SCIENTIFIC SECTION

Review Article

Halitosis

E.L. ATTIA, MD, FRCS[C]
K.G. MARSHALL, MD, FRCP[C], CCFP

Bad breath, halitosis, is an unpleasant problem most people try to avoid. Physicians seem particularly adept at avoiding halitosis by referring patients with this problem to a dentist. However, halitosis may be a symptom of a serious disease. Even if a serious disorder is not present, the cause of bad breath can usually be determined and appropriate therapy given. In this article the causes of halitosis and suggestions for treatment are outlined.

La mauvaise haleine est un phénomène déplaisant que la plupart des gens cherchent à éviter. Les médecins semblent les plus aptes a éviter ce problème en référant chez un dentiste les patients avec de la mauvaise haleine. Toutefois, la mauvaise haleine peut être un symptôme d'une sérieuse maladie. Même si il n'existe pas un sérieux désordre, la cause probable de la mauvaise haleine peut habituellement être déterminée et une thérapie appropriée donnée. Dans cet article les causes de la mauvaise haleine et des suggestions pour le traitement sont tracées.

Halitosis is a lyrical term derived from the Latin *halitus* (breath) and the Greek suffix *osis* (condition, action or pathologic process); in plain English it means bad breath.

The one certainty about bad breath is that it is profitable; in 1969 the American public spent more than $250 000 000 to combat this disorder. From such a figure and the emphasis it receives in television advertisements it seems that halitosis has great social significance. However, physicians have tended to ignore halitosis. Most available literature is in dental journals.

Bad breath is caused by mixture of the breath with malodorous compounds emanating from different areas of the respiratory and upper digestive tracts. The causes of halitosis can be divided into two categories: physiologic and pathologic (Table I).

Physiologic causes of halitosis

Lack of flow of saliva during sleep

There is no flow of saliva during sleep.[1] Therefore, putrefaction of the retained exfoliated oral epithelial cells and other debris causes an unpleasant odour, which quickly disappears after the usual oral toilet and the resumption of normal salivary flow.

Food

The metabolism of certain foods and beverages produces volatile fatty acids or other malodorous substances that are excreted through the lungs. The most common examples are alcohol, garlic, onions and pastrami. Studies in the 1930s and 1940s showed that if garlic were introduced into the peritoneal cavity or rubbed into the soles of the feet it still produced an unpleasant odour on the breath.[2,3] It was also found that if onion or garlic were swallowed without being chewed the odour would still be detected on the breath.[4]

Smoking

There is no doubt that smoking causes an odour on the breath. However, whether this is considered halitosis is subjective: if both partners of a couple smoke they will usually not notice each other's bad breath.

Menstruation

It has been reported that during menstruation some women have bad breath, probably secondary to hormonal changes;[5] however, to our knowledge this observation has not been verified.

Pathologic causes of halitosis

Disorders of the oral cavity

It is thought that disorders of the oral cavity cause 56% to 85% of all cases of halitosis.[6] Hence, it is important to understand how bad breath develops in these disorders.

Normal saliva generates an unpleasant odour after it has been incubated for 1 hour.[7] However, saliva from individuals with periodontitis becomes malodorous more rapidly; volatile compounds are produced through the putrefactive action of microorganisms on substances within the saliva, such as leukocytes, epithelial cells and mucopolysaccharides. However, putrefaction of saliva is only one source of oral halitosis; a healthy mouth is replete with proteinaceous materials ripe for putrefaction, the main ones being exfoliated epithelial cells and food debris.

