn. fractions in various solvents. *Afr J Tradit Complement Altern Med*. 2012 Oct 1;10(1):158-65. Pubmed PMID: 24082338.
- [38]. Khandelwal A, Palanivelu A. Correlation between dental caries and salivary albumin in adult population in Chennai: An in vivo study. *Braz. Dent. Sci*. 2019 Apr 30;22(2):228-33.
- [39]. Borah A, Yadav RN, Unni BG. Evaluation of antioxidant activity of different solvent extracts of *Oxalis corniculata* L. *J Pharm Res*. 2012 Jan;5(1):91-3.
- [40]. Swami DR, Malpathak NP. Exploring in-vivo and in-vitro *Oxalis Corniculata* L. for phytochemicals using non-targeted LC-MS approach and its antioxidant capacity. *Int. J. Pharm. Sci. Res*. 2018 Oct 1;9(10):4151-7.
- [41]. Siddique R, Nivedhitha MS. Effectiveness of rotary and reciprocating systems on microbial reduction: A systematic review. *J Conserv Dent*. 2019 Mar;22(2):114-22.
- [42]. Kathiriya A, Das K, Kumar EP, Mathai KB. Evaluation of antitumor and antioxidant activity of *Oxalis corniculata* Linn. against Ehrlich ascites carcinoma on mice. 2010.
- [43]. Nakayama T, Kuroi N, Sano M, Tabara Y, Katsuya T, Ogihara T, et al. Mutation of the follicle-stimulating hormone receptor gene 5'-untranslated region associated with female hypertension. *Hypertension*. 2006 Sep;48(3):512-8. Pubmed PMID: 16864747.
- [44]. VijayashreePriyadharsini J. In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens. *J Periodontol*. 2019 Dec;90(12):1441-1448. Pubmed PMID: 31257588.
- [45]. Pc J, Marimuthu T, Devadoss P, Kumar SM. Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study. *Clin Implant Dent Relat Res*. 2018 Apr 6;20(4):531-4.
- [46]. Ramesh A, Varghese S, Jayakumar ND, Malaiappan S. Comparative estimation of sulfiredoxin levels between chronic periodontitis and healthy patients - A case-control study. *J Periodontol*. 2018 Oct;89(10):1241-1248. Pubmed PMID: 30044495.
- [47]. Ramadurai N, Gurunathan D, Samuel AV, Subramanian E, Rodrigues SJ. Effectiveness of 2% Articaine as an anesthetic agent in children: randomized controlled trial. *Clin Oral Investig*. 2019 Sep;23(9):3543-50.
- [48]. Sridharan G, Ramani P, Patankar S, Vijayaraghavan R. Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma. *J. Oral Pathol. Med*. 2019 Apr;48(4):299-306.
- [49]. Mathew MG, Samuel SR, Soni AJ, Roopa KB. Evaluation of adhesion of *Streptococcus mutans*, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary molars: randomized controlled trial. *Clin Oral Investig*. 2020 Sep;24(9):1-6. Pubmed PMID: 31955271.
- [50]. Samuel SR. Can 5-year-olds sensibly self-report the impact of developmental enamel defects on their quality of life? *Int J Paediatr Dent*. 2021 Mar;31(2):285-286. Pubmed PMID: 32416620.
- [51]. R H, Ramani P, Ramanathan A, R JM, S G, Ramasubramanian A, et al. CYP2 C9 polymorphism among patients with oral squamous cell carcinoma and its role in altering the metabolism of benzo[a]pyrene. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2020 Sep;130(3):306-312. Pubmed PMID: 32773350.
- [52]. Chandrasekar R, Chandrasekhar S, Sundari KKS, Ravi P. Development and validation of a formula for objective assessment of cervical vertebral bone age. *ProgOrthod*. 2020 Oct 12;21(1):38. Pubmed PMID: 33043408.
- [53]. Vijayashree Priyadharsini J, SmilineGirija AS, Paramasivam A. In silico analysis of virulence genes in an emerging dental pathogen *A. baumannii* and related species. *Arch Oral Biol*. 2018 Oct;94:93-98. Pubmed PMID: 30015217.