ClinicalEvidence

Halitosis

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ABSTRACT

INTRODUCTION: Halitosis can be caused by oral disease or by respiratory tract conditions such as sinusitis, tonsillitis, and bronchiectasis, but an estimated 40% of affected individuals have no underlying organic disease. METHODS AND OUTCOMES: We conducted a systematic review and aimed to answer the following clinical question: What are the effects of treatments in people with physiological halitosis? We searched: Medline, Embase, The Cochrane Library, and other important databases up to July 2013 (Clinical evidence reviews are updated periodically; please check our website for the most up-to-date version of this review). We included harms alerts from relevant organisations such as the US Food and Drug Administration (FDA) and the UK Medicines and Healthcare products Regulatory Agency (MHRA). RESULTS: We found 11 studies that met our inclusion criteria. We performed a GRADE evaluation of the quality of evidence for interventions. CONCLUSIONS: In this systematic review, we present information relating to the effectiveness and safety of the following interventions: artificial saliva; cleaning, brushing, or scraping the tongue; regular use of mouthwash; sugar-free chewing gums; and zinc toothpastes.

QUESTIONS

INTERVENTIONS

Key points

- Halitosis can be caused by oral disease or by respiratory tract conditions such as sinusitis, tonsillitis, and bronchiectasis, but an estimated 40% of affected people have no underlying organic disease.

  The main chemicals causing the odour seem to be volatile sulfur compounds, but little is known about the cause of physiological halitosis.
- Regular use of a mouthwash may reduce breath odour compared with placebo.
- Zinc toothpastes seem to reduce breath odour compared with placebo for people with halitosis.
- We don't know whether tongue cleaning, sugar-free chewing gums, or artificial saliva reduce halitosis, as no studies of adequate quality have been found.

DEFINITION

Halitosis is an unpleasant odour emitted from the mouth. It may be caused by oral conditions, including poor oral hygiene and periodontal disease [1] [2] or by respiratory tract conditions, such as chronic sinusitis, tonsillitis, and bronchiectasis. In this review, we deal only with physiological halitosis (i.e., confirmed persistent bad breath in the absence of systemic, oral, or periodontal disease). We have excluded halitosis caused by underlying systemic disease that would require disease-specific treatment, pseudo-halitosis (in people who believe they have bad breath but whose breath is not considered malodorous by others), and artificially induced halitosis (e.g., in studies requiring people to stop brushing their teeth). This review is only applicable, therefore, to people in whom such underlying causes have been ruled out, and in whom pseudo-halitosis has been excluded. There is no consensus regarding duration of bad breath for the diagnosis of halitosis, although the standard organoleptic test for bad breath involves smelling the breath on at least two or three different days. [1] Professional tooth cleaning may be of value where periodontal disease or poor oral hygiene contribute to malodour.

INCIDENCE/ PREVALENCE

We found no reliable estimate of prevalence, although several studies report the population prevalence of halitosis (physiological or because of underlying disease) to be about 50%. [1] [3] [4] [5] One cross-sectional study of 491 people found that about 5% of people with halitosis have pseudo-halitosis and about 40% have physiological bad breath not caused by underlying disease. [6] We found no reliable data about age or sex distribution of physiological halitosis.

AETIOLOGY/ RISK FACTORS

We found no reliable data about risk factors for physiological bad breath. Mass spectrometric and gas chromatographic analysis of expelled air from the mouths of people with any type of halitosis have shown that the principal malodorants are volatile sulfur compounds, including hydrogen sulfide, methyl mercaptan, and dimethyl sulfide. [7] [8]

PROGNOSIS We found no evidence on the prognosis of halitosis.

AIMS OF INTERVENTION To improve social functioning; to reduce embarrassment; to reduce odour, with minimum adverse effects.

OUTCOMES **Breath odour**, measured by organoleptic test scores or other odour scales; **quality of life**, including embarrassment and social functioning; **adverse effects**. We excluded non-clinical outcomes such as gas chromatography and spectroscopy results, and concentrations of compounds in exhaled air.