While putrefaction may occur in everyone's mouth, the process is accentuated when degenerative and

From the departments of otolaryngology and family practice, McGill University and the Montreal General Hospital

Reprint requests to: Dr. E.L. Attia, Department of otolaryngology, Montreal General Hospital, 1650 Cedar Ave., Montreal, PQ H3G 1A4

inflammatory disorders are present. For example, gingivitis and periodontitis are almost always associated with severe halitosis.[8] Several factors enhance the putrefactive processes in such diseases: an increase in the number of bacteria, disintegrating epithelial cells or damaged leukocytes, reduced salivary flow and an increase in alkalinity in the oral cavity. No single type of microorganism is responsible for halitosis.[9] *Bacillus subtilus, Proteus vulgaris, Pseudomonas aeruginosa,* coliforms, *Bacteroides melanogenicus, Clostridium sporogenes* and *C. histolyticum* have all been associated with proteolytic activity in the mouth. The products of bacterial action that are primarily responsible for bad breath are methylmercaptan and hydrogen sulfide.[10]

Halitosis originating in the oral cavity is most frequently associated with poor oral hygiene, dental plaque, dental caries, gingivitis, stomatitis, periodontitis, hairy tongue and oral carcinoma. Dental plaque and hairy tongue are important sources of malodour, most of the odour emanating from the dorsoposterior surface of the tongue.[11] Carcinomas of the cheek, the floor of the mouth, the gum, the tongue and the palate, even when the lesions are small, tend to ulcerate and necrose; because they are usually secondarily infected, halitosis is a consistent problem. Carcinoma, while an uncommon cause of halitosis, must be considered in a patient with bad breath.

Oral halitosis, when it is not secondary to a specific disease, can usually be overcome with proper dental and periodontal care and good oral hygiene, which includes frequent brushing and flossing of the teeth and brushing of the tongue, so that bacteria and degenerating squamous cells are removed. The role of mouthwash and other commercial products in controlling halitosis is controversial. Such products probably serve only to mask bad breath and to increase salivary flow. However, the American Council on Dental Therapeutics believes that mouthwash does not substantially contribute to oral health.[12] Further, the Food and Drug Administration of the United States has advised the manufacturers of nine brands of mouthwash to stop using advertisements that claim that the mouthwash "effectively destroys bacteria that cause bad breath", because there is a lack of evidence for this action.[13] Unfortunately, such official actions seem to have had little effect on the public, which spends more and more each year on highly promoted and widely advertised breath deodorants.[14] The prolonged use of certain so-called deodorants, such as sodium perborate or hydrogen peroxide, is probably not only ineffective but also may have undesirable results, such as producing a black, hairy tongue.[12]

Disorders of the upper respiratory tract

Breathing through the mouth: Breathing through the mouth causes bad breath because the amount of saliva in the mouth is reduced by evaporation. There are several precipitating causes of breathing through the mouth, such as hypertrophied adenoids in children, a deviated nasal septum, allergic rhinitis and vasomotor rhinitis.

Sinusitis: Chronic suppurative sinusitis may produce a foul-smelling purulent discharge. If the sinusitis is secondary to an abscess at the root of one of the upper teeth the discharge will be present from the onset of the disease.

Foreign bodies: Long-standing nasal discharge that is unilateral and accompanied by a foul odour should be considered to be due to a foreign body until proven otherwise. The odour is caused by secondary infection, tissue necrosis or lack of normal drainage. The discharge should stop once the foreign body has been removed.[15]

Atrophic rhinitis (ozena): The inability of the nasal mucosa to cleanse itself because of atrophic changes with ciliary destruction results in the accumulation of dried nasal secretions that become infected. A characteristic foul odour (ozena) results. Frequent cleansing with normal saline and occasionally surgical interven-

