



Clinical and Microbiologically Controlled Comparative Study on the Efficacy of Commercially Available Oils as Oil Pulling

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Article History

Received: 07-11-2025

Accepted: 30-11-2025

Published: 01-12-2025



Abstract:

Original Research

Background: Marginal periodontitis is a biofilm-induced inflammatory disease that contributes to tooth loss, systemic inflammation, and functional decline in aging populations. Oil pulling, a traditional oral hygiene practice using natural oils, has gained interest as a potential adjunctive therapy, yet its translational relevance in geriatric oral health remains poorly understood. **Objectives:** This randomized controlled clinical trial evaluated the efficacy of commercially available oils used in oil pulling compared with a professional airflow treatment system in the management of subgingival biofilm. The translational objective was to assess whether oil pulling could serve as a low-cost, non-invasive intervention for preserving periodontal and systemic health in aging individuals. **Methods:** Thirty-two subjects with a history of marginal periodontitis were randomized into two groups: Group 1 (G1) received daily oil pulling with a mixed-oil formulation for six weeks, while Group 2 (G2) underwent airflow debridement using the Air N Go Perio[®] easy system. Clinical endpoints included probing depth (PD), gingival recession (GR), clinical attachment level (CAL), and bleeding on probing (BOP). Microbiological endpoints included total bacterial load (TBL) and quantification of periodontal pathogens (*Porphyromonas gingivalis*, *Treponema denticola*, *Tannerella forsythia*). **Results:** Both groups demonstrated significant reductions in TBL and modest, non-significant improvements in PD and BOP over six weeks. No significant differences were observed between the groups in CAL or GR. Oil pulling achieved comparable efficacy to airflow treatment in reducing bacterial load and improving clinical parameters. **Conclusions:** Oil pulling with commercially available oils demonstrated comparable short-term clinical and microbiological efficacy to professional airflow therapy. In the context of aging populations, this simple, low-cost, and culturally accessible practice may offer a valuable adjunct to conventional periodontal maintenance. Further large-scale, longitudinal studies are required to establish its role in translational geriatric oral health protocols.

Keywords: Marginal Periodontitis, Aging, Translational Medicine, Oil Pulling, Biofilm Management, Microbiota, Oral-Systemic Health.

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INTRODUCTION

Periodontal disease, particularly marginal periodontitis, represents a critical health burden in aging populations worldwide [1, 2]. Beyond the direct consequences of tooth loss and impaired mastication, periodontitis has been linked to systemic conditions highly prevalent in older adults, including cardiovascular disease, diabetes mellitus, and neurodegenerative disorders 3-5. The chronic low-grade inflammation characteristic of periodontal disease contributes to the systemic

inflammatory milieu of aging, often described as "inflammaging" [3]. Addressing oral health is therefore a central component of translational medicine strategies aimed at promoting healthy longevity.

Oil pulling is an ancient oral hygiene practice originating from Ayurveda, traditionally involving swishing of edible oils for oral detoxification [13, 14]. Contemporary research has suggested that oils may exhibit antimicrobial and

anti-inflammatory properties, potentially alter the oral microbiome and support periodontal health [10-12]. Despite anecdotal popularity, high-quality clinical evidence on oil pulling remains limited, particularly in the context of translational applications for aging populations.

This study was designed as a randomized controlled clinical trial comparing the efficacy of commercially available oils for oil pulling with a professional airflow therapy system in subgingival biofilm management. Our translational aim was to assess the feasibility of integrating oil pulling into oral health strategies as an accessible, non-invasive, and cost-effective intervention.