METHODS *Clinical Evidence* search and appraisal July 2013. The following databases were used to identify studies for this systematic review: Medline 1966 to July 2013, Embase 1980 to July 2013, and The Cochrane Database of Systematic Reviews 2013, issue 7 (1966 to date of issue). Additional searches were carried out in the Database of Abstracts of Reviews of Effects (DARE) and the Health Technology Assessment (HTA) database. We also searched for retractions of studies included in the review. Titles and abstracts identified by the initial search, run by an information specialist, were first assessed against predefined criteria by an evidence scanner. Full texts for potentially relevant studies were then assessed against predefined criteria by an evidence analyst. Studies selected for inclusion were discussed with an expert contributor. All data relevant to the review were then extracted by an evidence analyst. Study design criteria for inclusion in this review were: published RCTs and systematic reviews of RCTs in the English language, at least single-blinded, and containing at least 20 individuals (at least 10 per arm) of whom at least 80% were followed up. There was no minimum length of follow-up. We excluded all studies described as 'open', 'open label', or not blinded unless blinding was impossible. We included RCTs and systematic reviews of RCTs where harms of an included intervention were studied, applying the same study design criteria for inclusion as we did for benefits. In addition, we use a regular surveillance protocol to capture harms alerts from organisations such as the FDA and the MHRA, which are added to the reviews as required. To aid readability of the numerical data in our reviews, we round many percentages to the nearest whole number. Readers should be aware of this when relating percentages to summary statistics such as relative risks (RRs) and odds ratios (ORs). We have performed a GRADE evaluation of the quality of evidence for interventions included in this review (see table, p 15). The categorisation of the quality of the evidence (high, moderate, low, or very low) reflects the quality of evidence available for our chosen outcomes in our defined populations of interest. These categorisations are not necessarily a reflection of the overall methodological quality of any individual study, because the Clinical Evidence population and outcome of choice may represent only a small subset of the total outcomes reported, and population included, in any individual trial. For further details of how we perform the GRADE evaluation and the scoring system we use, please see our website (www.clinicalevidence.com).

QUESTION What are the effects of treatments in people with physiological halitosis?

OPTION REGULAR-USE MOUTHWASH (CONTAINING CHLORHEXIDINE, ZINC, HYDROGEN PEROXIDE, OR OTHER ANTIMICROBIAL AGENTS)

- For GRADE evaluation of interventions for Halitosis, see table, p 15 .
- Regular use of a mouthwash may reduce breath odour compared with placebo.

Benefits and harms

Regular-use mouthwash versus placebo:

We found two systematic reviews (search date 2008; [9] and 2012 [10]), which identified four RCTs of sufficient quality [11] [12] [13] [14] and one subsequent RCT. [15] The reviews did not pool data. We have reported the five RCTs from their original reports. [11] [12] [13] [14] [15] The first RCT compared an active-treatment mouthwash (containing chlorhexidine plus cetylpyridinium chloride plus zinc lactate) versus a placebo mouthwash. The mouthwashes were used twice-daily for 2 weeks. [11] The second RCT compared four mouthwashes, used twice-daily for 4 weeks (one containing essential oils; one containing cetylpyridinium chloride; one containing chlorine dioxide plus zinc; and a placebo mouthwash [composition not reported]). [12] The third RCT compared three interventions over 4 weeks (mouthwash containing zinc chloride plus sodium chlorite; mouthwash containing zinc chloride alone; and placebo mouthwash). All participants were instructed to use mouthwash for 30 seconds twice-daily. [13] The fourth RCT compared three mouthwashes with placebo (one containing amine fluoride/stannous fluoride, zinc lactate, and oral malodour counteractives; one containing chlorhexidine, cetylpyridinium chloride, and zinc lactate; and one containing chlorhexidine). [14] The fifth RCT compared mouthwash with placebo mouthwash and mouthwash plus tongue scraping with placebo mouthwash plus tongue scraping. The mouthwash contained zinc acetate, chlorhexidine diacetate, and sodium fluoride. [15]