Table I—Causes of halitosis

- Physiologic
  - Lack of flow of saliva during sleep
  - Food
  - Smoking
  - Menstruation
- Pathologic
  - Disorders of the oral cavity
    - Poor oral hygiene
    - Dental plaque
    - Dental caries
    - Gingivitis
    - Stomatitis
    - Periodontitis
    - Hairy tongue
    - Oral carcinoma
  - Disorders of upper respiratory tract
    - Breathing through the mouth
    - Chronic sinusitis
    - Foreign bodies
    - Atrophic rhinitis (ozena)
    - Wegener's granulomatosis (midline granuloma)
    - Tuberculosis
    - Syphilis
    - Rhinoscleroma
    - Adenoiditis
    - Nasopharyngeal abscess
    - Carcinoma of the larynx
    - Laryngoscleroma
  - Disorders of lower respiratory tract
    - Pulmonary abscess
    - Carcinoma of the lung
    - Other
      - Bronchiectasis
      - Necrotizing pneumonitis
      - Empyema
  - Gastrointestinal conditions
    - Salivary gland dysfunction
      - Dehydration
      - Anticholinergic drugs
      - Radiotherapy
      - Sjögren's syndrome
    - Peritonsillar abscess
    - Retropharyngeal abscess
    - Cryptic tonsillopathy
    - Vincent's angina
    - Carcinoma of the tonsil or pharynx
    - Pharyngitis sicca
    - Gangrenous angina
    - Zenker's diverticulum
    - Postcricoid carcinoma
    - Congenital bronchoesophageal fistula
  - Disorders of lower gastrointestinal tract
    - Gastric carcinoma
    - Hiatus hernia
    - Pyloric stenosis
    - Enteric infections
  - Neurologic disorders
    - Dysosmia
    - Dysgeusia
    - Zinc deficiency
  - Systemic diseases
    - Leukemia
    - Agranulocytosis
    - Febrile illness with dehydration
    - Ketoacidosis
    - Hepatic failure
    - Azotemia
  - Drugs
    - Lithium salts
    - Penicillamine
    - Griseofulvin
    - Thiocarbamide
    - Dimethylsulfoxide
  - Functional
    - Psychoses
    - Depression

tion to reduce the volume of the nasal chambers may help remedy the condition.[16]

Wegener's granulomatosis (midline granuloma): Wegener's granulomatosis is characterized by the development of necrotizing granulomas and vasculitis in the upper and lower respiratory tracts, and eventually systemic vasculitis and focal necrotizing glomerulonephritis. The respiratory tract, usually the nose and sinuses, is affected in most patients with this disorder, and almost always there is purulent malodorous rhinorrhea. The disease responds to cyclophosphamide therapy.[17]

Tuberculosis: Tuberculosis of the nose usually affects the cartilaginous septum just behind the vestibule. Apple jelly-like nodules on the septum eventually cause septal perforation, with nasal obstruction, crust formation and an offensive odour. The treatment is similar to that of tuberculosis occurring elsewhere.[18]

Syphilis: Syphilis of the nose may cause halitosis through gumma formation, which usually affects the nasal bones and surrounding tissues, thereby causing necrosis and an offensive odour. Also, the production of postsyphilitic atrophic rhinitis may cause halitosis.[19]

Rhinoscleroma: This is a protracted condition that occurs in the Middle East and eastern Europe. It has been associated with but not proven to be caused by the rhinoscleroma bacillus. The lesions are granulomatous and hypertrophic, and they usually become infected and malodorous. Rhinoscleroma can be controlled with long-term tetracycline therapy, sometimes in conjunction with radiation therapy.[20]

Adenoiditis: Adenoiditis may cause halitosis because the nasal passages become obstructed so that it is necessary to breath through the mouth, or because foul-smelling pus is produced.

Nasopharyngeal abscess: A midline nasopharyngeal pouch may be present either as a congenital abnormality (a remnant of Rathke's pouch) or, more commonly, as a result of adhesions in the adenoid furrows. When infection ensues, a nasopharyngeal abscess results that may intermittently drain spontaneously. Treatment consists of incision and drainage, followed by excision.[21]

Carcinoma of the larynx: Ulcerative and necrotic lesions of invasive carcinoma usually become infected with aerobic and anaerobic bacteria and halitosis results.

Laryngoscleroma: This condition is usually secondary to rhinoscleroma and can also be treated with long-term tetracycline therapy.