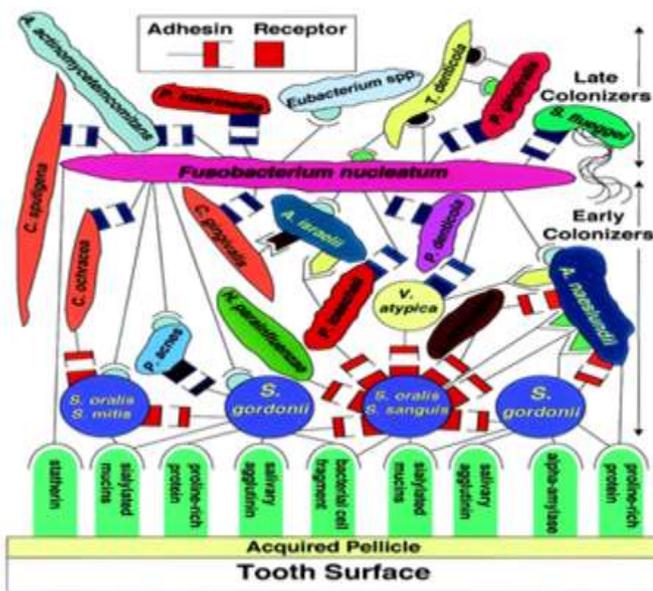


Fig 1: Biofilm model according to Kolenbrander (2002) [10]

Materials and Methods

Study Design

This was a randomized controlled clinical trial involving 32 subjects diagnosed with marginal periodontitis. Participants were randomly assigned to the oil pulling group (G1) or the airflow therapy group (G2). The study was approved by the Ethics Committee of the Medical Association of Westphalia-Lippe and Westphalia Wilhelms University (File No. 2015-530-f-S).

Participants

Eligible participants were adults with a history of treated periodontitis who were in the maintenance phase of periodontal care. Exclusion criteria included systemic diseases with strong immunological implications, recent antibiotic use, or active untreated caries. The mean age of

participants reflected a population typical of aging patients in periodontal maintenance.

Interventions

- **G1 (Oil pulling group):** Daily rinsing with 10 mL of Araschied® oil blend (sunflower, sage, black cumin) for 5-10 minutes over six weeks [13].
- **G2 (Airflow group):** Single-session subgingival biofilm removal using Air N Go Perio® easy system with gentle insertion into periodontal pockets [8].

Outcome Measures

- **Clinical Parameters:** Probing depth (PD), gingival recession (GR), clinical attachment level (CAL), bleeding on probing (BOP).
- **Microbiological Parameters:** Total bacterial load (TBL) and detection of *Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, *Treponema denticola*, and *Tannerella forsythia* using IAI PadoTest 4-5® [9].

Statistical Analysis

Data were analyzed using IBM SPSS 19. Descriptive statistics and inferential tests (t-tests, ANOVA, Wilcoxon) were employed. Significance threshold: $\alpha = 0.05$.

RESULTS

Clinical Outcomes

A significant reduction in the Total Bacterial Load (TBL) was achieved in both groups. Clinical parameters, such as Probing Depth and BOP, showed a slightly non-significant improvement in both study groups, particularly after 6 weeks:

- **Probing Depth (PD):** Slight reduction in both groups, non-significant
- **Bleeding on Probing (BOP):** Modest improvement in both groups after six weeks.
- **Clinical Attachment Level (CAL):** Stable, no deterioration.
- **Gingival Recession (GR):** No significant changes.

Overview of the patient population

The comparison groups were identical in terms of possible influencing factors, e.g. health or genetic factors. This relates to the parameters "age" and "gender" and refers to the homogeneous structure of both test groups.

Both groups showed improvements in PD and BOP after six weeks, with trends favoring oil pulling for early bacterial reduction¹⁰⁻¹². GR and CAL remained stable across groups, with no significant differences observed:

Clinical parameters

The analysis of the clinical parameters showed positive changes in both groups over the observation period. A statistically slightly non-significant decrease in Probing Depth (PD) and Bleeding on Probing (BOP) was observed in both G1 and G2. These improvements were particularly clear after 6 weeks of observation (T4).

PD (Probing Depth measurement)

For the statistical evaluation, the lowest measurement points at the time points t0, t3 and t4 of the periodontium were used. The periodontal status was assessed using a 2-point measurement. All measurements were taken with a commercially available periodontal probe (CP 15 UNC® from HuFriedyTM). We used the extreme values in accordance with Nossek *et al.*, (1979) [16]. For the PD measurement parameter (Fig 2), there was a slightly non-significant positive development in both groups for the period t1-t4.