Breath odour

Regular-use mouthwash compared with placebo Regular use of a mouthwash containing chlorhexidine plus cetylpyridinium chloride plus zinc lactate; cetylpyridinium chloride alone; zinc chloride plus sodium chlorite; amine fluoride/stannous fluoride, zinc lactate, and oral malodour counteractives; or chlorhexidine alone may be more effective than placebo at reducing breath odour at 2 to 4 weeks. However, regular use of mouthwash containing essential oil or chlorine dioxide plus zinc may be no more effective at reducing breath odour at 2 weeks. We don't know if regular use of mouthwash containing zinc acetate, chlorhexidine diacetate, and sodium fluoride (with or without tongue scraping) is more effective than placebo mouthwash (with or without tongue scraping) at reducing breath odour at 2 weeks (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Breath odour					
[11] RCT	40 people	**Mean odour score change from baseline (scale from 0 [no halitosis]—5 [offensive halitosis]), at 2 weeks** –1.3 with mouthwash containing chlorhexidine plus cetylpyridinium chloride plus zinc lactate (used twice-daily) –0.2 with placebo mouthwash (used twice-daily) Breath odour was assessed by 1 trained examiner	P <0.005	○○○	regular-use mouthwash containing chlorhexidine plus cetylpyridinium chloride plus zinc lactate
[12] RCT **4-armed trial**	99 people	**Mean odour score change from baseline (scale from 0 [no halitosis]—5 [offensive halitosis]), at 4 weeks** –0.41 with mouthwash containing cetylpyridinium chloride (used twice-daily) +0.16 with placebo mouthwash (used twice-daily) The remaining arms evaluated chlorine dioxide plus zinc mouthwash and essential oil mouthwash Breath odour was assessed by 2 experienced examiners	P <0.05 for cetylpyridinium chloride mouthwash *v* placebo 4 people were excluded or withdrew after randomisation Analysis not by intention-to-treat	○○○	regular-use mouthwash containing cetylpyridinium chloride
[12] RCT **4-armed trial**	99 people	**Mean odour score change from baseline (scale from 0 [no halitosis]—5 [offensive halitosis]), at 4 weeks** +0.06 with chlorine dioxide plus zinc mouthwash (used twice-daily) +0.16 with placebo mouthwash (used twice-daily) The remaining arms evaluated mouthwash containing cetylpyridinium chloride and essential oil mouthwash Breath odour was assessed by 2 experienced examiners	P value reported as not significant for chlorine dioxide plus zinc mouthwash *v* placebo 4 people were excluded or withdrew after randomisation Analysis not by intention-to-treat	⟷	Not significant
[12] RCT **4-armed trial**	99 people	**Mean odour score change from baseline (scale from 0 [no halitosis]—5 [offensive halitosis]), at 4 weeks** 0 with essential oil mouthwash (used twice-daily)	P value reported as not significant for essential oil mouthwash *v* placebo 4 people were excluded or withdrew after randomisation Analysis not by intention-to-treat	⟷	Not significant

