Dentika Dental Journal
Journal homepage: https://talenta.usu.ac.id/dentika

Effect of 20% Forest Honey on the Salivary Flow Rate in Menopausal Women with Xerostomia

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ARTICLE INFO

Article history:
Received 14 November 2022
Revised 8 May 2023
Accepted 8 May 2023
Available online 14 July 2023

E-ISSN: 2615-854X

P-ISSN: 1693-671X

How to cite:
Aida Fadhilla Darwis, Darmayanti Siregar. Effect of 20% Forest Honey on the Salivary Flow Rate in Menopausal Women with Xerostomia. Dentika Dental Journal 2023; 26(1): 42-47

ABSTRACT

The decrease in the production of estrogen and progesterone hormones in menopausal women may result in a condition called xerostomia, which is characterized by the subjective perception of dry mouth. This condition can be treated by using a chemical or mechanical stimulus. Therefore, the aims of this study were to identify the chemical content of forest honey as well as to determine the effect of its usage as a 20% mouth rinse on the salivary flow rate in menopausal women with xerostomia at RSGM Universitas of Sumatera Utara. This is an experimental study, which was designed using a single-blind randomized pretest-posttest control group. The inclusion criteria were menopausal women aged 40-65 years old with xerostomia, were not undergoing chemotherapy or radiotherapy treatment for the neck and head, had no systemic diseases, such as uncontrolled diabetes mellitus and kidney failure, and not consuming medication that could affect the normal saliva function. Subjects who were not cooperative during the study procedures were excluded. The sample population consisted of 30 menopausal women with xerostomia, which were divided into two groups. The first group was treated by asking them to gargle with 20% honey solution, while the second group, which served as a control used distilled water. Saliva was collected before and after treatment into a pot for 5 minutes using the spitting method, and the data collected were analyzed with T-test. The results showed that forest honey was rich in diastase enzyme and it increased the salivary flow rate, with p-value=0.000<0.05. Based on these findings, the use of 20% honey solution had a significant effect in increasing the salivary flow rate in menopausal women with xerostomia.

Keywords: Forest honey, Menopausal, Xerostomia, Salivary Flow Rate.

http://doi.org/10.32734/dentika.v26i1.10211

ABSTRAK

Produksi hormon estrogen dan progesteron yang menurun pada wanita menopause dapat menyebabkan xerostomia. Xerostomia merupakan keluhan subjektif kekeringan rongga mulut yang dapat diterapi dengan stimulasi, secara mekanis maupun kimiawi. Bagaimana kandungan kimiawi madu hutan dan pengaruhnya terhadap laju aliran saliva pada pasien wanita menopause dengan xerostomia di RSGM Universitas Sumatera Utara merupakan tujuan penelitian ini. Metode penelitian eksperimental menggunakan *single-blind randomized pretest posttest control group* dengan kriteria inklusi meliputi wanita menopause berusia 40-65 tahun yang mengalami xerostomia, tidak sedang melakukan kemoterapi maupun radioterapi kepala dan leher, tidak memiliki penyakit sistemik seperti diabetes melitus, penyakit ginjal maupun mengonsumsi obat-obatan yang dapat memengaruhi laju aliran saliva dengan subjek yang

nonkooperatif merupakan kriteria eksklusi. 30 orang wanita menopause total subjek yang dibagi menjadi dua kelompok, kelompok yang berkumur dengan larutan madu 20% dan kelompok kontrol berkumur dengan akuades. Laju aliran saliva dihitung selama 5 menit dengan metode spitting sebelum dan sesudah berkumur. Data dianalisis dengan uji T. Hasil yang diperoleh menunjukkan madu hutan memiliki kandungan yang kaya enzim diastase dan terjadi peningkatan laju aliran saliva dengan berkumur larutan madu 20%, p = 0.000 <0.05. Kesimpulan: berkumur dengan larutan madu 20% efektif untuk meningkatkan laju aliran saliva pada wanita menopause.

