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HALITOSIS: A SOCIAL STIGMA

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Abstract: Halitosis also known as Bad breath, is the most common complain of individual reporting to the dental practitioners. It can result in anxiety among the individuals affected. The halitosis is mainly divided into true and false type. Etiology of halitosis is multifactorial however the 90% of cases have oral origin and only 10% cases have extraoral etiology. Mainly volatile sulphur compounds are responsible for intraoral halitosis. Prevalence of halitosis is reported from 5% to 75% in reported cases. Various manual as well as advanced techniques are available for the diagnosis of halitosis. The treatment depends on the underlying cause. Management may include simple measures such as scaling and root planing, instructions for oral hygiene, tongue cleaning, and mouth rinsing. The aim of this review was to describe the etiological factors, prevalence, diagnosis and the management of halitosis.

Keywords: Bad breath, full mouth disinfection, sulfide probe, tongue coating, volatile sulphur compounds.

1. Introduction : The word halitosis is a latin word, derived from ‘halitus‘ meaning exhaled air and the word ‘osis‘ meaning pathologic changes. Halitosis or oral malodor is a multifactorial health issue adversaly affecting the psychological and social well being of an individuals. Halitosis, also known as foetor ex ore, breath odor, bad breath, oral malodor and offensive breath, is a common symptom in patients with periodontal and odontogenic infections. These infections lead to an increase in Gram-negative bacteria in the oral cavity producing volatile sulfur compounds which causes the bad odor to the breath. This undesirable condition is a common complaint of indivisuals of all age groups. Halitosis is a symptom leading to social anxiety, resulting in embarrassment with all its consequences [1]. Halitosis was first reported by Jewis Talmud and some Greek and Roman writers in the literature. Joseph Howe in 1874 published a monograph about the origin of modern literature on haitosis [2]. Present review describes the etiological factors, prevalence, diagnosis, and the therapeutic management of halitosis.

2. Prevalence

The prevalence of halitosis is from 5% to 75% in children[3]. Nachnani S et. Al observed halitosis in more than 50% of the population [4]. In a Swedish study by Soder B et.al. halitosis was present only in around 2% of the population [5]. However, halitosis prevalence in a China study of 2500 participants was present in 27.5% population [6]. There are different prevalence of halitosis due to differences in evaluation methods, socioeconomic conditions, geographic location and oral hygiene habits.

3. Types of Halitosis :

3.1. True halitosis: True halitosis is the condition in which actual odour or bad breath is coming from the oral cavity. It halitosis can be of two types: a) physiological and b) pathological halitosis. Physiologic halitosis is mainly caused by dietary components, deleterious habits, and morning breath, secondary to the xerostomia caused by physiologic factors. Pathologic halitosis occurs due to pathological oral conditions like gingival and periodontal diseases like periodontitis, acute necrotizing ulcerative gingivitis, residual post-operative bleeding, debris under dental appliances, ulcerative lesions of the oral cavity. Halitosis may be associated with tongue coating or may occur due to decreased salivation secondary to salivary gland diseases, tonsilloliths [7].

3.2. Pseudo halitosis: Patients who suffer from pseudo halitosis complain of the existence of bad breath or odour though it is not perceived by others. This condition can be managed effectively by patient counseling using literature support, patient motivation, education and explanation of halitosis evaluation results and oral hygiene measures like oral prohylaxis. In halitophobia some individuals continue to insist that they have bad breath even after the halitosis has been treated.

3.3. Psychogenic Halitosis: In Psychogenic Halitosis actual halitosis is not present however person thinks that bad breath or odour is coming from oral cavity. It is imaginary condition. This problem may occur in people who tend to exaggerate normal body sensations. Sometimes this is caused in psychological condition such as schizophrenia. In such condition patient counciling plays an important role and if the problem continues, person should take help from psychotherapist [8].