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		+0.16 with placebo mouthwash (used twice-daily) The remaining arms evaluated mouthwash containing cetylpyridinium chloride and chlorine dioxide plus zinc mouthwash Breath odour was assessed by 2 experienced examiners			
[13] RCT **3-armed trial**	48 people	**Organoleptic breath scores , 4 weeks** with regular-use mouthwash containing zinc chloride plus sodium chlorite with placebo mouthwash Absolute results reported graphically The remaining arm evaluated regular-use mouthwash containing zinc chloride only	Reported as significant for zinc chloride plus sodium chlorite mouthwash *v* placebo mouthwash P value not reported	○○○	regular-use mouthwash containing zinc chloride plus sodium chlorite
[14] RCT **4-armed trial**	174 people	**Mean odour score change from baseline , 21 days** with amine fluoride/stannous fluoride, zinc lactate, oral malodour counteractives mouthwash with placebo mouthwash (tap water) Absolute results reported graphically The remaining arms evaluated mouthwashes containing chlorhexidine, cetylpyridinium chloride, and zinc lactate, or chlorhexidine	P <0.05 Statistically significant improvement in odour scores in the mouthwash group *v* placebo group were observed additionally at days 1 and 7, but not day 14	○○○	regular-use mouthwash containing amine fluoride/stannous fluoride, zinc lactate, and oral malodour counteractives
[14] RCT **4-armed trial**	174 people	**Mean odour score change from baseline , 21 days** with chlorhexidine, cetylpyridinium chloride, and zinc lactate mouthwash with placebo mouthwash (tap water) Absolute results reported graphically The remaining arms evaluated mouthwashes containing amine fluoride/stannous fluoride, zinc lactate, and oral malodour counteractives, or chlorhexidine	P <0.05 Statistically significant improvement in odour scores in the mouthwash group *v* placebo group were observed additionally at days 7 and 14, but not day 1	○○○	regular-use mouthwash containing chlorhexidine, cetylpyridium chloride, and zinc lactate
[14] RCT **4-armed trial**	174 people	**Mean odour score change from baseline , 21 days** with chlorhexidine mouthwash with placebo mouthwash (tap water) Absolute results reported graphically The remaining arms evaluated mouthwashes containing amine fluoride/stannous fluoride, zinc lactate, and oral malodour counteractives, or chlorhexidine,	P <0.05 Statistically significant improvement in odour scores in the mouthwash group *v* placebo group were observed additionally at days 1 and 7, but not day 14	○○○	regular-use mouthwash containing chlorhexidine

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		cetylpyridinium chloride, and zinc lactate			
[15] RCT **Crossover design** **4-armed trial**	21 people	**Proportion of people reporting reduction in organoleptic breath scores from baseline , 14 days** 38% with zinc acetate, chlorhexidine diacetate, and sodium fluoride mouthwash 24% with placebo mouthwash Absolute numbers not reported The remaining arms of this 2 × 2 factorial trial evaluated combination of zinc acetate, chlorhexidine diacetate, and sodium fluoride mouthwash plus tongue scraping and combination of placebo mouthwash plus tongue scraping	Not reported		
[15] RCT **Crossover design** **4-armed trial**	21 people	**Proportion of people reporting reduction in organoleptic breath scores from baseline , 14 days** 67% with combination of zinc acetate, chlorhexidine diacetate, and sodium fluoride mouthwash plus tongue scraping 33% with combination of placebo mouthwash plus tongue scraping Absolute numbers not reported The remaining arms of this 2 × 2 factorial trial evaluated zinc acetate, chlorhexidine diacetate, and sodium fluoride mouthwash and placebo mouthwash	Not reported		

Quality of life

No data from the following reference on this outcome. [11] [12] [13] [14] [15]

Adverse effects

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Adverse effects					
[11] RCT	40 people	**Mean change in tongue discoloration score from baseline (assessed using the Winkel tongue discoloration index [measured in 6 tongue areas; range 0 = no discoloration to 12 = severe discoloration]) , 2 weeks** +2.8 with mouthwash containing chlorhexidine plus cetylpyridinium chloride plus zinc lactate +0.3 with placebo mouthwash	P <0.002	○○○	placebo mouthwash