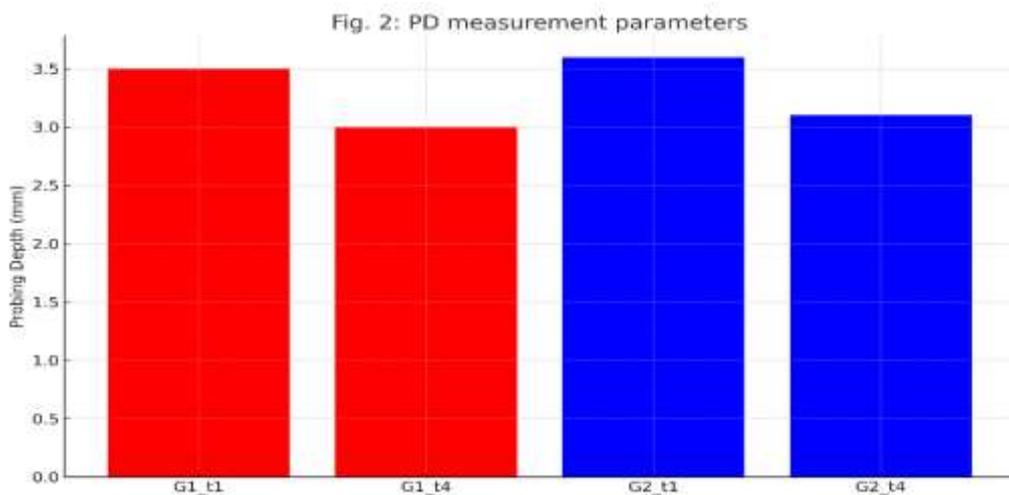


Fig 2: PD measurement parameters for both groups (1=G1, 2=G2) at time points t1

GR (Gingival Recession)

Looking at the clinical examination parameter of gingival recession, there was no

significant difference between the two comparison groups at any of the examination times (Fig 3).

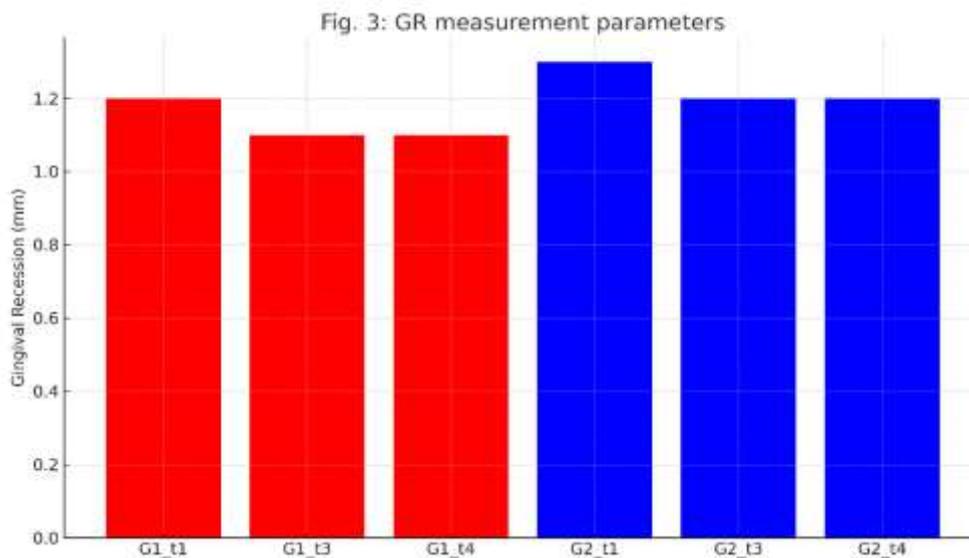


Fig 3: GR measurement parameters for both groups (1=G1, 2=G2) at time points t1, t3, and t4

CAL (Clinical Attachment Level)

This parameter can be considered a compositional factor and is made up of PD+GR (Fig 4). There was no increase in Clinical

Attachment Loss in either comparison group, with no significant difference between the oil pulling and air flow treatments.