4. Microbiology of Halitosis:

Table 1: Bacteria which is active producers of volatile sulfur compounds in vitro

Hydrogen sulfide from cysteine	Methyl mercaptan from methionine	Hydrogen sulfide from serum	Methyl mercaptan from serum
Peptosteptococcus anaerobius	Fusobacterium nucleatum	Prevotella intermedia	Treponema denticola
Microsprevotii	Fusobacterium periodonticum	Prevotella loescheii	Porphyromonas gingivalis
Eubacteriumlimosum	Eubacterium spp.	Porphyromonas gingivalis	Porphyromonas endodontalis
Bacteroides spp.	Bacteroides spp.	Treponema denticola	
Centipedia periodontii			
Selenomonas artermidis			

5. Etiology of Halitosis

Origin of halitosis in 90% of the patient is from oral cavity whereas in 9% of patient source of halitosis is extraoral such as respiratory system, gastrointestinal system, urinary system or other systemic conditions. In about 1% of patients, the halitosis is due to some products in diet or medications [9]. Researcher has found that halitosis occur mainly due to volatile molecules which are produced by microbial metabolism within saliva, dental plague , dorsum of tongue, gingival sulcus and periodontal pocket [10] These volatile compounds are sulphur compounds, aromatic compounds, nitrogen-containing compounds, amines, short-chain fatty acids, alcohols or phenyl compounds, aliphatic compounds, and ketones[11]. These compounds are mainly hydrogen sulfide and methyl mercaptan. They are produced by bacteria through the enzymatic reactions of sulphur containing amino acids L-cysteine and L-methionine [12]. Some bacteria produces hydrogen sulfide and methyl mercaptan from serum also. Extra-oral or blood-borne halitosis is caused by dimethyl sulfide [13].Ketones such as acetone, benzophenone, and acetophenone are present in both alveolar (lung) and mouth air; indole and dimethyl selenide are present in alveolar air [14]

Table 2: Compounds associated with Halitosis [15], [16]

Categories	Compounds
Volatile sulphur compounds	Methyl mercaptan: CH3SH Hydrogen sulphide: H2S Dimethyl sulphide: (CH3)2S
Diamines	Putrescine: NH2(CH2)4NH2 Cadaverine: NH2(CH2)5NH2 Butyric acid: CH3CH2CH2COOH Propionic acid: CH3CH2COOH Valeric acid: C5H10O2
Phenyl compounds	Indole: C8H7N Skatole: C9H9N Pyridine: C5H5N
Alcohols	1-propoxy-2-propanol
Alkalines	2-methy-propane
Nitrogen-containing compounds	Urea: (NH2)2CO Ammonia: NH3

5.1. Intraoral causes of halitosis [17]

- Poor oral hygiene,
- Food impaction
- Tongue coating
- Periodontal pockets
- Acute necrotizing ulcerative gingivitis
- Chronic and aggressive periodontitis
- Vincent's disease
- Dry socket
- Xerostomia
- Oral ulceration
- Oral malignancy
- Exposed tooth pulps
- Nonvital tooth with fistula
- Dentures/ prostheses

5.2. Extraoral causes of Halitosis :

- Respiratory disease
- Foreign body (nose/lung)
- Sinusitis
- Tonsillitis
- Tonsilloliths
- Malignancy (e.g., antral, pharyngeal)
- Bronchiectasis
- Subphrenic abscess
- Gastrointestinal and hepatic disease
- Pharyngeal pouch
- Zenker diverticulum
- Pyloric stenosis or duodenal obstruction
- Aorto-enteric anastomosis
- Gastroesophageal reflux disease and
- Helicobacter pylori infection
- Hepatic failure (foetorhepaticus)
- Leukemias
- Renal disease
- Renal failure (usually end-stage renal failure)
- Endocrine Diabetic ketoacidosis
- Menstruation (menstrual breath)
- Metabolic Trimethylaminuria
- Hypermethioninemia

5.3. Other Causes of Halitosis:

- Volatile food stuffs
- Garlic
- Onions
- Spiced foods
- Drugs
- Alcohol
- Tobacco
- Betel
- Solvent abuse
- Chloral hydrate
- Nitrites and nitrates
- Dimethyl sulfoxide
- Disulphiram
- Some cytotoxics

- Phenothiazines
- Amphetamines
- Paraldehyde

6. Assessment of Halitosis

Halitosis affects individual's routine life negatively, most of individuals who complain about halitosis report to the dental clinic for treatment however in some cases halitophobia or pseudo halitosis is present, there is no measurable halitosis. Assessment methods of halitosis ensure differentiation of pseudo-halitosis from halitophobia. For these reasons, assessment of the halitosis, and assessment of its severity is important. Therefore, the various diagnostic methods of halitosis were developed. Organoleptic scoring, gas chromatography, sulfide monitoring (Halimeter), the BANA test, and chemical sensors and diamond probe have most commonly used than the other methods such as quantifying β-galactosidase activity, salivary incubation test, ammonia monitoring, ninhydrin method.

