

## Diabetes-Induced Alterations in the Oral Microbiota of Companion Animals and Their Relationship with Periodontal Inflammation

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**Abstract:** Diabetes mellitus in geriatric companion animals is associated with metabolic imbalance, oral dysbiosis, and moderate to severe periodontal disease, as demonstrated in three clinical cases. The findings highlight a bidirectional relationship between hyperglycemia, altered oral microbiota, and periodontal inflammation, supporting the need for integrated metabolic and dental management.

**Keywords:** Diabetes mellitus; oral microbiota; periodontal disease; companion animals.

### Introduction:

Diabetes mellitus affects both metabolic balance and oral health in companion animals. It has a bidirectional relationship with periodontal disease, driven by oral dysbiosis and altered immune responses. Effective management requires an integrated approach targeting both metabolic control and oral health.

### Results:

#### Clinical findings

- All diabetic geriatric animals (2 dogs, 1 cat) showed **moderate to severe periodontal disease**.
- Common signs: **gingivitis, plaque/calculus accumulation, halitosis, gingival recession**.
- Severity of oral lesions appeared **associated with poor glycemic control**.



Figure 1. Clinical cases included in the study.

#### Oral microbiological profile

- Oral microbiota showed **dysbiosis with opportunistic bacteria**.
- Main species identified: *Pseudomonas aeruginosa*, *Enterococcus faecium*, *Hafnia alvei*.
- Findings indicate **increased pathogenic potential in diabetic oral environments**.

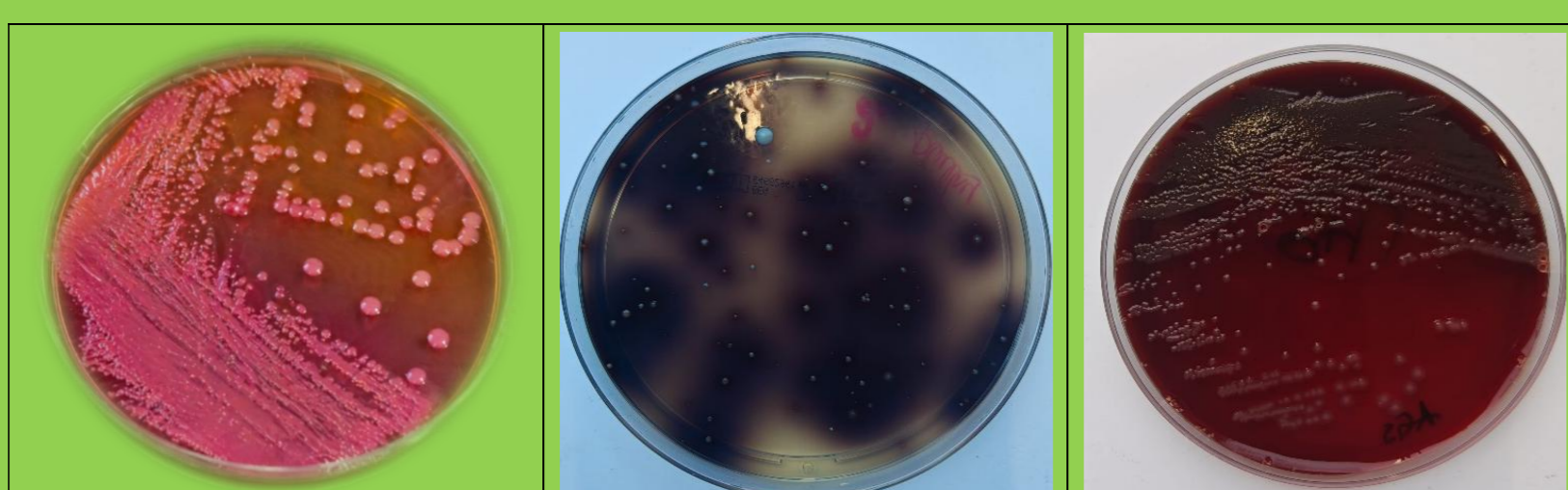


Figure 2 A-C. Bacterial growth on culture media Mc Konkey from dental plaque samples collected from diabetic companion animals.

#### Therapeutic Management

- **Multimodal approach:**
- Antidiabetic therapy (insulin and/or oral medication)
- Antibiotic and anti-inflammatory treatment
- Hepatoprotective support
- Dental interventions (scaling, tooth extraction)
- Specialized dietary management
- Emphasizes the importance of an **integrated systemic and oral therapeutic approach**.

**Discussion:** Diabetes mellitus in geriatric companion animals is associated with moderate to severe periodontal disease, oral dysbiosis characterized by opportunistic bacteria, acidic oral pH, and systemic low-grade inflammation, all of which reflect the impact of metabolic imbalance on the oral ecosystem. These findings support a bidirectional relationship between diabetes and periodontal disease and highlight the need for integrated therapeutic strategies, although complete restoration of microbial balance remains challenging.

### Materials and Methods:

The study included three geriatric companion animals (two dogs and one cat) diagnosed with diabetes mellitus and concurrent periodontal disease, all under individualized diabetic management. Clinical oral examinations were performed to assess periodontal status and were correlated with each animal's systemic condition. Microbiological samples from periodontal sites were cultured and identified using MALDI-TOF mass spectrometry, while blood analyses evaluated metabolic and inflammatory parameters. Oral pH was also measured, and data were interpreted descriptively to explore the relationship between diabetes, oral microbiota, and periodontal inflammation.

### Hematological & Biochemical Findings

- **Persistent hyperglycemia** in all cases.
- **Mild leukocytosis** → chronic inflammation.
- **Slight hepatic enzyme increase**, normal renal parameters.
- Indicates **chronic but compensated metabolic imbalance**.

Parameter	Reference range	Case 1 (Dog)	Case 2 (Dog)	Case 3 (Cat)
Glucose (mg/dL)	70–120	248	312	276
WBC ( $\times 10^9/L$ )	6.0–17.0	14.8	16.2	13.5
RBC ( $\times 10^{12}/L$ )	5.5–8.5 (dog) / 5.0–10.0 (cat)	6.1	5.8	6.9
Hemoglobin (g/dL)	12–18 (dog) / 8–15 (cat)	13.4	12.9	11.8
ALT (U/L)	10–60	68	74	55
AST (U/L)	10–50	45	52	41
Creatinine (mg/dL)	0.5–1.8	1.6	1.9	1.4
Urea (mg/dL)	20–50	48	52	39

### Oral pH

- Oral pH values: **acidic (6.1–6.4)**.
- Acidification promotes **pathogenic microbiota and biofilm formation**.
- Lower pH associated with **more severe periodontal disease**.

Case	Species	Oral pH value	Physiological reference range	Interpretation
Case 1	Dog	6,4	6,8 – 7,2	Mildly acidic
Case 2	Dog	6,1	6,8 – 7,2	Moderately acidic

### Conclusions:

Diabetes mellitus negatively affects oral health in companion animals by promoting dysbiosis, acidic pH, and periodontal inflammation, closely linked to poor glycemic control. Effective management requires an integrated approach combining metabolic control, dental care, and targeted microbial therapy.

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