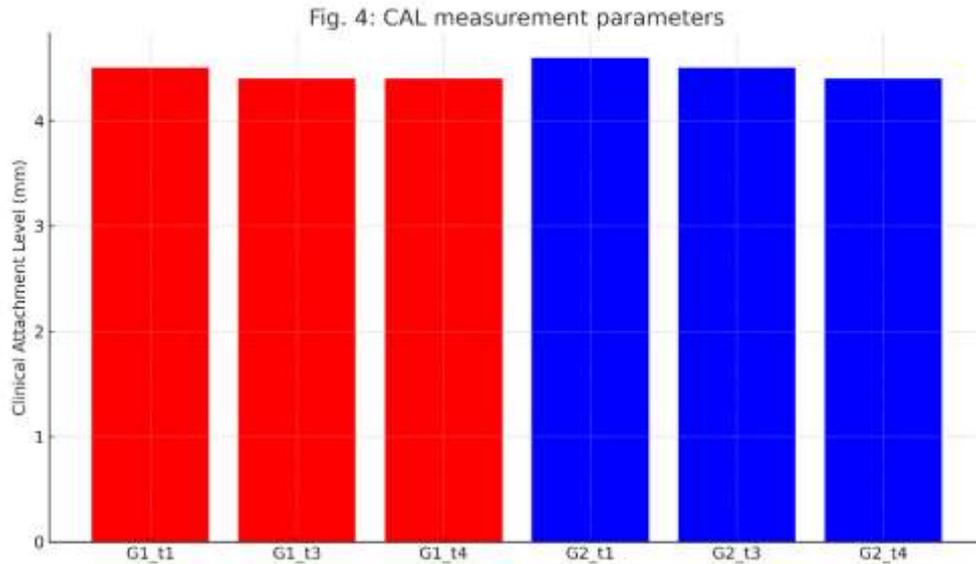


Fig 4: CAL measurement parameters for both groups at time points t1, t3 and t4 (1=G1, 2=G2)

BOP (Bleeding on Probing)

The measurement parameter Bleeding on Probing provides information on the current inflammatory state of the tissue (Fig 5). For data

collection purposes, only a distinction was made between positive and negative. No further gradations were made in relation to the bleeding findings.

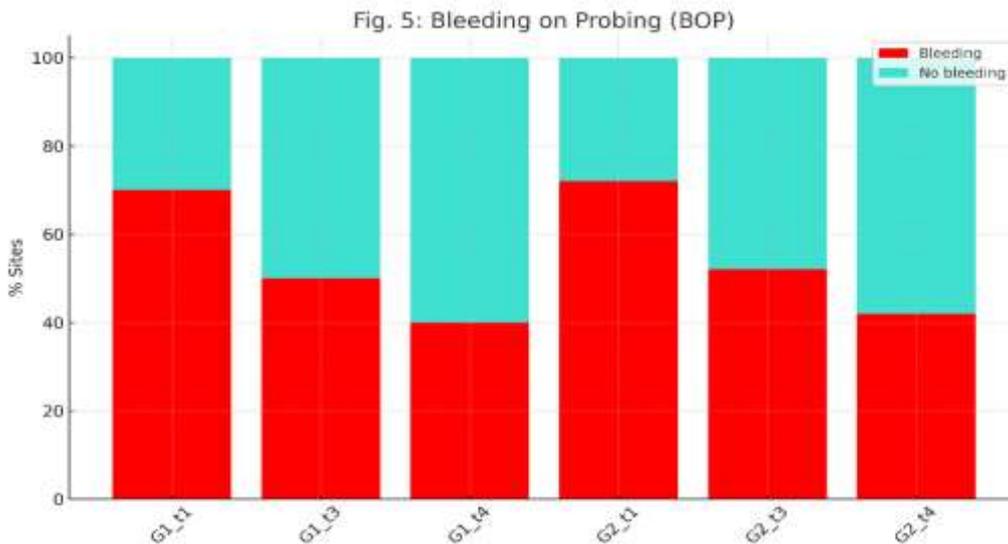


Fig 5: BOP (red=bleeding, turquoise=no bleeding) for both groups at time points t1, t3 and t4 (1=G1, 2=G2)

Microbiological Outcomes

- **Total Bacterial Load (TBL):** Significant reduction in both groups immediately post-intervention and sustained at four weeks. By six weeks, levels approached baseline.

