

Subjective halitosis: definition and classification .

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What benefits you will have by reading this manuscript:

In the literature, there are confusions about description and classification of subjective halitosis. A lot of psychiatry and dentistry terms have been used instead of each other, or even misused. In this paper, non-objective halitosis complaints truly defined, classified, eventually a route has been established to follow in halitosis clinic.

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ABSTRACT

Subjective halitosis is not confirmed by halitometer or third party individuals despite the patient insistently complaints malodor. This condition is named imaginary, delusional, pseudo, non-genuine, psychogenic, psychosomatic halitosis, halitophobia, body odor psychosis, depression, hypochondriasis, olfactory reference syndrome, chronic olfactory paranoid; syndrome, olfactory obsession, obsessive-compulsive disorder, olfactory delusion and more.

Almost all of the terms are psychiatric but they have been described by the dentistry related authors. Many of them need correction according to psychiatric concepts. In the dental literature there is confusion on the terminology and description of clinical forms of subjective halitosis has not been truly paid attention.

This paper reviews and defines the terminology on subjective halitosis. It may appear in clinically neurological (neurogenic) or psychological (psychogenic) forms. Each category is apparently described, reframed, terminology corrected, made it more understandable.

We conclude that dental practitioners should be encouraged to discover halitosis in a way whether a case in subjective or but not to diagnose psychiatric disorder in the patient with halitosis.

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INTRODUCTION

Halitosis is chronic, endogenous malodor. It is primarily associated with the condition of the oral cavity, including the oral hygiene level, however, In some cases malodor is not physically detected, and not confirmed by the social environment, further, there is no local or systemic problem. In dentistry related literature, this scenario is termed imaginary halitosis (Richter JL.1996), delusional halitosis (Iwu CO, 1990), pseudo-halitosis (Yaegaki K, Coil JM. 2000)³, non-genuine halitosis (Falcão DP, 2012) (Seemann R, 2006), halitophobia (Rosenberg M, Leib E.1997) (Suzuki N, 2008), olfactory reference syndrome (ORS) (Iwakura M, 1994), psychogenic halitosis (Ozeki H,1991), body odor psychosis (Mizuno U, 2002), depression and hypochondriasis (Ogino T,

1997). Despite almost all of the terms have been created (so-called termed) by dentistry related scientists but not by psychiatrists, these are psychiatric terms, or tightly connected to psychiatry. There are excessive terms whereby they essentially depict one clinical status.

Most of them do not exist in psychiatric text books or other scientific sources. So-called terminology do not satisfy practitioners and they are not understandable, acceptable, or explainable, moreover can lead to confusion or even misdiagnosis.

This difficulty comes from two aspects; 1) psychiatrists do not meet or experience enough subjective halitosis cases, case series and variables of such patients, so of enough experience and data for defining these terms; 2) the patients

with halitosis generally apply to dentists, so task of giving name of the disease/disorders is left to dental practitioners. Misusing terms or term pollution makes the area of subjective halitosis inconsistent.

This paper focuses on terminology, classification of subjective halitosis and its clinical forms that can be seen in halitosis cases.

Defining and framing subjective halitosis

Recently pathologic halitosis has been etiologically classified into 5 types; oral, airway, gastroesophageal, blood-borne and subjective halitosis respectively. Type 5 halitosis is described a halitosis complaint without objective confirmation by others or halitometer measurement. It covers all kind of non-genuine halitosis that is undetectable by machine or human nose and appears neurogenic and psychogenic forms. (Aydin M, 2014)

As much as 12% to 27% (Falcao DP, Seemann R, Muller N) of patients with halitosis classified in this category, in which cases can be misdiagnosed if there are measurement errors or transient symptoms.