6.1. Organoleptic scoring [18]**:** The first and simplest way for detection of halitosis by smelling the exhaled air from the mouth and nose is called organoleptic measurement. The measurement method is the organoleptic test; the patient takes breathe deeply by inspiring the air by nostrils and holding awhile, then expiring by the mouth directly or via a pipette, while the examiner sniffs the odour at a distance of 20 cm (the purpose of using a pipette is to lessen the intensity of expiring air) and the severity of odour is classified into various scales, such as a 0- to 5-point scale

Table 3: Organoleptic Scoring Criteria

Rosenberg & McCulloch scale	• 0 : No odour
	• 1 : barely noticeable odour
	• 2 : slight but clearly noticeable odour
	• 3 : moderate odour
	• 4 : strong odour
	• 5 : extremely strong odour

This measurement is the gold standard for measuring and assessing the halitosis because of no-cost, and being practical and simple. However, it has some limitations. It may be difficult to calibrate the practitioner and to gain the correct result; in clinical practice, the patient should avoid from eating odoriferous foods for 48 h before the assessment and that both the patient and the examiner should refrain from drinking coffee, tea or juice, smoking and using scented cosmetics before the assessment [19].To lessen unpleasant situations instead of expiring air to examiners, the patient can breathe the air inside the bag a while, then the examiner sniff this odor from the bag and classify its severity.

The organoleptic evaluation of halitosis also includes other simple tests such as tongue odour test, dental floss odour test and saliva odour test [20].

6.2. Spoon test: The spoon test is used to evaluate halitosis originating from the posterior part of the dorsum of the tongue. A sterile plastic spoon is used to scrape the dorsum of the tongue. After about 5 seconds, the halitosis from the contents of the spoon is evaluated, holding the spoon about 5 cms away from the evaluator's nose.

1. Dental floss odour test: This test is used to assess the odour originating from the interdental regions. The examiner passes a sufficient length of unwaxed dental floss through the interdental regions of posterior teeth. The odour is assessed by holding the floss about 3 cms from the nose.
2. Saliva odour test: The patient is instructed to expectorate about 1-2ml of saliva into a glass tube. The tube is covered immediately and incubated at 37^0C for five minutes. The glass tube is then held about 4 cms away from the nose for assessing odour.

6.3. Gas chromatography

Recently portable machine, Oral Chroma is being introduced to quantify the sulphur content of the oral breath. This technology is specifically designed to digitally measure molecular levels of the three major VSCs (hydrogen sulfide, methyl mercaptan, and dimethyl sulfide) in a sample of mouth air. In expired air, almost 500 different substances can be demonstrated [21]. It differentiate and analyses volatile sulphur compounds that can be evaporated without breakdown; samples are collected from saliva, tongue coating, or exhaled breath. In this method, measurements are performed and equipped with a flame photometric detector or by producing mass spectra. The concentration of each VSC (ng/10 mL mouth air) was determined based on a standard of hydrogen sulfide and methyl mercaptan gas prepared with a permeater [22] In the gas chromatography method, the patient closes the mouth and hold air for 30 seconds, then mouth air (approx. 10 ml) is aspirated using a gas-tight syringe. After aspiration of breath, it is injected into the gas chromatograph column at 70°C. The results are precise and reliable, but this method is time consuming and expensive. Mostly, the results of the gas chromatography method show high correlation to

organoleptic measurements but gas chromatography has high sensitivity and it can detect low concentration of molecules.