Disorders of the lower respiratory tract

Pulmonary abscess: Halitosis is sometimes the first symptom of a lung abscess and is often accompanied by fever, a productive cough and pleuritic pain. Several organisms, many of which are anaerobic, can cause the abscess. Treatment with appropriate antibiotics is usually successful.[22]

Carcinoma of the lung: This tumour usually occurs in one of the larger bronchi. The breakdown of tissue and secondary infection by anaerobic bacteria often produce bad breath.

Other: Bronchiectasis, necrotizing pneumonitis and empyema may all be associated with halitosis.[22]

Gastrointestinal conditions

Salivary gland dysfunction: Any condition that decreases salivary flow — for example, dehydration, the use of anticholinergic drugs, radiotherapy of the head and neck region, and Sjögren's syndrome (sicca syndrome) — may be associated with halitosis.

Peritonsillar abscess: A peritonsillar abscess usually produces temporary halitosis because of a foul-smelling purulent exudate, an inability to clear secretions because of difficulty in swallowing, and dryness of the mucosa secondary to fever and dehydration. Incision and drainage combined with antibiotic therapy is the management of choice.

Retropharyngeal abscess: Halitosis usually occurs in patients with a retropharyngeal abscess; the pathogenesis and treatment are the same as for a peritonsillar abscess.

Cryptic tonsillopathy: Large tonsils with prominent crypts allow epithelial cells to accumulate and mix with the saliva, which results in fermentation and putrefaction. Tonsillectomy is the only effective way of treating this condition.

Vincent's angina: Vincent's angina is caused by infection with *Bacillus fusiformis* and *Spirochaeta denticola*, and is characterized by a sore throat, foul breath, slight dysphagia and mild systemic manifestations. The infection causes ulceration of the tonsils, which are initially covered with a greyish-white pseudomembrane. After 2 or 3 days the membrane sloughs off, leaving an irregular ulcer surrounded by reddened tissue. Most patients recover within 2 weeks when treated with penicillin.

Carcinoma of the tonsil or pharynx: Ulceration and necrosis of tissue with secondary infection is common in carcinomas of the tonsil or pharynx and will cause halitosis.

Pharyngitis sicca: This condition is most frequently associated with atrophic rhinitis or chronic purulent sinusitis, but it can also occur as a complication of a chronic debilitating disease such as diabetes mellitus or chronic renal disease.[23]

Gangrenous angina: Usually gangrenous angina involves the pharynx, the tonsils and the soft palate. The disorder usually occurs secondary to diphtheria, scarlet fever, measles, smallpox or erysipelas and is most often seen in malnourished children. Appropriate antibiotic therapy and fastidious oral hygiene are usually effective.

Zenker's diverticulum: Accumulation of saliva or food residue in Zenker's diverticulum will inevitably cause putrefaction and bad breath; however, surgical correction of the condition will eliminate the problem.

Postcricoid carcinoma: Carcinoma of the hypopharynx, like other pharyngeal or oral carcinomas, is frequently associated with halitosis.

Congenital bronchoesophageal fistula: This rare condition has been reported to cause halitosis; however, it may not be discovered until adulthood.[24]

Disorders of the lower gastrointestinal tract

There is controversy as to whether conditions below the gastroesophageal junction can cause halitosis. Nu-

merous reports in the literature describe halitosis associated with gastric carcinoma, hiatus hernia and pyloric stenosis,[25] as well as with enteric infections. However, the current view is that halitosis, if present in conjunction with these disorders, is actually caused by disorders of the oral cavity. The unpleasant odour emitted from the lower gastrointestinal tract is only detectable during retching or vomiting, because the esophagus is normally collapsed.

Neurologic disorders

Patients with neurologic conditions that cause a disordered sense of smell (dysosmia) may believe they have halitosis; this is referred to as subjective halitosis because other people cannot detect an odour.