It can be considered normal for even mentally healthy individuals to worry occasionally about having halitosis. (Stein DJ, 1998) Such halitosis concern can rationally dismissed by most healthy people, who have a degree of psychological resilience which is capable of compensating for stressors. This normal level of concern for halitosis constitutes the physiologic aspect of Type 5 halitosis. (Aydin M, 2014)

Patients with objective halitosis may have an accompanying psychological condition (Yaegaki K. 1995) especially

when the complaints prolong. Halitosis causes changes in behaviors of patients or people leading to self-isolation, and in extreme cases even to suicide attempts. (Filippi A & Muller N, Nagell D, Takashi Y) For this reason, to treat any kind of halitosis patients, not only the dental treatment but also the psychological support may be necessary. (Kawaguchi Y, 1992) In particular, the prominent idea of the patients with subjective halitosis is what they think about their halitosis or what people think about them. Therefore, self assesment or other people assesment should be preferentially evaluated than halitometric, organoleptic (sniffing the patient), and chemical examination for halitosis. (Aydin M, 2016)

Dental practitioners are not trained for diagnosis or treatment of psychiatric disorders. Therefore, differential diagnosis of halitophobia versus pseudo halitosis or genuine halitosis towards psychological symptoms can be difficult at times for most dentists. (Suzuki N, 2011) Dental practitioner should distinguish only whether the halitosis is objective or not. Any further attempt to differential diagnosis should be established by psychiatrists, but not dentists.

There are some terms often used erroneously by dental literature has been corrected as follows:

Pseudo-halitosis It was previously defined, if oral malodour does not exist but the patient believes that he or she has oral malodour, the diagnosis was pseudohalitosis (Miyazaki 1999), but how can olfactor capability be determined by examining oral air of the patient? Furthermore, this definition is misleading when considered alongside other medical terms, e.g. pseudo-Cushing's syndrome, intestinal pseudo-obstruction, pseudo-

lymphoma or pseudo-Kaposi's sarcoma. These exist as physical entities which masquerade as their namesake. Pseudo-halitoses implies "an objective, physical condition mistaken for halitosis non-exists" (Aydin M, 2014), instead, refers to where malodour does not exist.

Psychosomatic halitosis was incorrectly used when referring to subjective halitosis complaints. Psychosomatic disorders are disorders in which psychological factors play a significant role, and there are physical symptoms which are detectable clinically. However, the term psychosomatic halitosis was used to describe an odor is that is clinically nonexistent. (Miyazaki 1999) Some hypothesize that anxiety enhances oral malodor production.(Calil CM, 2006). This mechanism is rare and need more evidence , but is correctly termed psychosomatic, since a physical symptom is being influenced by psychological factors. This is the uniquely correct usage of the term "psychosomatic halitosis", rather than previous meanings (Aydin M, 2014).

NEUROGENIC FORMS OF SUBJECTIVE HALITOSIS

Nearly 200 disorders may be the cause of chemosensory dysfunction (CSD) (Falcão DP, 2012). Dysosmia (disordered olfaction including parosmia) and dysgeusia (disordered gustation) present extensive differential diagnoses.

Olfaction and gustation are intimately interlinked at the neuronal level in the brain. Many people fail to discriminate between bad taste and bad odor. Gustatory stimuli may influence orthonasal and retronasal odor perception. (Welge-Lüssen A, 2009)

Side effects of medication, hypothyroidism, hyposalivation (another extensive differential diagnosis), nutrient

deficiency (zinc, copper, iron, and vitamins A and B12), trauma and tumors involving the olfactory center in the brain, or nerve damage (glossopharyngeal, vagus, chorda tympani, olfactory), neurodegenerative diseases (Parkinson's, Alzheimer's and Huntington's disease), environmental pollutants (e.g. smoking), drug abuse, certain oral hygiene products (e.g. mouthwashes) and certain foodstuffs can all be potentially involved in subjective halitosis complaints, by various mechanisms.(Falcão DP,2012) (Bromley SM, 2000) Diabetes mellitus, gastroesophageal reflux disease and blood-borne stimulation of taste and smell receptors via the blood circulation may also contribute to subjective halitosis. (Falcão DP,2012), (Pacheco-Galván A,2011)

The term **Self halitosis** has been used to describe a lack of objective halitosis even though the patients believe themselves to have halitosis, (Yaegaki K,1999) but it is better used to define endogenously produced, self perceived odor, which is not a detectable odor by others. Patients can perceive their self odor from own airway themselves or tonsillar malodor by the olfactory receptors scattered on nasopharyngeal mucosa (retronasal olfaction) without odor emission to physical environment. (Ferguson M, 2014) By true description, self halitosis appears in three forms: retronasal olfaction, olfactory receptor responses triggered by blood-borne odorants, and phantom bad tastes/oral malodors (phantosmia) (Aydin M, 2014) As an exception, only third form (phantosmia) can be assessed also as the psychological form.