Kata kunci: Madu Hutan, Menopause, Xerostomia, Laju Aliran Saliva

1. Introduction

The loss of ovarian follicular activity has been reported to cause permanent menstruation cessation, which is commonly referred to as menopausal. Furthermore, approximately 50 million women around the world enter this period annually.[1] In 2020, the population of Indonesia was estimated to be 262.6 million people, with 30.3 million reaching menopausal.[2]

One of the most common complaints in the oral cavity among menopausal women is xerostomia. According to Mojabi et al, 50% of 100 menopausal women that were surveyed had the condition.[3] Xerostomia is a subjective symptom also known as dry mouth, which can be treated using medication therapy and stimulus. In recent times, natural materials have gained popularity as a means to avoid the side effect of medications. Honey is a natural stimulant that has been used in several studies to increase the salivary flow rate as an alternative xerostomia treatment.

Based on several studies, honey is a nutrient-rich substance with therapeutic effect, and contains antioxidant ingredients, anti-inflammatory properties, amino acids, vitamins, enzymes, and minerals.[4],[5] It has also been used in the production of modern medicine due to its numerous health benefits. Although honey is considered a sweet and sticky food, it does not damage the teeth, as the remaining sugar left in the oral cavity is broken down by oral bacteria. Furthermore, its constituent fructose and glucose are easily absorbed by the body tissues. Honey has also been reported to have anti-microbial properties in inhibiting the growth of microorganisms. Apart from its role in inhibiting the proliferation of bacteria that cause the thickening of plaque in the mouth, it can also reduce the acid level. This makes honey an effective antibiotic for preventing the growth of pathogenic microorganisms.[5],[6]

The use of natural materials as mouthwash has made significant progress recently, with honey being one such material that is accessible and offers numerous benefits. Honey can be divided into 2 categories based on the source of nectar, namely monofloral and multiflora. It is also often categorized into 2 classes, namely forest and cattle honey based on the environmental circumstances. This material has a pH of 3.9 but can range from 3.4-6.1. Although it has a low pH, honey contains high levels of minerals that act as alkaline and a cavity disinfectant.[7] Furthermore, organic acids in saliva, such as ascorbic acid, citric acid, and malic acid act as stimulators and can increase the level of gastric acid, thereby stimulating chemoreceptors. This explains the mechanism through which honey increases the salivary flow rate.[4] Honey has osmotic properties, high sugar levels, and strong interaction with water molecules, which further increases its effect.[4],[8] Therefore, this study aims to determine the water content, carbohydrate, and acidity level of 20% forest honey solution as well as to evaluate its gargling effect on the salivary flow rate in menopausal women in xerostomia.

2. Materials and Methods

Ethical clearance was obtained from the Ethics Committee on Health Research of Universitas Sumatera Utara, which was formerly known as Komite Etik Penelitian Bidang Kesehatan Fakultas Kedokteran Universitas Sumatera Utara/ RSUP HAM. The test material in this study was forest honey obtained from the Sumatran Forest, Indonesia. This is an experimental study, with a single-blind randomized pretest-posttest control group design, involving patients from Rumah Sakit Gigi dan Mulut Universitas Sumatera Utara (RSGM USU).

The inclusion criteria were postmenopausal women who visited RSGM USU aged 40-65 years old with xerostomia (known by xerostomia questionnaire xerostomia score = 5),[9] not undergoing radiotherapy

treatment or chemotherapy for neck and head, no systemic diseases, such as uncontrolled diabetes mellitus and kidney failure, did not consume medication that affected the normal saliva function, and willing to become a participant. Meanwhile, patients who were not cooperative with the procedures were excluded. The sample population consisted of 30 women, which were equally divided into two groups.

The first group was treated by asking the participants to gargle with 20% forest honey solution, while the second group serving as the control, gargled with distilled water. The samples were selected using the probability sampling technique, particularly the simple random sampling method. Saliva was collected before and after the interventions for five minutes in a pot using the spitting method.