Because of the close relation between taste and smell, conditions that cause a disordered sense of taste (dysgeusia) may also give rise to subjective halitosis. A syndrome characterized by idiopathic hypogeusia with dysgeusia, hyposmia and dysosmia was described by Henkin[26] in 1971; it usually occurs immediately after an acute febrile illness involving the respiratory tract. The syndrome used to be considered idiopathic, but it is now known that patients with this disorder often have decreased serum zinc levels and that treatment with zinc will usually alleviate the symptoms.[27]

Systemic diseases

Conditions like leukemia and agranulocytosis are usually characterized by severe buccal manifestations similar to those of periodontitis. Halitosis is usually caused by necrotizing inflammation of the gingivae and buccal mucosa and a decreased flow of saliva.

Although almost any systemic disease, especially if associated with fever and dehydration, will cause halitosis, some systemic diseases produce specific odours; for example, ketoacidosis produces a sweet or fruity odour, hepatic failure a mousy amine odour and azotemia a smell of ammonia.[28]

Drugs

Drugs can either alter the senses of taste and smell (e.g., lithium salts, penicillamine, griseofulvin and thiocarbamide[29]), thus causing subjective halitosis, or can be excreted in the breath (e.g., dimethyl sulfoxide, which produces an odour of stale oysters).[30]

Functional abnormalities

Subjective halitosis may occur as a manifestation of a mental disorder, usually a psychosis. For example, if patients complain of "rotten" breath and say their lungs and stomach are "rotting away" they probably have a psychosis. Such patients may also complain of bad smells around them. An examination of mental status will confirm the diagnosis. In these cases treatment with major tranquillizers is usually necessary. In patients with depression, halitosis is usually just one of many somatic complaints.

Making the diagnosis

History-taking

To determine the diagnosis in a patient presenting with halitosis it is essential to carefully examine his or her history.

A short duration of symptoms suggests an infectious source, such as Vincent's angina or stomatitis, or an oropharyngeal or lung abscess, recent drug use, a severe systemic disease, recent experimentation with ethnic cooking or, in a child or a psychotic patient, a foreign body in the nose. A long duration of symptoms is more consistent with persistently poor oral hygiene, carcinoma of the mouth, pharynx or upper respiratory tract, or bronchiectasis. Intermittent halitosis may be sleep- or food-induced, although halitosis associated with a Zenker's diverticulum or a nasopharyngeal abscess may also be intermittent, occurring when the diverticulum empties or the abscess drains.

Patients who do not visit a dentist regularly are at high risk of halitosis from dental plaque, dental caries or periodontitis.

It is important to ascertain whether the halitosis is subjective or objective. Most cases are objective, but subjective halitosis may occur with the use of medications, such as lithium, with zinc deficiency or in association with some psychoses.

Nasal symptoms, such as discharge, crusting, bleeding or blockage, raise the possibility of a foreign body, vasomotor, allergic or atrophic rhinitis, hypertrophied adenoids or carcinoma. Breathing through the mouth is usually secondary to nasal obstruction caused by allergic, infectious or vasomotor rhinitis, particularly in association with septal deviation or, in children, enlarged adenoids. Because dryness of the mouth is almost always associated with halitosis, dehydration, the use of anticholinergic agents and Sjögren's syndrome should also be considered. Also, a purulent postnasal drip caused by sinusitis, adenoiditis or a nasopharyngeal abscess will often cause halitosis.

In patients with head and face pain halitosis may be coincidental, but sinusitis or a malignant disorder of the nasopharynx, tongue or paranasal sinuses should be considered. Acute symptoms can usually be related to gingivostomatitis, tonsillitis, pharyngitis, a peritonsillar or retropharyngeal abscess, or acute adenoiditis. A persistently sore throat, particularly in elderly patients, should be considered secondary to carcinoma until proven otherwise.

If a patient cannot taste food, he or she may have a nasal obstruction and objective halitosis. On the other hand, a patient with zinc deficiency may have both a disordered sense of smell and subjective halitosis.