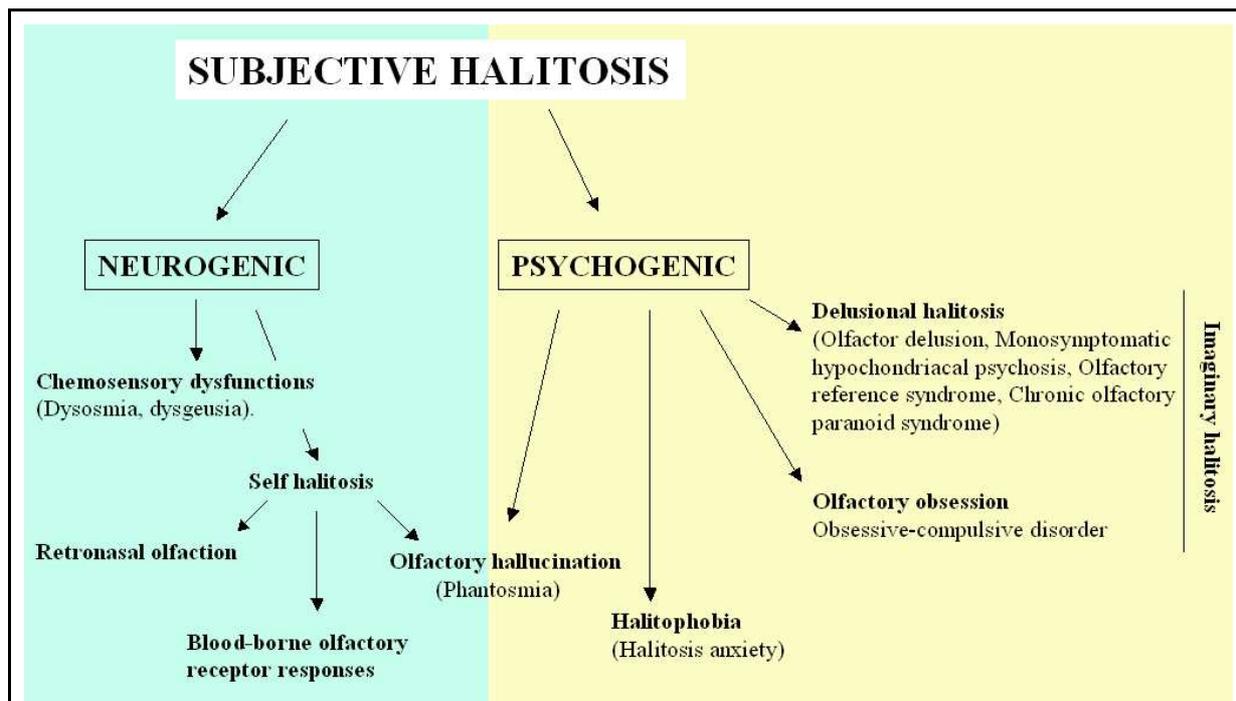


Fig.1 Subjective halitosis can be seen 2 main clinic forms. Generally, problem with neurogenic forms appear at receptor level, olfactor stimuli arrives to the receptor, but wrong, less, high, or distorted signal is generated; while pycogenic forms, problem is addressed at the level of perception, usually olfactor stimuli do not exist or negligible amount.

PSYCHOGENIC FORMS OF SUBJECTIVE HALITOSIS

Newly proposed definitions of terms that have been used in dentistry to refer psychological forms of subjective halitosis and their contents are corrected as following (Table.1)

Olfactory depression It is asserted halitosis may cause embarrassment and depression (Van Steenberg D, 2005), though this condition is mistakenly called olfactory depression. The usage of this term should refer to loss of olfactor sense because of medical disorders, or external factors such as codeine, morphine and its derivatives that may cause chemosensory disturbance including olfactory depression (Spielman AI. 1998). Olfactory bulbectomized animal models show reduced smelling capacity that returns back by antidepressant therapy (Kelly JP, 1997); thus, depression causes olfactory

problems which is related with misperception of smell.

