



ORIGINAL ARTICLE

Chlorhexidine and honey: Mouthwash liquids in reducing halitosis of stroke patients[☆]



Lestari Makmuriana*, Wuriani, Lilis Lestari, Usman Usman, Surtikanti Surtikanti, Jaka Pradika, Ramadhaniyati Ramadhaniyati, Haryanto Haryanto

Muhammadiyah College of Nursing, Pontianak, Indonesia

Received 4 January 2021; accepted 19 July 2021

KEYWORDS

Chlorhexidine;
Halitosis;
Honey;
Mouthwash liquids

Abstract

Objective: This research aimed to assess the effectiveness of honey and chlorhexidine in reducing halitosis of stroke patients.

Method: Pretest–posttest randomized control group design was used to obtain the data in 102 patients at RSUD Dr. Soedarso. The present study compared the effectiveness of different mouthwash liquids; chlorhexidine and honey. The data were analyzed using univariate and bivariate analysis.

Result: Most of the halitosis cases were observed in male patients at the age of >54 years old. The mean halitosis score of the patients before treatment was 4 (estimated by using *Tanita Breath Checker*). After the treatment, both chlorhexidine and honey showed a positive result in reducing halitosis. The average Halitosis score before treatment in the chlorhexidine group was 4 and changed into 1.5 post-treatment. In honey group, the mean Halitosis score before treatment was 4 and changed into 1 after treatment. The average score of halitosis in the group treated with chlorhexidine and in a group treated with honey was not really significant. In the chlorhexidine group, the average score was 2.377 while in the honey group, the average score was 2.277. It meant that both liquids have a similar impact in reducing halitosis.

Conclusion: Honey and chlorhexidine are effective in reducing halitosis. Moreover, honey was better in improving halitosis in stroke patients compared to chlorhexidine.

© 2021 Elsevier España, S.L.U. All rights reserved.

[☆] Peer-review process of the 3rd International Nursing & Health Sciences Students & Health Care Professionals Conference (INHSP) 2019 is under the responsibility of the scientific committee of the 3rd International Nursing & Health Sciences Students & Health Care Professionals Conference (INHSP).

* Corresponding author.

E-mail address: lestarimakmuriana@gmail.com (L. Makmuriana).

Introduction

Halitosis is experienced by many people, particularly when they have limited body movement or low consciousness stage. Halitosis term is used to describe any disagreeable bad or unpleasant odor emanating from the mouth air and breath. Based on research conducted in Japan, from 2,762 subjects measured by monitoring volatile sulfur compounds (VSCs), the prevalence of bad breath patients was 23%. Likewise, a study of 2000 subjects in China revealed that 27.5% had bad breath. Nurses, as the health care agents in the hospital who directly connected to the patients, often find the problem. In fact, 90% cases of halitosis are caused by oral cavities such as poor oral hygiene, periodontal disease, tongue coat, food impaction, unclean dentures, faulty restorations, oral carcinomas, and throat infections.¹

In nursing, oral hygiene is carried out as prevention of Halitosis prevalence. One of the duties of nurses is to maintain the hygiene of their patients, especially when the patients suffer from a disease that limits their movement, such as stroke or coma. Even though tooth brushing, as the simple action of oral hygiene is an independent nursing action, is not routinely performed in critically ill patients. Whereas oral care is a key component of nursing care. If oral hygiene is not carried out within 48 h, it will turn into *oropharyngeal flora* from gram-positive to gram-negative and at risk of pneumonia.²

This condition is supported by research conducted on 13 respondents who suffered head injuries with low consciousness at the RSU Dr. Saiful Anwar Malang by Anang Satrianto in 2008. It was found that there was a significant relationship between oral hygiene and the incidence of oral cavity infections on patients with low consciousness because of head injury. If the average number of stroke patients according to basic health research data is 12.1 per 1000 patients, then the prevalence of halitosis is also quite high. Whereas, the results of interviews conducted at RSUD Dr. Soedarso showed the incidence of stroke is treated in the nerve room of the Dr. Soedarso Hospital is about 20 patients per month.