- **Pathogen-specific findings:** *P. gingivalis*, *T. denticola*, and *T. forsythia* were detectable in low concentrations in both groups, with reductions observed post-intervention but without long-term significance [9].

In terms of total bacterial load (TBL), microbiological studies showed a significant reduction in both groups after the intervention. Both G1 and G2 showed comparable efficacy in subgingival biofilm management. The IAI Pado Test 4-5[®] was used for each specific sample tooth. Regarding the bacterial counts, it should be noted that the test used has a sensitivity of 10^4 bacteria. This means that a result of 0 does not indicate the complete absence of the tested bacteria, but only a bacterial concentration lower than the threshold (i.e. $<10^4$ bacteria). The presence of species below this detection limit is therefore quite possible. Bacterial counts were reported as the base value n multiplied by 10^6 .

When looking at the microbiological test results at the specified measurement times, there were some significant differences in the analysis of individual measurement parameters. The determination was carried out for the data at the specified times t1, t2 and t4 as well as at the different times. This applies to all microbiological parameters examined in this study.

Primary microbiological endpoint - Total Bacterial Load (TBL)

The measurements taken at the specified times were used to plot TBL (Fig 6). The data shown in the box plots indicate that the median distribution of TBL at time 2 was slightly higher for Group 2 than for Group 1. This means that for the period t1-t2, there is an even greater decrease in TBL for Group 1. This can be explained by the apparently lower root surface erosion due to oil pulling compared to airflow-induced abrasion. In addition, there was an absolute improvement in TBL for both groups over the course of the study.

Looking at the data compared to time t4, i.e. after 6 weeks, it is noticeable that the medians have returned to approximately the initial value. Again, however, the result was not significant. In summary, the following can be stated for the development of TBL over the 6-week period in our clinically controlled study:

- The total bacterial count for the observation periods t1 and t2 differs significantly between the two groups.
- When comparing the development of the two groups over the observation period, there were no significant differences.
- The total bacterial count at the end of the observation period t4 was approximately the same as at time t1.