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
[11] RCT	40 people	**Tooth staining , 2 weeks** with mouthwash containing chlorhexidine plus cetylpyridinium chloride plus zinc lactate with placebo mouthwash Absolute results not reported	Reported as non-significant P value not reported	⟷	Not significant
[12] RCT **4-armed trial**	99 people	**Adverse effects , 4 weeks** with mouthwash containing cetylpyridinium chloride with chlorine dioxide plus zinc mouthwash with essential oil mouthwash with placebo mouthwash Absolute results not reported 13 people reported adverse effects such as lip blisters, localised gingival oedema, and sores (figures not reported by treatment group); the RCT reported, "it was determined that these adverse events were unlikely to be related to the product usage"	4 people were excluded or withdrew after randomisation Analysis not by intention-to-treat		
[14] RCT **4-armed trial**	174 people	**Discoloration of at least 1 upper anterior or incisor tooth , day 21** 8/44 (18%) with amine fluoride/stannous fluoride, zinc lactate, oral malodour counteractives mouthwash 10/44 (23%) with chlorhexidine, cetylpyridinium chloride, and zinc lactate mouthwash 13/44 (30%) with chlorhexidine mouthwash 5/44 (11%) with placebo mouthwash (tap water)	Reported as not significant	⟷	Not significant

No data from the following reference on this outcome. [13] [15]

Regular-use mouthwashes versus each other:

We found two systematic reviews (search date 2008; [9] and 2012 [10]), which identified three RCTs [12] [13] [14] and one subsequent RCT. [16] We have reported all four RCTs from their original reports. [12] [13] [14] [16] The first RCT compared four mouthwashes, used twice-daily, for 4 weeks (one containing essential oils; one containing cetylpyridinium chloride; one containing chlorine dioxide plus zinc; and a placebo mouthwash [composition not reported]). [12] The second RCT compared three interventions over 4 weeks (mouthwash containing zinc chloride plus sodium chlorite; mouthwash containing zinc chloride alone; and placebo mouthwash). All participants were instructed to use mouthwash for 30 seconds, twice-daily. [13] The third RCT compared four mouthwashes (one containing amine fluoride/stannous fluoride, zinc lactate, and oral malodour counteractives; one containing chlorhexidine, cetylpyridinium chloride, and zinc lactate; one containing chlorhexidine; and a placebo mouthwash [tap water]). [14] The fourth RCT compared a chlorine dioxide mouthwash with a chlorhexidine gluconate mouthwash. All participants also had tongue scraping. [16]

Breath odour

Regular-use mouthwashes compared with each other Regular use of a mouthwash containing zinc chloride plus sodium chlorite may be more effective than mouthwash containing zinc chloride alone at reducing breath odour at

4 weeks. We don't know how other regular-use mouthwashes with different ingredients compare with each other. (low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Breath odour					
[12] RCT **4-armed trial**	99 people	**Mean odour score change from baseline (assessed on a scale from 0 [no halitosis] to 5 [offensive halitosis]) , at 4 weeks** –0.41 with mouthwash containing cetylpyridinium chloride (used twice-daily) +0.06 with chlorine dioxide plus zinc mouthwash (used twice-daily) 0 with essential oil mouthwash The remaining arm evaluated placebo mouthwash Breath odour was assessed by 2 experienced examiners	P value (among the 3 treatment groups) reported as not significant 4 people were excluded or withdrew after randomisation Analysis not by intention-to-treat	⟷	Not significant
[13] RCT **3-armed trial**	48 people	**Organoleptic breath scores , 4 weeks** with regular-use mouthwash containing zinc chloride plus sodium chlorite with regular-use mouthwash containing zinc chloride only Absolute results reported graphically The remaining arm evaluated regular-use placebo mouthwash	Reported as significant for zinc chloride plus sodium chlorite mouthwash *v* zinc chloride alone mouthwash P value not reported	○○○	regular-use mouthwash containing zinc chloride plus sodium chlorite
[14] RCT **4-armed trial**	174 people	**Mean odour score change from baseline , day 21** with amine fluoride/stannous fluoride, zinc lactate, oral malodour counteractives mouthwash with chlorhexidine, cetylpyridinium chloride, and zinc lactate mouthwash with chlorhexidine mouthwash Absolute results reported graphically The remaining arm evaluated placebo mouthwash (tap water) No statistically significant differences in odour scores among the 3 mouthwashes were additionally observed at days 1, 7, and 14	Reported as not significant	⟷	Not significant
[16] RCT	22 people	**Proportion of individuals with organoleptic scores 1 or less , 1 week** 64% with chlorine dioxide mouthwash plus tongue scraping 81% with chlorhexidine gluconate mouthwash plus tongue scraping Absolute numbers not reported	Reported as not significant	⟷	Not significant