6.4. Sulfide monitoring

A portable sulfide monitor was developed to overcome the limitations of gas chromatography to measure VSCs in oral breath. In this method before taking measurement, patients should close the mouth and refrain from talking food for 5 min prior to measurement, then a disposable tube of the sulfide monitor is inserted into patient's mouth to collect mouth air. Meanwhile, the patient is breathing through the nose and the disposable tube is connected to the monitor. Sulfur-containing compounds in the breath can generate an electro-chemical reaction. This reaction related directly with levels of volatile sulfur compounds present in the breath [23].

The sensitivity and specificity of the portable sulfide monitor is less than the gas chromatography but correlations of measurements are highly significant. On the other hand, the sulfide monitor and organoleptic scoring show low correlation because of volatile compounds such as alcohols, phenyl compounds, alkenes, ketones, polyamines [24].

6.5. Diamond Probe®/Perio 2000® System

The new periodontal probe system "Diamond Probe®/Perio 2000® System," is an innovative periodontal probe with a sulfide microsensor on the tip. Its intended use is to detect the presence of sulfides in the periodontal pocket as an indicator of gram-negative bacterial activity, also evaluate probing depths and assess bleeding upon probing and halitosis.

6.6. Photodynamic Therapy

Photodynamic therapy has shown significant results in the treatment of halitosis [25]. Photodynamic therapy involves the projecting of energy from the activated photosensitizer activated by exposure to light of a specific wavelength resulting in a reduction of the concentration of VSCs. It mainly reduces the bacterial load which are producing sulphur compounds in the periodontal pocket and hence help eliminate halitosis.

6.7. Tongue Sulfide Probe :

Recently tongue sulfide probe has been developed to detect the sulfide compounds present in the tongue coating. This probe assesses the correlation between sulfide level on the dorsum of tongue and oral malodour [26].

6.8. Chemical sensors

Because of limitations of gas chromatography and less sensitivity of sulfide monitors, a more sensitive and simpler device was made. Chemical sensor has an integrated probe to measure sulphur compounds from tongue coating and subgingival area. Through the sulfide-sensing probe, sulfide compounds generate an electrochemical voltage and this voltage is measured by an electronic unit. The measurement is shown on device screen as a digital score [26] New chemical sensors detect ammonia and methyl mercaptan compounds in the breathed air and new types of sensors measure each volatile sulphur compounds separately. The sensitivity is similar to the gas chromatography and results are highly close to organoleptic scoring therefore chemical sensors are also called as electronic nose [27].

6..9. BANA test

The BANA test is used to determine the proteolytic activity of certain oral anaerobes that contribute to halitosis. *P*. gingivalis, *T*. denticola, and *B*. forsythus produces by-products that are quite odiferous, and as a result contribute to bad breath. The BANA test is chairside test strip composed of benzoyl-DL-arginine-a-naphthylamide and detects short-chain fatty acids and proteolytic obligate gram-negative anaerobes, which hydrolyze the synthetic trypsin substrate and cause halitosis [28].

The debris from subgingival area and tongue dorsum are placed on the BANA test strip, which is then inserted into a slot on a small toaster-sized incubator. The incubator automatically heats the sample to 55° for 5 min and changes the colour of test strip to blue or deep blue. Deepening of the blue colour shows presence of higher concentration and number of *P*. gingivalis, *T*. denticola, and *B*. forsythus. These red complex microorganisms are responsible for halitosis.

6.10. Quantifying *β*-galactosidase activity

Deglycosylation of glycoproteins are initial step in oral malodour production. By deglycosylation of glycoproteins, proteolytic bacteria degrade proteins which are especially salivary glycoproteins and cause halitosis. Proteolysis of glycoprotein depends on the initial removal of the carbohydrate O- and N-linked side-chains of carbohydrates. β-Galactosidase is one of the important enzymes which removes both O- and N-linked carbohydrate side-chains [29]. β-Galactosidase activity can be easily determined by chromogenic substrates absorbed onto a chromatography paper disc. Saliva was collected in a paper disc to measure β-galactosidase activity and colour changes based on β-galactosidase activity are recorded [30];

- no color : 0,
- faint blue color: 1,
- moderate to dark blue color: 2 .