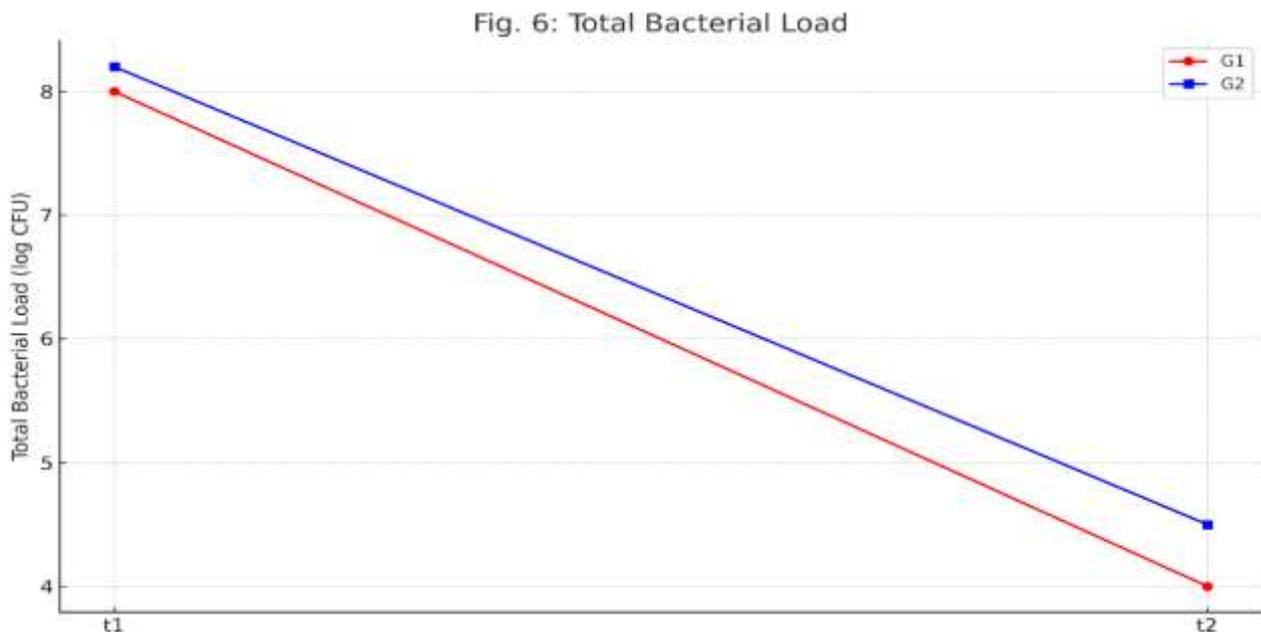


Fig 6: Total Bacterial Load (TBL) at time points t1-t2 in comparison of the two groups (red=G1, blue=G2)

A similar development can be observed as for measurement parameter PG (Fig 7).

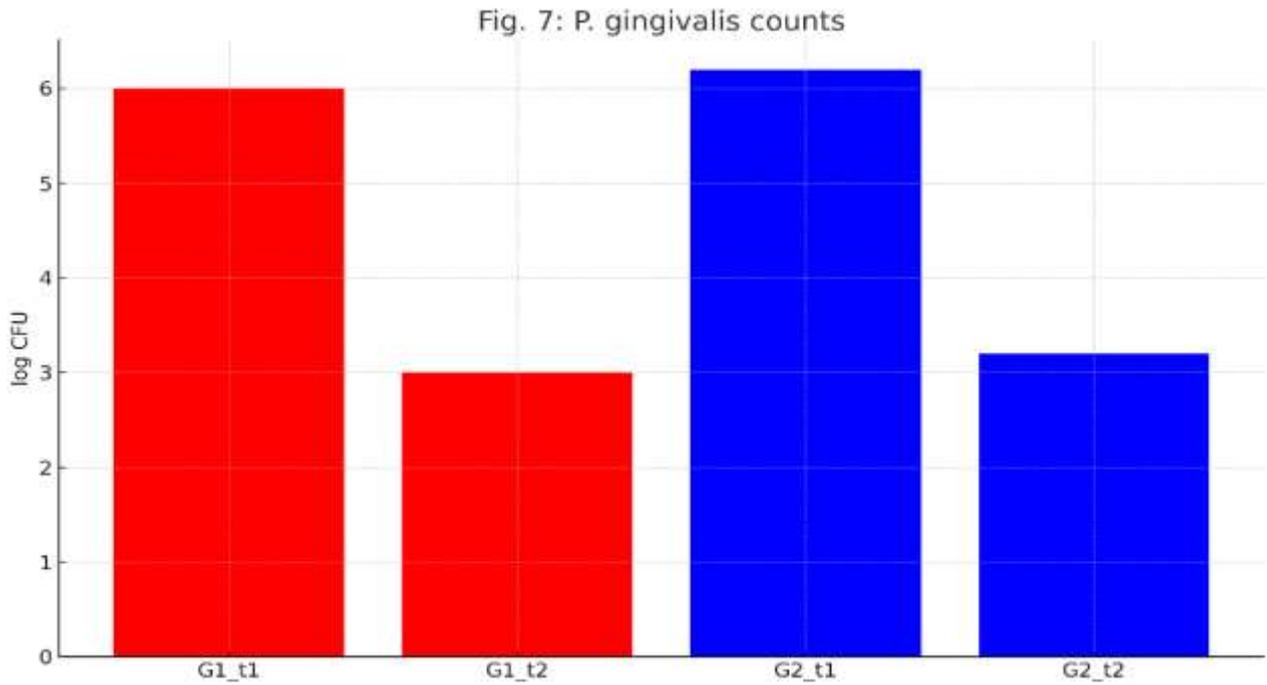


Fig 7: Bacterial count of PG at the defined time points t1 (baseline) and t2 in both study groups (left G1, right G2)

TD (*Treponema denticola*)

TD was only detectable in small numbers in both groups at all time points. The only

statistically non-significant development for TD can be seen when looking at the mean values from t1-t2 (Fig 8).