Psycho-olfactory sensitivity due to neurodegenerative diseases (i.e., Alzheimer’s Disease, Parkinson’s Disease, Huntington’s Disease); loss of sensitivity to smells due to ageing (unawareness of smell loss in normal ageing), (Falcao DP, 2012); that is an organic disorder of olfactory system. This term can be used interchangeable with olfactory depression

Halitophobia: Formerly, after a therapy, if the patients continue to believe they have halitosis, it was classified as halitophobia (Miyazaki et al. 1999). But how can these be determined beforehand if they depend on results of treatment? Accurately and simply redefined the term points “an irrational fear of having halitosis” (Aydin M, 2014), instead, this refers to where the patients believe their continuing halitosis after treatment.

Table 1 Psychogenic pathologies cause subjective halitosis

Psycopathology	Prominent symptoms	Olfactor stimulus
Olfactory depression + Psycho-olfactory sensitivity	Complete or incomplete loss of olfactor sense due to pshyologic or pathological reasons. (not specific for halitosis)	+
Halitophobia: + Halitosis anxiety (Imaginary halitosis)	the patients have anxiety or fear from having halitosis rather than halitosis	-
Olfactory hallucination + Phantosmia	An imagination for any kind of odor (not specific for halitosis or body malodor)	-
Delusional halitosis (Olfactor delusion) + Monosymptomatic hypochondriacal psychosis + Olfactory reference syndrome + Chronic olfactory paranoid syndrome	referential thinking towards people around and their behaviors are stonemarks	-
Olfactory obsession+Obsessive-compulsive disorder	repetitive thinkings and behaviors are common	-

Halitosis anxiety (Imaginary halitosis) is an olfactory etiology model of emotional disorders, as exaggerated emotion-olfaction interaction in negative mood states turns innocuous odors aversive, fueling anxiety and depression with rising ambient sensory stress (Krusemark EA, 2013) It is worse than real halitosis for it can become an obsession that dominates the victim's life and turns him into a social outcast. In some of those with imaginary halitosis it is a solitary delusion based on hypochondriasis, which may respond to reassurance or behavioural psychotherapy (Hawkins C, 1987). Imaginary halitosis, halitosis anxiety and halitophobia terms refer and associate the same disorders. The patient may not

complain from de facto having halitosis but fears any probability of having halitosis at any time.

Due to the patient's psychopathologic status, depending on the severity of symptom, the disorder that patient is in could be renamed as "olfactory obsession" or "delusional halitosis" respectively. Because boundary between them is not clear enough.

Olfactory hallucination is false perception of smell; most common in medical disorders (Sadock BJ & Sadock VA, 2007), that is an organic cause without olfactor stimulation.

Phantosmia is the perception of an odor when there are no odorants in the environment, can be a very debilitating

symptom. Results may suggest the possibility that phantosmia is related to a central processing problem. As is seen with gustatory phantoms, it is suggested that olfactory phantoms may occur when there is a long-term decrease in the peripheral input into the central olfactory processing centers. (Grouios, 2002) However, it is observed phantoms in patients with only slightly decreased olfactory abilities (Leopold DA, 2002). Patients with phantosmia have a significantly reduced quality of life, and are eager for resolution of their always annoying, and often debilitating symptoms. (Leopold DA, 2013)

Olfactory hallucination and Phantosmia defines the same psychopathologic status. Both terms are not specific for oral malodor and they can be used interchangeable. The patient assumes any kind of odor exists without olfactory stimulus. If this imagination is specific for halitosis this condition falls in the self halitosis definition (See Fig.1).

Delusional halitosis (Olfactor delusion): Delusion is a person's false belief that behavior of others refer to himself or herself; that events, objects, or other persons have a particular and unusual significance, usually of a negative nature; derived from an idea of reference, in which a person falsely feels that others are talking about him or her (e.g., belief that persons around talking about him or her). In delusional disorder; delusions of persecution, reference, control, grandiosity, somatic types, etc. are included. Delusional halitosis is a special form of delusional disorder and covers delusions of hypochondriacal ideation of olfaction. Which is defined and termed as **Monosymptomatic hypochondriacal psychosis (MHP)** the traditional meaning