Based on etiologic factors, halitosis is divided into (1) Genuine Halitosis happened when the bad breath has really happened, and people can smell it, (2) Pseudo Halitosis happened when someone assumes he has bad breath, but nobody smelt it and (3) *Halitophobia* happened when someone after detail examination of both oral and dental health and the result generally turn out to be good, and no abnormalities associated with halitosis are found, but feeling disturbed by bad breath which actually does not exist or feels fear of having bad breath. This has referred to the patient's psychological problems.¹

The main cause of halitosis is bacteria lived and multiplied in the mouth by eating leftover food proteins attached to the gaps of the teeth and gums. These bacteria arise due to mouth activity, which always in contact with open air. These bacteria produce toxins or poisons, by breaking down food scraps and dead cells found in the mouth. This toxin causes bad breath because of the decomposition of food waste and produces sulfide and ammonia compounds. Etiologically, the bacteria and protein putrefaction of sulfur-containing amino acids produce volatile sulfur compounds (VSC) that contain hydrogen sulfide and methyl mercaptan.³

The bacteria are produced by enzymatic reactions of sulfur-containing amino acids which are L-cysteine and L-methionine. Furthermore, halitosis is formed by volatile molecules. These volatile compounds are sulfur compounds, aromatic compounds, nitrogen-containing compounds, amines, short-chain fatty acids, alcohols or phenyl compounds, aliphatic compounds, and ketones.¹ The intensity of halitosis is changing during the day. It is caused by some activities done by someone such as eating certain foods, smoking, alcohol consumption and/or dryness of the mouth.⁴

Halitosis can be diagnosed in several ways. First, it can be done by smelling the smell that emanates from the mouth. Second, by using *Tanita Breath Checker*, a simple portable monitoring tool that provides results of reading halitosis scores by looking at VSCs indicators in 5 levels. Third, using the Dental Saliva pH indicator, to determine the acidity level that is for a neutral solution pH equal to 7, acid strength pH <7 and base at pH >7. Moreover, the individual evaluation of volatile sulfur compounds during the breath tests can give valuable information.⁵

Doing good and right oral hygiene can maintain oral health. Mechanical tooth cleaning, such as tooth brushing or interdental flossing is the routine activities to maintain oral hygiene. In fact, some articles found that tooth brushing alone will not significantly reduce oral malodor, but by doing mouth rinsing and tongue cleaning can reduce VSCs levels.³ However, cleansing the tongue at its posterior area is uncomfortable and can be impossible by the gag reflex that it may cause.⁵ For that reason, Mouth rinsing is the best choice to be done as the prevention of halitosis prevalence. One of the chemical liquids used to mouthwash is chlorine dioxide (ClO₂). The precursors of VSCs so it effectively reduced total VSCs in oral malodor patients. For natural mouthwash liquids, honey can be the best choice to reduce the oral hygiene problem. Mouth rinsing using honey will reduce the production of dental plaque.⁶ Yet, for chronic and persistent halitosis new approaches taking into account both methods may bring far superior results for the elimination of this unpleasant mouth odor.⁵

The common liquid used as mouthwash liquid is normal saline. Instead of normal saline, there are two other liquids recommended to be used in oral hygiene, and they are chlorhexidine and honey. Chlorhexidine is classified as antibiotics and oral rinse. For the oral rinse, it is an antibacterial dental rinse for gingivitis treatment. This liquid can be used by swishing for 30s with 15 mL (one capful) of undiluted oral rinse after tooth brushing, then expectorate; repeat twice daily (morning and evening). Therapy should be initiated immediately following dental prophylaxis.⁷ The antibacterial action of chlorhexidine is the result of immediate bactericidal action, followed by a prolonged bacteriostatic action, due to its ability to attach to enamel surfaces. The bactericidal against gram-positive, gram-negative bacteria and yeasts (such as those responsible for oral candidiasis). The strong antiplaque effect of chlorhexidine which makes it gold standard can be attributed to its substantivity.⁸

Honey, as an oral cleansing liquid inhibits the growth of several pathogenic microorganisms including *Albion candida*, especially pure honey, with a concentration of 30–50%. It has been shown to have broad antimicrobial activity and thus inhibit the growth of a wide range of bacteria, fungi,

protozoa, and viruses. Hydrogen peroxide is generated on the slow dilution of unprocessed honey. Several chemicals had been demonstrated in honey with different antibacterial activity.⁹ Honey is effective to prevent the prevalence of halitosis because it can reduce the bacteria in the mouth or oral cavity. It is due to the high osmotic properties in honey so it can extract water from bacterial cells and cause them to die. The osmotic properties put honey as antimicrobial.