Quality of life

No data from the following reference on this outcome. [12] [13] [14] [16]

Adverse effects

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Adverse effects					
[12] RCT **4-armed trial**	99 people	**Adverse effects , 4 weeks** with mouthwash containing cetylpyridinium chloride with chlorine dioxide plus zinc mouthwash with essential oil mouthwash with placebo mouthwash Absolute results not reported 13 people reported adverse effects such as lip blisters, localised gingival oedema, and sores (figures not reported by treatment group); the RCT reported, "it was determined that these adverse events were unlikely to be related to the product usage"	4 people were excluded or withdrew after randomisation Analysis not by intention-to-treat		
[14] RCT **4-armed trial**	174 people	**Discoloration of at least 1 upper anterior or incisor tooth , day 21** 8/44 (18%) with amine fluoride/stannous fluoride, zinc lactate, oral malodour counteractives mouthwash 10/44 (23%) with chlorhexidine, cetylpyridinium chloride, and zinc lactate mouthwash 13/44 (30%) with chlorhexidine mouthwash 5/44 (11%) with placebo mouthwash (tap water)	Reported as not significant	⟷	Not significant
[16] RCT	22 people	**Adverse effects , 1 week** with chlorine dioxide mouthwash plus tongue scraping with chlorhexidine gluconate mouthwash plus tongue scraping Chlorine dioxide group reported altered taste sensation, which resolved upon mouthwash discontinuation (n = 1) No other adverse effects including soft tissue lesions or effect on teeth or restorations were reported	Not reported		

No data from the following reference on this outcome. [13]

Regular-use mouthwash versus artificial saliva, sugar-free gum, tongue cleaning, or zinc toothpastes:
We found one RCT comparing regular-use mouthwash with tongue scraping. [15]

Breath odour

Regular-use mouthwash compared with placebo mouthwash plus tongue scraping We don't know how effective regular-use mouthwash is compared with placebo mouthwash plus tongue scraping in reducing halitosis (very low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Breath odour					
[15] RCT **Crossover design** **4-armed trial**	21 people	**Proportion of people reporting reduction in organoleptic breath scores from baseline , day 14** 38% with zinc acetate, chlorhexidine diacetate, and sodium fluoride mouthwash 33% with combination of placebo mouthwash plus tongue scraping Absolute numbers not reported The remaining arms of this 2 × 2 factorial trial evaluated combination of zinc acetate, chlorhexidine diacetate, and sodium fluoride mouthwash plus tongue scraping and placebo mouthwash	Not reported		

Quality of life

No data from the following reference on this outcome. [15]

Adverse effects

No data from the following reference on this outcome. [15]

Mouthwash plus tongue scraping versus placebo:

We found one RCT comparing regular-use mouthwash plus tongue scraping with placebo mouthwash alone. [15]

Breath odour

Regular-use mouthwash plus tongue scraping compared with placebo mouthwash We don't know how effective regular-use mouthwash plus tongue scraping is compared with placebo mouthwash alone (very-low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Breath odour					
[15] RCT **Crossover design** **4-armed trial**	21 people	**Proportion of people reporting reduction in organoleptic breath scores from baseline , day 14** 67% with combination of zinc acetate, chlorhexidine diacetate, and sodium fluoride mouthwash plus tongue scraping 24% with placebo mouthwash	Not reported		

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
		Absolute numbers not reported The remaining arms of this 2 × 2 factorial trial evaluated zinc acetate, chlorhexidine diacetate, and sodium fluoride mouthwash and combination of placebo mouthwash plus tongue scraping			

Quality of life

No data from the following reference on this outcome. [15]

Adverse effects

No data from the following reference on this outcome. [15]

Comment: None.