Carcinoma of the larynx or lung must be considered in elderly patients complaining of hoarseness and halitosis. When halitosis is associated with a cough, the production of sputum or hemoptysis one should suspect lung carcinoma, bronchiectasis, a pulmonary abscess or, rarely, communicating empyema or a tracheobronchial fistula.

The use of drugs such as lithium, penicillamine and griseofulvin may cause subjective halitosis. Dimethyl sulfoxide causes objective halitosis, and anticholinergic drugs may cause halitosis by decreasing the flow of saliva.

Weight loss, fever, joint pains and alcohol abuse suggest a primary systemic cause for the halitosis, such

as sepsis and dehydration, agranulocytosis, carcinoma, Sjögren's syndrome or hepatic failure.

If the patient uses strange or unusual terms to describe his or her symptoms, subjective halitosis secondary to a psychosis should be considered.

Physical examination

A careful physical examination will usually pinpoint the cause of halitosis. In most cases attention should first be directed to the oral cavity and pharynx. All areas of the oral mucosa, including the buccal gutters, the floor of the mouth, the lateral aspects of the tongue and all of the hard palate, should be carefully inspected, as should the teeth and gums. Palpation with a gloved index finger is often a useful supplementary examination, not only to evaluate suspicious-looking lesions seen on the initial inspection but also to detect hidden lesions — for example, on the posterior pillar of the tonsil, on the posterior third of the tongue or low in the nasopharynx behind the soft palate. The paranasal sinuses should be palpated and percussed, and the nasal passages should be examined with a nasal speculum.

If the cause of the halitosis is still not obvious a complete physical examination and a mirror examination of the nasopharynx, hypopharynx and larynx is indicated.

Further investigation

Roentgenography, cultures, cytologic examinations, biopsies and other investigations should be ordered if indicated by the history and the physical findings. However, in most cases of halitosis these procedures will serve only to confirm the diagnosis.

Conclusion

Halitosis is an important symptom and sign. While it is usually due to benign oral disorders it may be the first manifestation of a serious or even fatal disease. Therefore, a careful evaluation of patients presenting with this problem is indicated. The cause can usually be identified and treatment instituted, to the intense relief of not only the patients, but also their families, friends and medical advisers.