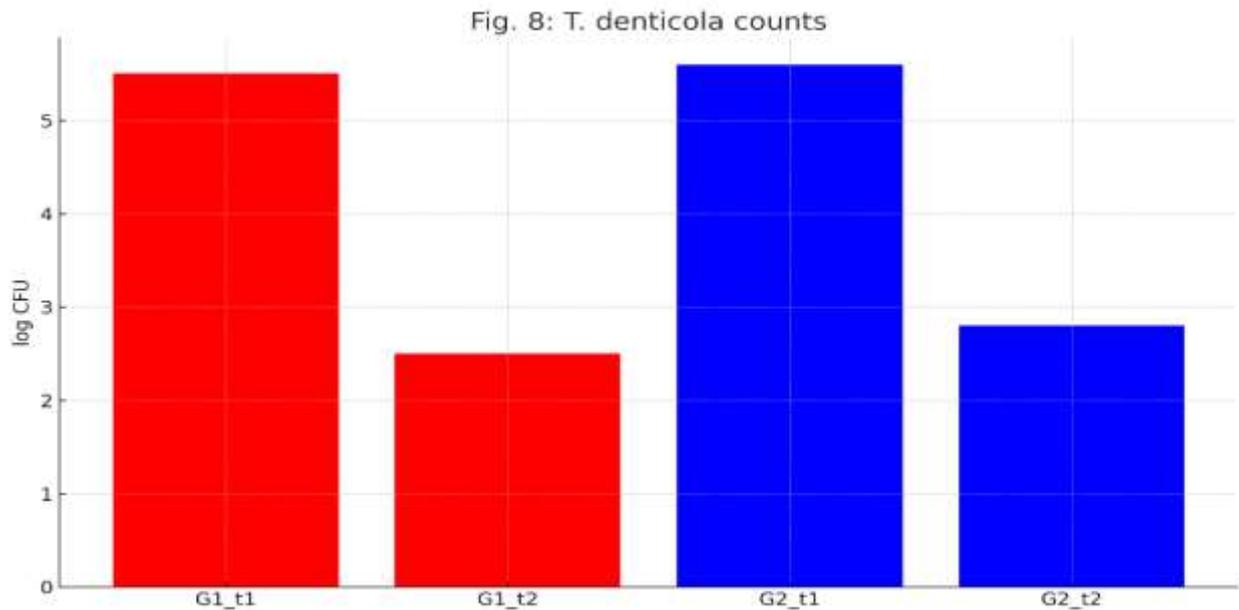


Fig 8: Bacterial count TD at the defined time points t1 (baseline) and t2 in both study groups (left G1, right G2)

TF (*Tannerella forsythia*)

Overall, the results correspond to those of the previously evaluated measurement parameters TBL, PG and TD (Fig 9).