of the term psychotic emphasized loss of reality testing and impairment of mental functioning- manifested by delusions, hallucinations, confusion, and impaired memory. In the most common psychiatric use of the term psychotic became synonymous with severe impairment of social and personal functioning characterized by social withdrawal and inability to perform the usual household and occupational roles. The term may be used to describe the behavior of a person at a given time or mental disorder in which at some time during its course all persons with the disorder have grossly impaired reality testing. With gross impairment in reality testing, persons incorrectly evaluate the accuracy of their perceptions (e.g., auditory, visual, taste, tactile or olfactory) and thoughts and make incorrect inferences about external reality, even in the face of contrary evidence. (Sadock BJ & Sadock VA, 2007) The term was first used by Munro in 1978 (Munro A, 1980) MHP is classified as a somatic type of delusional disorder in DSM- IV (APA, 1994) and is defined as an erroneous conviction of bodily disease, abnormality or alteration. (Reilly TM, 1977) It includes delusional beliefs about bodily sensations or functions; such as feeling malodorous, being infected by parasites, having dysmorphic features, or that a certain organ is no longer functioning. (Roberts LW, 2010) MHP has been divided into 4 main categories: Delusions of infestation (including parasitosis); delusions of dysmorphophobia, such as of misshapeness, personal ugliness, or exaggerated size of body parts (this seems closest to that of body dysmorphic disorder); delusions of foul body odours or halitosis or delusional bromosis (also known as olfactory reference syndrome);

and a miscellaneous group (Sadock BJ & Sadock VA, 2007) Somatic delusional disorder term is used also for MHP (Ajiboye PO, 2013)

Olfactory reference syndrome (ORS) As a final decision in DSM-5 so far, ORS has its place in "Other Specified Obsessive-Compulsive or Related Disorder" category rather than a separate one. This category is for patients who have symptoms characteristic of obsessive-compulsive and related disorder but do not meet the full criteria for any specific obsessive-compulsive or related disorder. This diagnosis is appropriate under three situations: (1) an atypical presentation, (2) another specific syndrome not listed in DSM-5, and (3) the information presented is insufficient to make a full diagnosis of an obsessive-compulsive or related disorder. In assessing a patient with olfactory reference syndrome, it is important to exclude somatic causes (DSM-5). Otherwise ORS should be placed to MHP category due to its delusional nature.

Chronic olfactory paranoid syndrome refers to an olfactory syndrome that nearly defines a delusional disorder monosymptomatic and also chronic. This term should also be used instead or equal to MHP and ORS

Olfactory obsession Characteristic features of such an olfactory obsession are exactly those typical for classic obsessions related to thoughts: the symptom is persistent, unwanted yet recurrent, in the end unpleasant, uncontrollable by patient's will, connected with anxiety and leading to an appropriate compulsion which brings temporal relief. Significantly for differential diagnosis, the patient is critical of his/her obsessions, but although he/she is aware of the irrationality of the sensations (the insight can be limited), the

ritual is repeated. (Sadock BJ & Sadock VA, 2007) It is a rather academic discussion whether the patients know that they smell an obsessive and unpleasant odor or whether they indeed experience a recurrent erroneous smell sensation; however, all patients described in a paper were quite positive that in their case – contrary to other obsessive sensations – they smelled rather than thought. (Kelly JP, 1997) It should be categorized in "Obsessive Compulsive Disorder", not as another term.

Obsessive-compulsive disorder (OCD) Clinically, repetitive thinking and behaviors are main complaints of an OCD patient, as given in "Olfactory obsession". However, in patients of OCD with olfactory content, they think rather than smell, however, the smell described in OCD is only "ideational". (Maciej Żerdziński, 2008)

Conclusion

A new perspective has been established to subjective halitosis (undetectable malodor by others or halitometers). Neurogenic and psychogenic conditions and various clinical forms of subjective halitosis are listed, redefined, classified, and boundaries among them are clarified. The terms are revised and submitted to attention of readers. The goal of this paper is achieved to constitute a terminologic base for future studies on subjective halitosis. Thereby, subjective halitosis would be more understandable by readers with having a harmony by means of psychiatric literature.

It can be concluded that dental practitioner's mission is restricted to detect whether the halitosis is objective or not, but, not to estimate, distinguish, assess or diagnose psychiatric disorders.