Method

This study used quantitative approach with experimental research design. RS Dr. Soedarso was elected as the place to get the data because it is the biggest public hospital in Pontianak. The population of this study was all patients in the hospital. In narrowing the number, inclusion and exclusion criteria were needed to select the patients who were eligible to be the sample on this study. The intended inclusion criteria are (1) stroke patients who experience paralyzed, (2) patients' consciousness being categorized as *Compos Mentis*, (3) the patients are willing to be a sample in this study. While the exclusion criteria are (1) Experiencing damage to the oral cavity due to complications of the disease, and (2) having fractures in the mandibular or maxillary area. The set of criteria were needed to make sure the sample had equal standard and the set of data obtained could be reliable. Based on the inclusion and exclusion criteria, there were 102 patients who were elected to be the sample of this research.

In this study, there were two variables needed to be concerned; (1) the halitosis as the dependent variable, and (2) mouthwash used to cure halitosis as independent variable. To prove the hypothesis, the data was collected by conducting a measurement to the level of halitosis of the samples. The measurement was conducted by using specific equipment called *Tanita Breath Checker*. This equipment showed scale 0–5 to indicate the level of halitosis. The scale "0" indicated that the patients did not suffer halitosis, while scale "5" indicated that the patients suffer terrible halitosis. The data set obtained before and after the treatment given was analyzed by using bivariate analysis to see the relationship between 2 variables. The data set obtained after treatment was analyzed statistically using effect size analysis and it was compared to the initial score of halitosis before any treatment.

This study was conducted under the ethical consideration where all patients who were eligible to be the sample were voluntarily joining the study. Before they sign consent papers as legal document stated their willing as the sample of the research, they were given brief explanation about this study. In order to protect personal data, the identity of the samples was made anonymous and each sample was only labeled by a code. The ethical code of this study has been proven by legal document of ethical code number 38/II.I.AU/KET.ETIK/IV/2018 issued by Research and Development Center of STIK Muhammadiyah Pontianak.

Results

The aim of this study was to know the use of honey and chlorhexidine in reducing halitosis. The study was conducted

on patients at Dr. Soedarso Hospital Pontianak who suffered from a stroke and have limited body movement. After it was selected based on inclusion and exclusion criteria, and followed by univariate analysis, the sample consisted of 43 male respondents and 29 female respondents with the average age 50–56 years old (Table 1).

The study aimed to know the effect of honey and chlorhexidine in reducing halitosis. Therefore the initial amount of halitosis from each sample had been measured by using a special tool named *Tanita Breath Checker*. From Table 2, it showed that 11 of 36 respondents had halitosis score as 4 and 5. The number showed that 11 of 36 persons had bad mouth odor or bad breath. The finding became the parameter in determining whether honey and chlorhexidine reduce the halitosis.

After knowing the initial halitosis score, each group of the sample was given the treatment of oral hygiene by using honey and chlorhexidine. After several times of treatment, the halitosis was measured again to know the effect. The result showed that the halitosis scores after the treatment in honey or chlorhexidine group are decreased. The average score after the treatment is about 1.3. It indicated the mouth odor or bad breath was still exist, but it was not really bad. It indicated that honey and chlorhexidine successfully reduce halitosis. The data is presented in Table 3.

Based on Table 3, the data showed that p -value $0.000 < 0.05$ in both groups, meaning that there was a significant difference between the average number of Halitosis Scores before and after oral hygiene using chlorhexidine and honey. The average Halitosis score before treatment in the chlorhexidine group is 4, and after treatment, it turns into 1.5 and in honey group is 4 and after treatment reduce to 1.

The average difference score of halitosis score in the intervention and control groups with a p -value of $0.423 > 0.05$, meaning that there is no difference in the average of the halitosis score in the chlorhexidine and honey groups. The average analysis of the number of halitosis scores after treatment in the honey group was higher than in the chlorhexidine group of 2.305, whereas in the chlorhexidine group 2.277 (Table 4).