References

1. SCHNEYER LH, PIGMAN W, HANAHAN L, GILMORE RW: Rate of flow of human parotid, sublingual and submaxillary secretions during sleep. *J Dent Res* 1956; 35: 109–114
2. SILVERSTINE CT: Garlic breath odor. *Ohio State Med J* 1936; 32: 1233
3. CROHN BB, DROSD R: Halitosis. *JAMA* 1941; 117: 2242–2245
4. CHERASKIN E, LANGLEY L: *Dynamics of Oral Diagnosis*, Year Bk Med, Chicago, 1956: 400–403
5. MASSLER M, EMSLIE RD, BOLDEN TE: Fetor ex ore. *Oral Surg* 1951; 4: 110–125
6. SULSER GF, BRENING RH, FOSDICK LS: Some conditions that affect odor concentration of breath. *J Dent Res* 1939; 18: 355–359
7. BERG M, BURRILL DY, FOSDICK LS: Chemical studies in periodontal disease; putrefaction rate as index of periodontal disease. *J Dent Res* 1947; 26: 67–71
8. TONZETICH J: Production and origin of oral malodor: a review of mechanisms and methods of analysis. *J Periodontal* 1977; 48: 13–20
9. MCNAMARA TF, ALEXANDER JF, LEE M: The role of microorganisms in the production of oral malodor. *Oral Surg* 1972; 34: 41–48
10. TONZETICH J: Direct gas chromatographic analysis of sulphur compounds in mouth air in man. *Arch Oral Biol* 1971; 16: 587–597
11. LAW DB, BERG M, FOSDICK LS: Chemical studies in periodontal disease. *J Dent Res* 1943; 22: 373–379
12. CERAVOLO FG, BAUMHAMMERS A: Halitosis (abstr). *Periodont Abstr* 1973; 21: 151
13. Labelling of mouth wash, mouth fresheners, and gargle preparations. *Fed Reg* 1970; 21 (pt 3)
14. EVERETT FG: Halitosis. *J Ore Dent Assoc* 1971; 41 (2): 13
15. KEOGH CA: Affections of the external nose and nasal cavities. In SCOTT-BROWN WG, BALLANTYNE J, GROVES J (eds): *Disease of Ear, Nose and Throat*, vol 1, 2nd ed, Butterworth, London, 1965: 75–103
16. WILLIAMS HL: Infections and granulomas of the nasal airways and paranasal sinuses. In PAPARELLA MM, SHUMRICK DA (eds): *Otolaryngology*, vol 3: *Head and Neck*, Saunders, Philadelphia, 1973: 27–38
17. BATSAKIS JG: *Tumors of Head and Neck: Clinical and Pathological Considerations*, 2nd ed, Williams & Wilkins, Baltimore, 1979: 492
18. ST CLAIR THOMSON: Tuberculosis of the upper air-passages. In *Diseases of the Nose and Throat: a Textbook for Students and Practitioners*, 6th ed, revised by NEGUS VE, BATEMAN GH, Cassell, London, 1955: 860-874
19. Idem: Syphilis of the upper air passages. Ibid: 897–904
20. Idem: Other infective diseases. Ibid: 926–933
21. LEDERER FL: Chronic pharyngitis. In *Diseases of the Ear, Nose and Throat: Principles and Practice of Otorhinolaryngology; Clinical Techniques and Procedures*, 6th ed, Davis, Philadelphia, 1952: 746–752
22. BARTLETT JG, FINEGOLD SM: Anaerobic pleuropulmonary infections. *Medicine (Baltimore)* 1972; 51: 413–450
23. ST CLAIR THOMSON: Pharyngitis; retropharyngeal abscess. In *Diseases of the Nose and Throat: a Textbook for Students and Practitioners*, 6th ed, revised by NEGUS VE, BATEMAN GH, Cassell, London, 1955: 477–492
24. HILL DG: Congenital esophago-bronchial fistula in an adult. *Br J Surg* 1972; 59: 921–922
25. TYDD TF, DYER NH: Pyloric stenosis presenting with halitosis. *Br Med J* 1974; 3: 321–326
26. HENKIN RI: Idiopathic hypogeusia with dysgeusia and hyposmia, and dysosmia. A new syndrome. *JAMA* 1971; 217: 434–440
27. HUSSEY HH: Taste and smell deviations: importance of zinc (E). *JAMA* 1974; 228: 1669–1670
28. DELP MH, MANNING RT: *Major's Physical Diagnosis*, 8th ed, Saunders, Philadelphia, 1975: 209
29. ERIKSSEN J, SEEGAARD E, NAESS K: Side-effect of thiocarbamides (C). *Lancet* 1975; 1: 231–232
30. KUTSCHER AH, ZEGARELLI EV, EVERETT FG: DMSO in stomatologic research. *Ann NY Acad Sci* 1967; 141: 465–470

Home cures for bad breath

Epsom salts, one drachm, tincture of calumba, two drachms, infusion of roses, one and a half ounces. Mix. To be taken once or twice a week before breakfast.*

To four ounces of prepared lime-water add a drachm of Peruvian bark; wash the teeth with this water before breakfast and after supper; it will effectually destroy the tartar, and remove the offensive smell from those which are decayed.

—Reprinted from "The Book of Home Remedies and Herbal Cures" (copyright 1979 by Jonathan–James Books), by Carol Bishop, Octopus Books Ltd, London, Engl, 1979: 147

**Calumba is a climbing plant indigenous to the forest of Mozambique and is sometimes used as a mild tonic.*