Forest honey sample was tested for water content, carbohydrate, activity of diastase enzyme, and acidity. Subsequently, it was analyzed based on SNI standards with thermogravimetric methods, luff schrool, as well as photometric and neutralization titration. These tests were carried out at the Biochemical and Food Chemical Laboratory in the Science and Mathematics Faculty, University of North Sumatra to determine the suitability of honey as a food or medicine. The data collected before and after the interventions were analyzed using an r-unpaired test.

3. Results

The results showed that the carbohydrate and water level of honey was 64.11% w/w and 15.45% w/w, respectively. Furthermore, it had an enzyme diastase activity of 5DN, with an acidity of 35 Ml/NaOH 0.1 N/kg, as shown in Table 1)

Table 1. Water Level Analysis, Carbohydrate, Enzyme Diastase Activity, and Acidity of Honey

No	Test Type	Units	SNI 01-3545-1023	Honey (Sample)
1	Carbohydrate	% w/w	Minimum 65	64.11
2	Water Level	% w/w	Maximum 22	16.45
3	Enzyme Diastase Activity	DN	Minimum 3	5
4	Acidity	Ml/NaOH 0.1 N/kg	Maximum 50	35

Based on Table 2, 6.7%, 20%, 40%, and 33.33% of the participants were aged 45-49 years, 50-54 years, 55-59 years, and ≥60 years, respectively. The results also showed that 12 of the patients were aged 55-59 years.

Tabel 2. Distribution and Subject Frequency by Age

Age (years)	Total (n)	Percentage (%)
40-44	0	0
45-49	2	6.7
50-54	6	20
55-59	12	40
≥60	10	33.3
Total	30	100

Table 3 revealed that the average salivary flow rate before and after gargling with 20% forest honey solution and distilled water was 0.475±0.091 ml/minute, and 0.096±0.075 ml/ minute, respectively. Based on the unpaired t-test, there were significant differences in the average salivary flow rate between the control and treatment groups, with a p-value of 0.000.

Tabel 3 Statical Analysis Before and After Gargling Between Treatment Group and Control

Group	Total Sample (n)	The Difference of Average Before and After Gargling±SD (ml/minute)	p-value
Gargling 20% with Honey Solution	15	0.475±0.091	0.000
Gargling with Distilled Water	15	0.096±0.075	

4. Discussion

Several reports have shown that carbohydrate are the primary compounds found in honey, and this current study found a 64.11% w/w composition. Furthermore, sugars accounted for 95-99% of the total constituent of honey. The main carbohydrate found were fructose (32.56 – 38.2%) and glucose (28.54 – 31.3%), accounting for 85–95% of the total sugar absorbed in the digestive tract.7 This study recorded a water content of 16.45% w/w in honey sample used, and this value was considered to be low. Previous studies had shown that high carbohydrate and low water content caused high osmolarity pressure, leading to the inhibition of microbes' growth.[10] Other studies also reported that the higher the concentration of honey, the more its effectiveness in reducing the number of bacteria colonies in the oral cavity compared to chlorhexidine, a standard drug. This indicated that it was more effective in preventing caries and periodontal disease.[11] Honey also contains several compounds, such as organic acids, proteins, amino acids, minerals, polyphenols, and vitamins. One of the protein compounds assessed in this study was the diastase enzyme, whose activity was evaluated.

Based ob the results, the activity of diastase was 5 DN, which exceeded the minimum standard set by SNI. The enzyme was often added by bees during the maturation of honey. Diastase had also been reported to play an important role in evaluating the quality of honey and could be used as an indicator of purity, as it was produced by the bee’s body.[10] Honey used in this study had an acidity of 35 Ml/NaOH 0.1 N/kg due to the presence of various organic acids.[7],[10]

Based on the analysis of carbohydrate content, water level, the activity of enzyme diastase, and acidity, forest honey was appropriate and had passed the criteria as a herbal material. Xerostomia is a symptom of dry mouth that often occur in menopausal women due to hormonal changes.[9],[12],[13] This study was carried out using 30 menopausal women with xerostomia in RSGM USU.