Discussion

The present study compared the effectiveness of two different mouthwash liquid in reducing halitosis in a stroke patient. The alternative chemical substance which can be used for mouthwash is chlorhexidine. This research proves that chlorhexidine is effective in reducing halitosis case and safe to be used as a mouthwash because of its antibacterial feature. The bactericides against gram-positive, gram-negative bacteria and yeasts (such as those responsible for oral candidiasis). The strong antiplaque effect of chlorhexidine which makes it gold standard can be attributed to its substantivity.⁸ Chlorhexidine is a cationic bis-biguanide, with a very broad antimicrobial spectrum. Chlorhexidine will cause changes in the permeability of bacterial cell membranes, causing cell cytoplasm to emerge and components of low molecular weight cells from within the cell to penetrate cell membranes causing bacterial death. It becomes the most studied antimicrobial agent in the treatment of gingivitis. It has also been tested for its efficacy in

Table 1 Distribution of respondents by age and gender.

| Variable | Chlorhexidine group | | | | Honey group | | | |
|-----------------|---------------------|--------------------|---------|--------------|-------------|--------------------|---------|--------------|
| | Mean | Standard deviation | Min-max | 95%CI | Mean | Standard deviation | Min-max | 95%CI |
| Age (year) | 52.45 | 9.59 | 32–74 | 50.22; 57.26 | 56.34 | 9.28 | 41–73 | 51.34; 58.15 |
| Halitosis Score | 3.64 | 2.3 | 1–5 | 3.03; 4.72 | 4 | 3.61 | 1–5 | 3.03; 4.96 |

Table 2 The frequency distribution of respondents based on Halitosis Score before intervention in Stroke patients at Dr. Soedarso General Hospital Pontianak.

| Variable | Chlorhexidine group | | Honey group | |
|------------------------|---------------------|-------|-------------------|-------|
| | <i>f</i> (person) | % | <i>f</i> (person) | % |
| <i>Halitosis Score</i> | | | | |
| 1 | 2 | 5.6 | 3 | 8.3 |
| 2 | 5 | 13.9 | 4 | 11.1 |
| 3 | 7 | 19.4 | 8 | 22.2 |
| 4 | 12 | 33.3 | 10 | 27.8 |
| 5 | 10 | 27.5 | 11 | 30.6 |
| <i>Gender (person)</i> | | | | |
| Male | 23 | 63.89 | 20 | 55.56 |
| Female | 13 | 36.11 | 16 | 44.44 |
| Total | 36 | 100 | 36 | 100 |

Table 3 Frequency distribution of respondents based on Halitosis Score on Stroke clients in Dr. Soedarso General Hospital Pontianak.

| Variables | Chlorhexidine group | | Honey group | |
|------------------------------------|---------------------|------------------|------------------|------------------|
| | Before | After | Before | After |
| Halitosis average score \pm s.d. | 3.638 \pm 2.04 | 2.277 \pm 1.01 | 3.611 \pm 2.24 | 1.305 \pm 1.19 |
| Median | 4 (1.00–5.00) | 1.5 (0.0–3.00) | 4 (1.00–5.00) | 1 (0.00–3.00) |
| <i>p</i> | 0.000 | | 0.000 | |

Table 4 The difference in the average number of halitosis scores in the chlorhexidine group and the honey group.

| | <i>n</i> | Average \pm s.d. | Median (min–max) | <i>p</i> | <i>Z</i> |
|--|----------|--------------------|------------------|----------|----------|
| The average score of difference in the chlorhexidine group | 36 | 2.277 \pm 1.59 | 1.5 (0.00–3.00) | 0.423 | –0.255 |
| The average score of difference in the honey group | 36 | 2.305 \pm 1.33 | 1 (0.00–3.00) | | |

the treatment of oral halitosis. Results from a case series study in halitosis patients suggested a significant effect of chlorhexidine rinsing and tongue brushing after one week of treatment.¹⁰ Chlorhexidine reduced bad breath only at the end of the second hour, an effect that lasted for 3 h.

Although chlorhexidine is being considered the gold standard of mouth rinse for halitosis treatment, it has undesirable side effects such as a change in the taste of food and a burning sensation at the tip of the tongue.¹⁰ Therefore, natural mouth rinse liquid is required. This study found that honey is also effective in reducing the bacteria as the cause

of halitosis. In a study conducted with five men and five women with halitosis proved that halitosis could be reduced by using honey.¹¹ Honey plays a role in reducing halitosis because it is an antibacterial agent and contains antiseptic, which has a function to inhibit bacterial growth. In some types of honey, there is a typical antibacterial substance called methylglyoxal (MGO). The methylglyoxal increases the antibacterial activity and reduces the halitosis.¹¹ Instead of that, high sugar levels in honey will prevent bacteria from moving so that the bacteria die and cannot develop. Moreover, it is more convenient to be used as an oral

hygiene liquid because of its sweet and non-stinging taste and makes the mucosa of the lips become moist.⁹ The previous study found that honey can be used to cure some of the most common oral dental ailments/diseases include dental plaque, gingivitis, halitosis, malodor. Scientific studies have shown that honey was effective against nearly 60 species of gram-positive, gram-negative, anaerobic, and aerobic bacteria.¹²