OPTION ARTIFICIAL SALIVA

- For GRADE evaluation of interventions for Halitosis, see table, p 15 .
- We don't know whether artificial saliva reduces halitosis, as no trials of adequate quality have been found.

Benefits and harms

Artificial saliva:

We found no systematic review or RCTs comparing artificial saliva versus placebo or versus the other interventions covered by this review.

Comment: Although we searched for artificial saliva, it is mainly given to people with dry mouth syndrome, which lies outside of the remit of this review.

OPTION SUGAR-FREE CHEWING GUM

- For GRADE evaluation of interventions for Halitosis, see table, p 15 .
- We don't know whether sugar-free chewing gums reduce halitosis, as no trials of adequate quality have been found.

Benefits and harms

Sugar-free chewing gum:

We found no systematic review or RCTs comparing sugar-free chewing gum versus placebo or versus the other interventions covered by this review.

Comment: None.

OPTION TONGUE CLEANING, BRUSHING, OR SCRAPING

- For GRADE evaluation of interventions for Halitosis, see table, p 15 .
- We don't know whether tongue cleaning reduces halitosis.

Benefits and harms

Tongue scraping versus no tongue scraping:

We found two systematic reviews (search date 2005; [17] and 2009 [18]), which identified no RCTs of sufficient quality. We found one subsequent RCT comparing tongue scraping with no tongue scraping. [15]

Breath odour

Tongue scraping compared with no tongue scraping We don't know how effective tongue scraping with or without mouthwash is compared with mouthwash or placebo in reducing halitosis (very-low-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Breath odour					
[15] RCT **Crossover design** **4-armed trial**	21 people	**Proportion of people reporting reduction in organoleptic breath scores from baseline , day 14** 67% with combination of zinc acetate, chlorhexidine diacetate, and sodium fluoride mouthwash plus tongue scraping 38% with zinc acetate, chlorhexidine diacetate, and sodium fluoride mouthwash Absolute numbers not reported The remaining arms of this 2 × 2 factorial trial evaluated combination of placebo mouthwash plus tongue scraping, and placebo mouthwash	Not reported		
[15] RCT **Crossover design** **4-armed trial**	21 people	**Proportion of people reporting reduction in organoleptic breath scores from baseline , day 14** 33% with combination of placebo mouthwash plus tongue scraping 24% with placebo mouthwash Absolute numbers not reported The remaining arms of this 2 × 2 factorial cross-over trial evaluated combination of zinc acetate, chlorhexidine diacetate, and sodium fluoride mouthwash plus tongue scraping and zinc acetate, chlorhexidine diacetate, and sodium fluoride mouthwash	Not reported		

Quality of life

No data from the following reference on this outcome. [15]

Adverse effects

No data from the following reference on this outcome. [15]

Further information on studies

[15] The mouthwash used in the RCT contained 0.3% zinc acetate, 0.025% chlorhexidine diacetate, and 0.05% sodium fluoride.

Comment: None.

OPTION ZINC TOOTHPASTES

- For GRADE evaluation of interventions for Halitosis, see table, p 15 .
- Zinc toothpastes seem to reduce breath odour compared with placebo for people with halitosis.

Benefits and harms

Zinc toothpastes versus placebo:

We found one RCT comparing zinc toothpaste versus placebo. [19]

Breath odour

Zinc toothpastes compared with placebo Use of zinc toothpastes may be more effective than placebo at reducing breath odour at 4 weeks (moderate-quality evidence).