REFERENCES

- Richter JL. Diagnosis and treatment of halitosis. *Compendium*, 1996; 17(4):370-386.
- Iwu CO, Akpata O. Delusional halitosis. Review of the literature and analysis of 32 cases. *Br Dent J*. 1990;168(7):294-6.
- Yaegaki K, Coil JM. Examination, Classification, and treatment of halitosis, *Clinical Perspectives*. *J Can Dent Assoc*. 2000;66:257-261.
- Falcão DP, Vieira CN, Batista de Amorim RFB: Breaking paradigms: a new definition for halitosis in the context of pseudo-halitosis and halitophobia. *J. Breath Res*. 2012;6(1):017105.
- Seemann R, Bizhang M, Djamchidi C, Kage A, Nachnani S. The proportion of pseudo-halitosis patients in a multidisciplinary breath malodour consultation. *Int Dent J*. 2006;56(2):77-81.
- Rosenberg M, Leib E. Introduction. In: Rosenberg M, editor. *Bad breath: research perspectives*, 2nd edition. Ramot Publishing: Tel Aviv University, 1997; p. 9-13.
- Suzuki N, Yoneda M, Naito T, Iwamoto T, Hirofuji T. Relationship between halitosis and psychologic status. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2008;106:542-7.
- Iwakura M, Yasuno Y, Shimura M, Sakamoto S. Clinical characteristics of halitosis: differences in two patient groups with primary and secondary complains of halitosis. *J Dent Res*. 1994;73:1568-74.
- Ozeki H, Amemiya H, Tanaka N, Kanamori K, Tojo H, Ushiyama T. Therapy of psychogenic halitosis and its problems. *Jpn J Psychosomatic Dent*. 1991;6:76-80.
- Mizuno U, Yamazaki T, Hoshi K, Nakamura K, Saito T, Ogiuchi H. Clinical examination of the effects of pharmacotherapy for patients complaining of foul halitosis. *Jpn J Psychosomatic Dent*. 2002;17(2):69-73.
- Ogino T, Ohno K, Hoshi K, Sangu Y, Ogiuchi H. Two Cases of Psychosomatic Halitosis Referred to Psychiatry Depression and Hypochondriasis. *Jpn J Psychosomatic Dent*. 1997;12(1):49-53.
- Aydin M, Harvey-Woodworth CN. Halitosis: a new definition and classification. *British Dental Journal*. 2014;217:E1
- Müller N. Halitosis – Ergebnisse einer Mundgeruch sprechstunde, *Medizinische Dissertation*, Basel, 2005.
- Stein DJ, Le Roux L, Bouwer C, Van Heerden B. Is olfactory reference syndrome an obsessive-compulsive spectrum disorder?: two cases and a discussion. *J Neuropsychiatry Clin Neurosci*. 1998;10(1):96-9.
- Yaegaki K. In: Rosenberg M, editor. *Bad Breath Research Perspectives*. Tel-Aviv: Ramot Publishing, Tel Aviv University; 1995; p. 87-108.
- Filippi A, Müller N. Echte und psychisch bedingte Halitosis – Befunde, Diagnosen und Ergebnisse einer Mundgeruch- Sprechstunde. *Schweiz Monatsschr Zahnmed*. 2006;116:129–135.
- Nagell D, Lutz C, Filippi A. Halitophobie – das unterschätzte Krankheitsbild. *Schweiz Monatsschr Zahnmed*. 2006;116:1:57-60.
- Takashi Y, Seigo M, Hideki O. A case of halitophobia with two planned attempts at suicide. *Jpn J Psychosomatic Dent*. 2005;20:17-19.
- Aydin M, Bollen CML, Özen ME. Diagnostic value of halitosis examination methods. *Compend Contin Educ Dent*. 2016, in press.
- Kawaguchi Y, Shinada K, Shimura N. Study on the clinical analysis of the “Questionnaire for halitosis” *Jpn J Psychosomatic Dent*. 1992;7(2):134-140.
- Suzuki N, Yoneda M, Naito T, Inamitsu T, Yamada K, Okada I, Hatano Y, Iwamoto T, Masuo Y, Fujimoto A, Hirofuji T. Association between oral malodour and psychological characteristics in subjects with neurotic tendencies complaining of halitosis. *Int Dent J*. 2011;61:57–62.
- Miyazaki H, Arao M, Okamura K, Kawaguchi Y, Toyofuku A, Hoshi K, Yaegaki K. [Tentative classification of halitosis and its treatment needs]. *Niigata Dental Journal* 1999;32: 7–11.
- Calil CM, Klein F. Influence of anxiety on the production of oral volatile sulfur compounds. *Life Sciences*. 2006;79(7):660-664.
- Welge-Lüssen A, Husner A, Wolfensberger M, Hummel T. Influence of simultaneous gustatory stimuli on orthonasal and retronasal olfaction. *Neurosci Lett*. 2009;454(2):124-8.
- Bromley SM. Smell and taste disorders: a primary care approach. *Am Fam Physician*. 2000;61(2):427-36, 438.
- Pacheco-Galván A, Hart SP, Morice AH. Relationship between gastro-oesophageal reflux and airway diseases: the airway reflux paradigm. *Arch Bronconeumol*. 2011;47(4):195-203.