This study only focused on how honey can reduce halitosis compared to chlorhexidine on stroke cases. The result was seen by the number of causal bacterial of halitosis measured by *Tanita Breath Checker*. A further study is required to know better about the cause of halitosis and the preventive action to minimize the halitosis. In nature, there are also a lot of natural resources that are possible as oral hygiene liquid such as betel leaves and *siwak*. In fact, it is required further research on whether they can solve halitosis.

Conclusion

Halitosis can be reduced by using mouthwash liquid formulated from honey or chlorhexidine. Both substances are effective to reduce halitosis because of their characteristics as bactericidal and bacteriostatic against various kinds of bacteria. Honey is superior to chlorhexidine in reducing halitosis because honey acts as an antibacterial without side effects and also contains antiseptic substances which function to inhibit bacterial growth. High sugar levels in honey will prevent bacteria from moving, resulting in bacterial death and inhibition of bacterial growth. Because of its natural substances, it will be safer to use.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgments

This study was funded by STIK Muhammadiyah Pontianak.

References

1. Aylikci B, Çolak H. Halitosis: from diagnosis to management. *J Nat Sci Biol Med.* 2013;4:14, <http://dx.doi.org/10.4103/0976-9668.107255>.
2. Grap JM, Munro CL, Ashtiani B, Bryant S. Oral care interventions in critical care: frequency and documentation. *Am J Crit Care Oral Care Interv Crit Care Freq Doc Am J Crit Care.* 2003;12:113–9.
3. Aung EE, Ueno M, Zaitu T, Furukawa S, Kawaguchi Y. Effectiveness of three oral hygiene regimens on oral malodor reduction: a randomized clinical trial. *Trials.* 2015;16:1–8, <http://dx.doi.org/10.1186/s13063-015-0549-9>.
4. Teeth H. *Bad breath treatment; 2015.*
5. Jeronimo Manco VP. Important variables for halitosis clinical trials: causes. Diagnostic methods and treatments. *JBR J Interdiscip Med Dent Sci.* 2014;2:31–3, <http://dx.doi.org/10.4172/2376-032X.1000119>.
6. Purwati DE, Sulastri S. Pengaruh mengkonsumsi minuman madu terhadap tingkat keasaman ph saliva anak sekolah dasar. *J Kesehatan Gigi.* 2016;3:1–6.
7. Gluconate C, Wash WVM. Chlorhexidine gluconate 0.2% w/v mouth wash. s. f.:2–4.
8. Ellaiah P, Srinivasulu B, Adinarayana K. A review on microbial alkaline proteases. *J Sci Ind Res (India).* 2002;61:690–704, <http://dx.doi.org/10.21474/IJAR01>.
9. Jain A, Bhaskar DJ, Gupta D, Agali C, Gupta V, Gupta RK, et al. Comparative evaluation of honey, chlorhexidine gluconate (0.2%) and combination of xylitol and chlorhexidine mouthwash (0.2%) on the clinical level of dental plaque: a 30 days randomized control trial. *Perspect Clin Res.* 2015;6:53–7, <http://dx.doi.org/10.4103/2229-3485.148819>.
10. Cortelli JR, Barbosa MDS, Westphal MA. Halitosis: a review of associated factors and therapeutic approach. *Braz Oral Res.* 2008;22 Suppl. 1:44–54, <http://dx.doi.org/10.1590/S1806-83242008000500007>.
11. Shiga H, Jo A, Terao K, Nakano M, Oshima T, Maeda N. Decrease of halitosis by intake of manuka honey. *Gen Sess LADR Barcelona.* 2010.
12. Ramsay EI, Rao S, Madathil L, Hegde SK, Baliga-Rao MP, George T, et al. Honey in oral health and care: a mini review. *J Oral Biosci.* 2019;61:32–6, <http://dx.doi.org/10.1016/j.job.2018.12.003>.