6.11. Salivary incubation test

First time, Marc Quirynen *et al*. [31] evaluated the correlation between salivary incubation and halitosis. Saliva was collected in a glass tube and then incubating the tube at 37°C in an anaerobic chamber under an atmosphere of 80% nitrogen, 10% carbon dioxide, and 10% hydrogen for 3-6 hours. After incubation, an examiner evaluates the odour of saliva. Although this method has some similarities with the organoleptic measurements, it has some advantages over them. The most important advantage is that the salivary incubation test has much less influence of smoking, drinking coffee, eating garlic, onion, spicy food, and scented cosmetics. If the hardness of the incubation process does not be counted, the salivary incubation test could be one of the valuable tests for halitosis measurements.

6.12. Ammonia monitoring

Besides VSCs, ammonia is another important factor present in oral breathed air. Breathed air contains high levels of ammonia; it is 1 ppmv in the breath of a healthy individual or may be higher in individuals with renal disease [32]. A new portable monitor has been developed to detect ammonia level in breathed air produced by oral bacteria. At least 2 hours before measurements, the patients should refrain from eating and drinking activity. Then patients use special mouth rinse for 30 seconds and close the mouth for 5 minutes. This rinse includes urea solution and the bacteria produce ammonia from urea. A disposable mouth piece of the ammonia monitor is placed inside a patient's mouth and disposable part connected to an ammonia gas detector which contained a pump that drew 50 ml of air through a tube and the concentration of ammonia is measured directly from the scale on the detector tube [33].

6.13. Ninhydrin method

Breakdown of peptides and glycopeptides by bacterial putrefaction in the oral cavity produces gases in the oral cavity leads to halitosis. During this process, peptides are hydrolysed to amino acids which further are metabolized to amines or polyamines. These molecules can not be measured by sulfide monitoring. Hence, the ninhydrin method was used for examination of amino acids and low-molecular-weight amines in the saliva.

The ninhydrin method is simple, rapid, and inexpensive. This method is a kind of colorimetric reaction. The collected saliva is mixed with isopropanol and centrifuged. The supernatant was diluted with isopropanol, buffer solution (pH 5), and ninhydrin reagent. The mixture was refluxed in a water bath for 30 minutes, cooled to 21 8°C, and diluted with isopropanol. Light absorbance readings were determined using a spectrometer [34].

7. Management of Halitosis: The management of halitosis is ideally a multidisciplinary approach. It is necessary to correct the causes of food impaction, plaque retention by restorative or prosthetic measures. Sometime orthodontic treatment of malocclusion is also helpful to eliminate plaque retention. After correction of underlying causes of food impaction and plaque retention, the treatment of halitosis is initiated by nonsurgical periodontal therapy. Halitosis is managed by combination of mechanical and chemical periodontal therapy at individual and professional level. Patient motivation, education and psychological counseling plays an important role in the management of halitosis.

7.1. Individual Mechanical therapy: It consist of demonstration of brushing techniques and interdental cleansing aids for the disruption of bacterial plaque as it is the main cause of halitosis. Brushing techniques has limitations of removing complete bacterial plaque from the subgingival, interproximal areas. This the reason brushing techniques are supplemented by chemical plaque control agents in the management of halitosis.

- In healthy periodontium modified Bass brushing technique is most effective for the removal of bacterial plaque from subgingival and interproximal area.
- In cases of gingival recession, modified Stillman brushing technique is most promising method of plaque control.
- After the surgical periodontal therapy Charter's brushing technique is best to eliminate plaque from the dentition.
- To remove plaque from interproximal areas interdental cleansing aids are always supplemented to the brushing techniques.

7.2. Self-care chemical products

Halitosis interferes with normal well social well-being of an individual leading to psychological disturbances. For these reasons, self-care products are used by halitosis patients for preventing unpleasant odour. However, by these products direct treatment of halitosis is not possible; these products such as

chewing gum and mints, toothpastes, mouth rinses, and sprays decrease the odour up to some extent by masking effect but it is not possible to eliminate the halitosis. The use of chewing gum may decrease halitosis, especially through increasing the salivary secretion [35]. Mouth rinses containing chlorine dioxide and zinc salts have a substantial effect on masking halitosis, not allowing the volatilization of the unpleasant odour [36]. Especially halitosis caused by dietary products such as onion, garlic, or cigarette can be masked by these approaches. These approaches should only be used as a temporary solution to relieve and improve the satisfaction of the patient. Professional treatment of halitosis is most important.