A decrease in the production of estrogen could cause a reduction in the salivary flow rate, ultimately leading to dry mouth.[13] Estrogen had been shown to regulate the maturation of epithelial cells in organs, including the atrophy glandular epithelium. Therefore, women who experienced menopausal due to a decline in the level of the hormone tended to suffer from atrophy of glandular epithelium. This condition often led to a decrease in saliva secretion, thereby causing xerostomia.[9],[13]

The results of this study showed that the majority of menopausal women with xerostomia were aged 55-59 years, accounting for 40% of the sample population. Menopausal often appeared within the age range of 40-65 years and could be influenced by various factors, including first menstruation age, descent, public health, and social economics.[3],[14] Based on these findings, menopausal could be influenced by hormonal changes as well as aging. Furthermore, a decline in body function was reported to cause atrophy of the salivary glands, leading to a setback in their functions.[15]

The saliva could be stimulated by various, such as mechanical (mastication and gargling), chemical (stimulation of sweet, sour, salted, and bitter), neural (through the autonomic nerve, both sympathetic and parasympathetic), and psychological (stress could hinder secretion the salivary) stimulation. In the rest state, the submandibular glands produced the largest amount of saliva, while the parotid glands were more active in response to mechanical stimulation. Previous studies also showed that the submandibular and sublingual glands were majorly stimulated with chemicals, such as menthol. Sour substances, such as citric acid were the most effective stimuli for all the glands.[8],[9] Tampubolon et all reported that green tea effectively increased the salivary flow rate.[16]

The unpaired t-test showed that there were significant differences in the average salivary flow rate between the control and treatment groups, with a p-value of 0.000. These findings were consistent with

Charalombous's study that gargling with honey was effective in reducing or stabilizing the level of xerostomia.[8] Gargling with honey solution increased the salivary flow rate compared to distilled water, which did not contain active ingredients. Therefore, the improvement by distilled water was only caused by mechanical stimulation.

In the treatment group, there were two types of stimulation, namely mechanical, such as gargling movements and chemical stimulation, including ascorbic acid, citric acid, malic acid, and sweet taste in honey. Gargling movements caused an expansion in the surface area between the press receptors that were spread in the oral cavity, thereby increasing the stimulus.[10],[17],[18]

Previous studies showed that the secretion of saliva was influenced by the activation of taste receptors,[19] as well as chemoreceptors and pressure receptors. These receptors produced afferent nerve fiber impulses bringing information to the salivary center in the medulla brain stem. The impulses were then sent through the autonomic nerves to the saliva glands to increase secretion.[17],[18],[20] Another factor that could increase the salivary flow rate was the presence of high mineral content in honey, such as potassium, sodium, calcium, magnesium, sulfate, and phosphate.[5],[10]

5. Conclusion

In conclusion, gargling with certain substances, such as honey can stimulate the salivary flow rate mechanically and chemically. Honey has the ability to stimulate the taste (gustatory system) receptors and can elicit a sialogogue effect by inducing the salivary gland to produce more saliva. Furthermore, it contains various organic acids, which can be used as a saliva stimulator for increasing the salivary flow rate through the stimulation of the chemoreceptor in the oral cavity.

Honey is an important commodity in the community and it is easy to obtain without any toxicity. It is also useful in dentistry as a wound-healing agent after extraction or surgery as well as an antibacterial against mucositis, ulceration, candidiasis, and periodontal disease. Based on the results of this study, honey was effective in improving the salivary flow rate, especially in menopausal women with xerostomia.

Acknowledgement

The authors are grateful to Lembaga Penelitian University Sumatera Utara for TALENTA (Tropical Science and Medicine, Agroindustry, Local Wisdom, Energy, Natural Resources, Technology, and Arts) grant program in 2019.

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