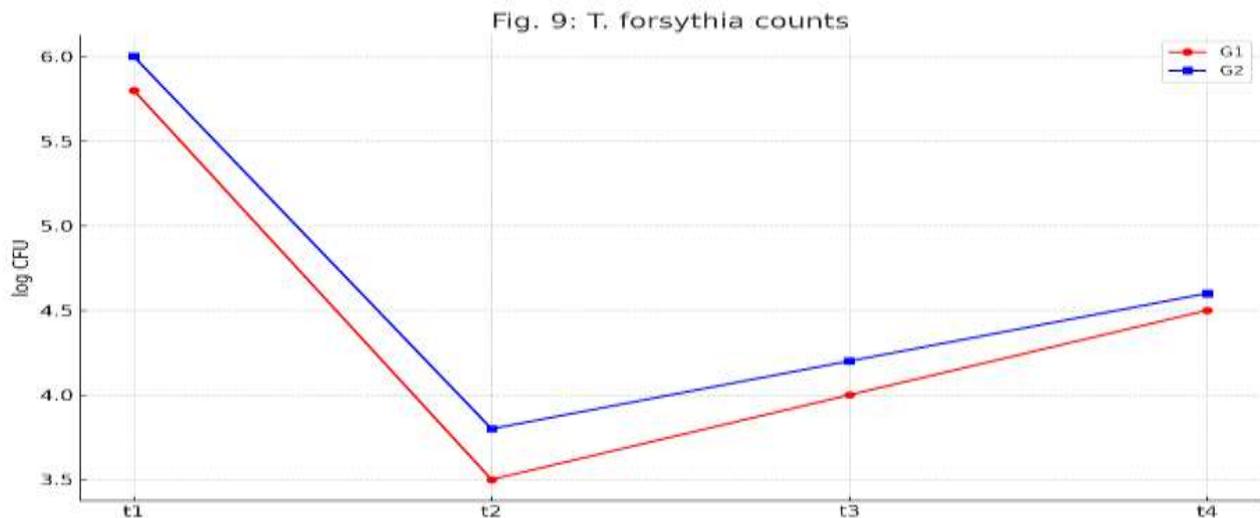


Fig 9: Bacterial counts TF at the specified time points (t1-t4) in the study group (red) and in the comparison group (blue)

Comparative Efficacy

Both interventions demonstrated comparable efficacy, with oil pulling showing slightly greater reductions in TBL immediately post-intervention. Airflow therapy, however, maintained consistency across time points.

DISCUSSION

Translational Relevance for Aging Populations

Periodontitis disproportionately affects older adults, with prevalence and severity increasing with age [1, 2]. Its systemic associations make 3-5 prime target for interventions aimed at reducing inflammaging and maintaining functional independence [3-5]. Professional periodontal therapy is effective but costly, time-intensive, and may be less accessible for elderly individuals, particularly in resource-limited settings.

Oil pulling offers several translational advantages:

- **Accessibility:** Readily available oils are inexpensive and culturally accepted [13, 14].
- **Non-invasive:** Does not require dental chair procedures or specialized equipment.
- **Potential systemic benefits:** Reduction in microbial load may mitigate systemic inflammatory burden [11, 12].

- **Patient empowerment:** Encourages self-care practices in elderly populations with limited mobility.

Biological Mechanisms

Three plausible mechanisms underpin the observed efficacy of oil pulling:

1. **Alkaline hydrolysis (saponification):** Oils emulsify and disrupt lipid-soluble bacterial membranes [13].
2. **Viscosity-mediated inhibition:** Oils reduce microbial adherence and biofilm stability [14].
3. **Antioxidant action:** Oils inhibit lipid peroxidation and generate antibiotic-like metabolites [12].

These mechanisms align with prior studies demonstrating antimicrobial and anti-inflammatory properties of edible oils.

Limitations

- Small sample size limits statistical power.
- Short duration (six weeks) precludes conclusions about long-term efficacy.
- Lack of blinding introduces potential bias.
- Participants were maintenance patients, not untreated cases, which may underestimate differences between interventions.

Future Directions

Future studies should:

- Enroll larger and more diverse cohorts, including frail elderly.
- Extend follow-up to assess long-term sustainability.
- Explore systemic biomarkers of inflammation and aging (e.g., IL-6, TNF- α , CRP).
- Investigate cost-effectiveness of oil pulling as a public health intervention.

CONCLUSION

This randomized controlled study demonstrated that oil pulling with commercially available oils yields comparable clinical and microbiological outcomes to professional airflow therapy in periodontal maintenance. Given its accessibility, simplicity, and low cost, oil pulling holds translational promise for aging populations as an adjunctive oral hygiene measure with potential systemic benefits. Larger and longer-term studies are warranted to integrate oil pulling into evidence-based geriatric oral care protocols.

Acknowledgments

We thank Prof. Dr. M.A. Vukovic and his team for their generous support in conducting the study.

Author Contributions

- **WDG:** Conceptualization, methodology, formal analysis, investigation, original draft, review and editing, supervision.
- **TF:** Conceptualization, supervision.

Funding: This study did not receive external funding.

Conflict of Interest: The authors declare no conflicts of interest.

Ethics Statement

The study protocol was approved by the Ethics Committee of the Medical Association of Westphalia-Lippe and Westphalia Wilhelms University (File No.

2015-530-f-S). Written informed consent was obtained from all participants.

Data Availability

The data supporting this study are available from the corresponding author upon reasonable request.

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