Ref (type)	Population	Outcome, Interventions	Results and statistical analysis	Effect size	Favours
Breath odour					
[19] RCT	187 people	**Mean organoleptic breath scores before brushing , 4 weeks** 2.15 with toothpaste containing zinc sulfate and fluoride 2.80 with placebo toothpaste containing fluoride	P = 0.0001	○○○	zinc sulfate tooth-paste
[19] RCT	187 people	**Mean organoleptic breath scores 2 hours after brushing , 4 weeks** 1.54 with toothpaste containing zinc sulfate and fluoride 2.85 with placebo toothpaste containing fluoride	P <0.0001	○○○	zinc sulfate tooth-paste

Quality of life

No data from the following reference on this outcome. [19]

Adverse effects

No data from the following reference on this outcome. [19]

Comment: None.

GLOSSARY

Low-quality evidence Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Moderate-quality evidence Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Organoleptic test scores These are assigned by one or more examiners who sniff the person's exhaled breath on two or three different days. People having this examination should not have had antibiotics in the previous 3 weeks, and should have refrained from eating garlic, onions, and spicy foods for 48 hours, and should have refrained from usual oral hygiene and smoking for the previous 12 hours. [1] Scoring systems vary among studies.

Very low-quality evidence Any estimate of effect is very uncertain.

SUBSTANTIVE CHANGES

Regular-use mouthwash (containing chlorhexidine, zinc, hydrogen peroxide, or other antimicrobial agents) Two systematic reviews added, [9] [10] and three RCTs. [14] [15] [16] Categorisation unchanged (likely to be beneficial).

Tongue cleaning, brushing, or scraping Two systematic reviews added, [17] [18] and one subsequent RCT. [15] Categorisation unchanged (unknown effectiveness).

Zinc toothpastes One RCT added. [19] Categorisation changed from unknown effectiveness to likely to be beneficial.

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GRADE **Evaluation of interventions for Halitosis.**

Important outcomes			Breath odour, Quality of life						
Studies (Participants)	Outcome	Comparison	Type of evidence	Quality	Consistency	Directness	Effect size	GRADE	Comment
What are the effects of treatments in people with physiological halitosis?									
5 (382) [11] [12] [13] [14] [15]	Breath odour	Regular-use mouthwash versus placebo	4	–2	0	0	0	Low	Quality points deducted for methodological flaws and incomplete reporting of results
4 (less than 343 people) [12] [13] [14] [16]	Breath odour	Regular-use mouthwashes versus each other	4	–2	0	0	0	Low	Quality points deducted for methodological flaws and incomplete reporting of results
1 (21) [15]	Breath odour	Regular-use mouthwash versus artificial saliva, sugar-free gum, tongue cleaning, or zinc toothpastes	4	–2	0	–1	0	Very low	Quality points deducted for sparse data and incomplete reporting of results; directness point deducted for uncertainty about the definition of the outcome
1 (21) [15]	Breath odour	Mouthwash plus tongue scraping versus placebo	4	–2	0	–1	0	Very low	Quality points deducted for sparse data and incomplete reporting of results; directness point deducted for uncertainty about the definition of the outcome
1 (21) [15]	Breath odour	Tongue scraping versus no tongue scraping	4	–2	0	–1	0	Very low	Quality points deducted for sparse data and incomplete reporting of results; directness point deducted for uncertainty about the definition of the outcome
1 (187) [19]	Breath odour	Zinc toothpastes versus placebo	4	–1	0	0	0	Moderate	Quality point deducted for sparse data

We initially allocate 4 points to evidence from RCTs, and 2 points to evidence from observational studies. To attain the final GRADE score for a given comparison, points are deducted or added from this initial score based on preset criteria relating to the categories of quality, directness, consistency, and effect size. Quality: based on issues affecting methodological rigour (e.g., incomplete reporting of results, quasi-randomisation, sparse data [<200 people in the analysis]). Consistency: based on similarity of results across studies. Directness: based on generalisability of population or outcomes. Effect size: based on magnitude of effect as measured by statistics such as relative risk, odds ratio, or hazard ratio.