7.3. Professional treatment

For complete treatment of halitosis, etiology of halitosis should be ruled out before commencing the professional treatment. Although 90% etiologies are intraoral, extraoral source of halitosis is also to be ruled out. In some cases of halitosis multidisciplinary approach is required. In intraoral halitosis, reduction of the bacterial load is essential. Appropriate initial periodontal treatment includes scaling and root planing to eliminate debris and bacterial plaque. In periodontal therapy of halitosis use of antibacterial mouth rinse minimize the bacterial load. Chlorhexidine is gold standard of chemical plaque control agent used however long-term therapy by chlorhexidine may cause adverse effect on teeth and mucosal surfaces.

One of the studies showed the importance of tongue cleaning; reduction of VSC levels was found with the toothbrush 33%, with the tongue scraper 40%, and with the tongue cleaner 42% [37].

Quirynen et. al has evaluated the full mouth disinfection protocol for the complete removal of plaque and disinfection of oral niches. Full mouth disinfection is very effective in management of halitosis.

Table 4: Protocol of Full Mouth Disinfection [38]

1-Full mouth scaling and root planing	Full mouth scaling and root planing is done in two visits within 24 hours, under local anesthesia
2-Tongue brushing	Tongue brushing is done for 1 minute, with 1% chlorhexidine gel
3-Mouthwash is used	10 ml of 0.2% Chlorhexidine mouthwash is used 2 times, for 1 minute and in last 10 seconds gargle is done in such a way to reach the tonsils
4-Subgingival irrigation of all pockets	Subgingival irrigation with 1% CHX gel 3 times, for 10 minutes, after each of the sessions of scaling and root planing. Irrigation is repeated at day 8, using a 6 and 8 mm syringe labelled
5-Mouthwash (at home)	10mL of CHX at 0.2%, twice a day for 1 minute, over 2 weeks
6-Oral hygiene instructions	Tooth brushing, interdental cleaning with brushes or other hygiene aid, brushing of the tongue

Causes of food impaction such as occlusal wearing, loss of proximal contacts, extrusion beyond occlusal surfaces of adjacent tooth, congenital morphologies and improper restorations must be reviewed and treated. Also existing of the non-restored cavity of decayed teeth, nonvital tooth with fistula or exposed tooth pulps may create a reservoir area for bacteria, so treatments of these teeth with proper restoration are important.

The other conditions causing halitosis such as xerostomia, pericoronitis, oral ulceration, or malignancy which must be diagnosed and treated well in advance. Mostly, xerostomia causes decreased salivation which affects cleaning of the oral structures and teeth, that should be managed. The reasons of xerostomia must be examined in detail. If xerostomia caused by head and neck radio therapy or salivary glands pathology, the artificial saliva products must be suggested to the patients.

Medical conditions or history can be evaluated and managed to treat the halitosis. If halitosis originate from nonoral causes such as respiratory, gastrointestinal and hepatic, renal, endocrine or haematological disease, patient should be referred to specialist for consultation and management of medical systemic condition.

As mentioned above, detailed clinical examination on halitosis is crucial. Sometimes people may have halitophobia and this condition can be mono symptomatic delusion (“delusional halitosis”) or manifestation of olfactory reference syndrome. Management of halitophobia is more complex than management of real halitosis. Halitophobia persons avoid socializing and even avoids talking with people; therefore, treatment of halitophobia is very important. Prior to treating people who have halitophobia, it must be proven that he/she has no measurable halitosis by measuring devices.

8. Conclusion : Halitosis is an offensive smell of the exhaled air mainly in subjects with oral or periodontal diseases. If these oral conditions are not diagnosed at initial level, it leads to production of volatile sulphur compound which is the main source of halitosis. Halitosis is a social issue affecting individual’s day to day life. With accurate diagnosis, evaluation of the causes of halitosis and timely referrals to specialist if needed a successful management of halitosis is possible. It is significant to highlight the necessity of an interdisciplinary approaches for the management of halitosis to prevent misdiagnosis or unnecessary

treatment. As halitosis is a recognizable common complaint among the general population. The primary healthcare practitioner should also be trained to diagnose, classify and manage patients that suffer from this socially debilitating condition.