- Yaegaki K, Coil JM. Clinical dilemmas posed by patients with psychosomatic halitosis. *Quintessence Int.* 1999;18:328-33.
- Ferguson M, Aydin M, Mickel J. Halitosis and the Tonsils: A Review of Management. *Otolaryngol Head Neck Surg* 2014;151(2):567-574.
- Van Steenberg D, Quirynen M. Mau hálito. Lindhe J, Karring T, Lang NP. *Tratado de periodontia clínica e implantodontia oral.* 4ª ed. Rio de Janeiro: Guanabara-Koogan; 2005; p. 595-600.
- Spielman AI. Chemosensory function and dysfunction. *Crit Rev Oral Biol Med.* 1998;9(3):267-291.
- Kelly JP, Wrynn AS, Leonard BE. The Olfactory Bulbectomized Rat as a Model of Depression: An Update. *Pharmacol Ther.* 1997;74(3):299-316.
- Krusemark EA, Novak LR, Gitelman DR, Li W. When the sense of smell meets emotion: anxiety-state-dependent olfactory processing and neural circuitry adaptation. *J Neurosci.* 2013; 2533(39):15324-32.
- Hawkins C. Real and imaginary halitosis. *British Med J* 1987;294(1);200-201.
- Sadock BJ, Sadock VA. Delusional disorder and shared psychotic disorder In: Kaplan and Sadock's *Synopsis of psychiatry* 10th ed. Philadelphia, PA; Lippincott Williams and Wilkins 2007:509-530.
- Grouios G. Phantom Smelling. *Percept Mot Skills.* 2002;94(3Pt 1):841-50.
- Leopold DA, Loehrl TA, Schwob JE. Long-term follow-up of surgically treated phantosmia. *Arch Otolaryngol Head Neck Surg.* 2002;128(6):642-7.
- Leopold DA, Hornung DE. Olfactory Cocainization is Not an Effective Long-Term Treatment for Phantosmia. *Chem. Senses.* 2013; 38(9):803-806. doi: 10.1093/chemse/bjt047.
- Munro A. Monosymptomatic hypochondriasis psychosis. *Br J Hosp Med.* 1980;24:34-8.
- American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders- IV.* Washington DC. American Psychiatric Association, 1994.
- Reilly TM. Monosymptomatic hypochondriacal psychosis: Presentation and Treatment. *Proc R Soc Med* 1977;70(suppl110):39-43.
- Roberts LW, Hoop JG, Heinrich TW. Delusional disorder In : *Clinical Psychiatry Essentials* 1st ed. Baltimore, Maryland; Lippincott Williams and Wilkins 2010:175-76.
- Ajiboye PO. Monosymptomatic Hypochondriacal Psychosis (somatic delusional disorder): A report of two cases. *Afr J Psychiatry.* 2013;16:87-91. doi.org/10.4314/ajpsy.v16i2.11)
- Żerdziński M. Olfactory obsessions – individual cases or one of the symptoms of obsessive-compulsive disorder? An analysis of 2 clinical cases. *Arch Psychiatr Psychother.* 2008; 3:23–27.