References

[1] Zaitsu T, Ueno M, Shinada K, Wright FA, Kawaguchi Y. "Social anxiety disorder in genuine halitosis patients" Health Qual Life Outcome. (2011), 9, pp. 94.

[2] Rosenberg M. "Clinical assessment of bad breath-Current concepts" J Am Dent Association (1996), vol. 127, issue 4, pp. 475-82.

[3] Kharbanda OP, Sidhu SS, Sundaram K, Shukla DK. "Oral habits in school going children of Delhi: A prevalence study" Journal of the Indian Society of Pedodontics and Preventive Dentistry. (2003) 21, pp. 120–124.

[4] Nachnani S. "Oral malodor: Causes, assessment, and treatment" Compend Contin Educ Dent. (2011) vol.32, pp. 22–24.

[5] Soder B, Johansson B, Soder PO. The relation between foetor ex ore, oral hygiene and periodontal disease. Swedish dental journal. 2000;24:73–82.

[6] Miyazaki H, Sakao S, Katoh Y, Takehara T. "Correlation between volatile sulphur compounds and certain oral health measurements in the general population" Journal of periodontology. (1995, vol 66, pp. 679–684.

[7] Ongole R1, Shenoy N." Halitosis: Much beyond oral malodor" Kathmandu University Medical Journal (2010), vol. 8, pp. 269-275.

[8] Scully C, Greenman J. "Halitosis (breath odor)" Periodontol 2000 (2008); vol. 48, no. 1. pp. 66-75.

[9] Faveri M, Hayacibara MF, Pupio GC, Cury JA, Tsuzuki CO, Hayacibara RM. "A cross-over study on the effect of various therapeutic approaches to morning breath odour" J Clin Periodontol (2006) vol. 33. no. 8. pp 555-560.

[10] Quirynen M "Management of oral malodour" J Clin Periodontal. vol. 30, Suppl, pp 17-18.

[11] Loesche WJ, Kazor C. "Microbiology and treatment of halitosis" Periodontology 2000, (2002), vol. 28, pp 256–279.

[12] Nakano Y, Yoshimura M, Koga T. "Correlation between oral malodor and periodontal bacteria" Microbes and infection / Institut Pasteur. (2002), vol. 4, pp. 679–683.

[13] Tangerman A, Winkel EG. "Intra- and extra-oral halitosis: Finding of a new form of extra-oral blood-borne halitosis caused by dimethyl sulphide." Journal of clinical periodontology. (2007), vol. 34. pp. 748–755.

[14] Whittle CL, Fakharzadeh S, Eades J, Preti G. "Human Breath Odors and Their Use in Diagnosis" Annals of the New York Academy of Sciences. (2007), vol. 1098. pp. 252–266.

[15] Goldberg S, Kozlovsky A, Gordon D. "Cadaverine as a putative component of oral malodour" J Dent Res (1994), 7vol. 3, issue. 6.

[16] Greenman J, Duffield J, Spencer P. "Study on the organoleptic intensity scale for measuring oral malodour" J Dent Res (2004), vol. 83, no.1.

[17] Aylikci BU, Çolak H." Halitosis: From diagnosis to management" J Nat Sc Biol Med (2013, vol. 4, pp. 14-23

[18] Rosenberg M, Gelernter I, Barki M, Bar-Ness R. "Day-long reduction of oral malodor by a two-phase oil: water mouthrinse as compared to chlorhexidine and placebo rinses" Journal of periodontology (1992), vol. 63, pp. 39–43.

[19] Yaegaki K, Coil JM. "Examination, classification, and treatment of halitosis; clinical perspectives" J Can Dent Assoc. (2000), vol. 66, pp. 257–261.

[20] Suvarna H Patil, Anita Kulloli, Minal Kella "Unmasking Oral Malodor : A Review" People's Journal of Scientific Research, (2012), Vol. 5, no. 1, pp. 61-67

[21] Tonzetich J. "Direct gas chromatographic analysis of sulphur compounds in mouth air in man" Arch Oral Biol (1971), vol. 16(, no. 6, pp. 587–597.

[22] Suzuki N, Yoneda M, Naito T, Iwamoto T, Hirofuji T. "Relationship between halitosis and psychologic status" Oral surgery, oral medicine, oral pathology, oral radiology, and endodontics (2008), vol. 106, pp.542–547.

[23] Rosenberg M, Kulkarni GV, Bosy A, McCulloch CA. "Reproducibility and sensitivity of oral malodor measurements with a portable sulphide monitor" Journal of Dental Research. (1991), vol. 70, pp.1436–1440.

[24] Furne J, Majerus G, Lenton P, Springfield J, Levitt DG, Levitt MD. "Comparison of volatile sulfur compound concentrations measured with a sulfide detector vs.gas chromatography" Journal of Dental Research. (2002), vol. 81, pp. 140–143.

[25] Lopes RG, De Santi ME, Franco BE "Photodynamic therapy as a novel treatment for halitosis in adolescent: case series study" J of Laser Medi Sci (2014), vol. 5, pp.146-152.

[26] Morita M, Musinski DL, Wang HL "Assessment of newly developed sulphide probe for detecting oral malodour" J Clin Periodontal (2001), vol. 28, pp. 494-496.

[27] Tanaka M, Anguri H, Nonaka A. "Clinical assessment of oral malodor by the electronic nose system" Journal of Dental Research (2004), vol. 83, pp.317–321

[28] Loesche WJ, Giordano J, Hujoel PP. "The utility of the BANA test for monitoring anaerobic infections due to spirochetes (Treponema denticola) in periodontal disease) Journal of Dental Research. (1990), vol. 69, pp. 1696–1702.

[29] De Jong MH, Van der Hoeven JS. "The growth of oral bacteria on saliva" Journal of Dental Research. (1987), vol. 66, pp. 498–505.

[30] Yoneda M, Masuo Y, Suzuki N, Iwamoto T, Hirofuji T. "Relationship between the beta-galactosidase activity in saliva and parameters associated with oral malodor" Journal of Breath Research (2010), vol. 4.

[31] Quirynen M, Zhao H, Avontroodt P, "A salivary incubation test for evaluation of oral malodor: A pilot study" Journal of periodontology. (2003), vol. 74, pp. 937–944.

[32] Toda K, Li J, Dasgupta PK. "Measurement of Ammonia in Human Breath with a Liquid-Film Conductivity Sensor" Analytical chemistry (2006), vol. 78, pp. 7284–7291.

[33] Amano A, Yoshida Y, Oho T, Koga T. "Monitoring ammonia to assess halitosis" Oral surgery, oral medicine, oral pathology, oral radiology, and endodontics. (2002), vol. 94, pp. 692–696.

[34] Iwanicka-Grzegorek K, Lipkowska E, Kepa J, Michalik J, Wierzbicka M. "Comparison of ninhydrin method of detecting amine compounds with other methods of halitosis detection" Oral diseases. (2005), vol. 11, Suppl 1, pp. 37–39.

[35] Rosing CK, Gomes SC, Bassani DG, Oppermann RV. "Effect of chewing gums on the production of volatile sulfur compounds (VSC) in vivo" Acta odontologica latinoamericana: AOL (2009), vol. 22, pp. 11–14.

[36] Fedorowicz Z, Aljufairi H, Nasser M, Outhouse TL, Pedrazzi V. "Mouthrinses for the treatment of halitosis" Cochrane Database Syst Rev. (2008).

[37] Seemann R, Kison A, Bizhang M, Zimmer S. "Effectiveness of mechanical tongue cleaning on oral levels of volatile sulfur compounds" J Am Dent Assoc. (2001), vol. 132, pp. 1263–1267.

[38] Quirynen M., Bollen C.M., Vandekerckhove B.N., Dekeyser C., Papaioannou W., Eyssen H. "Full- *vs*. partial-mouth disinfection in the treatment of periodontal infections: Short-term clinical and microbiological observations" J. Dent. Res. (1995), vol. 74, no. 8, pp. 1459–1467.