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# The relationship between the use of antihypertensive drugs (Beta (β) Blockers) and conditions in the oral cavity

Rara Aninditha [1,*] and Rahma Maulidya [2]

[1] *Mahasiswa Fakultas Kedokteran Gigi Universitas Airlangga, Surabaya, Indonesia.*
[2] *Undergraduate Student, Faculty of Dental Medicine, Airlangga University, Surabaya, Indonesia.*

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## Abstract

**Introduction:** Hypertension is a dangerous disease, because it is related to the risk of cardiovascular disease. This disease is considered a global problem in the health sector that often occurs in Indonesia because it can increase premature death rates as well as a large burden of health costs due to long-term therapy. In systemic diseases such as hypertension, patients need to take antihypertensive drugs, one of which is included in the beta-blocker class. These drugs are susceptible to oral cavity infections, which affect protein levels in saliva.

**Objective:** To determine the relationship between the use of beta blocker antihypertensive drugs to the occurrence of xerostomia and changes in taste in the oral cavity.

**Method:** This study uses the literature review method by searching the literature by reading various books, journals and publications related to the topic.

**Results:** The results of the study found that there was an effect of using beta-blocker antihypertensive drugs on the occurrence of xerostomia due to a decrease in the rate of secretion of salivary stimulation.

**Conclusion:** There is a relationship between the use of beta blocker antihypertensive drugs and the condition of the oral cavity.

**Keywords:** Hypertension; Antihypertensive drugs; Beta blockers; Xerostomia; Taste change

## 1. Introduction

### 1.1. Hypertension

Hypertension is often referred to as a silent killer because most cases of this disease do not show any symptoms. High blood pressure is generally characterized by headaches that appear in patients. The public generally knows hypertension as one of the main factors of cardiovascular disease. Hypertension, or high blood pressure, is a disease in which the blood pressure in a person's arteries is higher than normal. Blood pressure consists of two numbers, namely systolic pressure (pressure when the heart beats and pumps blood) and diastolic pressure (pressure when the heart rests between heartbeats). According to the American Heart Association, hypertension is blood pressure above 130/80 mmHg.

* Corresponding author: Rara Aninditha.

The causes of high blood pressure can vary, including genetic factors, unhealthy lifestyles such as lack of exercise, obesity, and consuming too much salt. Treatment for high blood pressure usually includes lifestyle changes, such as a healthy diet and regular exercise, as well as antihypertensive medication.

### 1.2. Antihypertensions

Antihypertensives are drugs used to lower high blood pressure in patients with high blood pressure. Commonly used antihypertensive drugs are diuretics, ACE inhibitors, ARBs, beta-blockers, calcium antagonists, and aldosterone antagonists.

Antihypertensive drugs are used to lower high blood pressure in patients with high blood pressure. Treatment with blood pressure drugs can help prevent serious complications such as heart disease, stroke, and heart failure. In addition, blood pressure drugs can also help improve the function of blood vessels and organs affected by blood pressure, such as the heart, kidneys and retina of the eye. Some antihypertensive drugs also have additional benefits such as increasing nitric oxide synthesis and releasing prostacyclin, which can help improve blood flow and blood vessel function.

Antihypertensive drugs can be divided into several types according to their mechanism of action. The following is a classification of blood pressure drugs according to their type according to James et. al.:

#### *1.2.1. Diuretics*

Drugs that help remove excess water and salt from the body through urine, thereby reducing the amount of fluid in the blood vessels and lowering blood pressure. Examples of diuretics are hydrochlorothiazide (HCTZ) and furosemide.

#### *1.2.2. ACE inhibitors*

Drugs that block the activity of the enzyme responsible for converting angiotensin I to angiotensin II, which can narrow blood vessels and increase blood pressure. Examples of ACE inhibitors are lisinopril and enalapril.

#### *1.2.3. ARBs (angiotensin II receptor blockers)*

Drugs that bind to angiotensin II receptors, thereby reducing the vasoconstrictor effect and lowering blood pressure. Examples of ARBs are losartan and valsartan.

#### *1.2.4. Calcium antagonists*

Drugs that prevent calcium from entering blood vessel muscle cells, thereby reducing vasoconstriction and lowering blood pressure. Examples of calcium antagonists are amlodipine and diltiazem.

#### *1.2.5. Aldosterone antagonists*

Drugs that block the effects of the hormone aldosterone, which can increase the amount of fluid in the body and increase blood pressure. Examples of aldosterone antagonists are spironolactone and eplerenone.

#### *1.2.6. Beta blockers*

Drugs that block the action of the hormones adrenaline and norepinephrine on beta receptors in the heart and blood vessels, thereby reducing heart rate and blood pressure. Examples of beta blockers are metoprolol and propranolol.

### 1.3. Beta blockers

Beta-blockers are a type of blood pressure-lowering drug that works by blocking the action of adrenaline and norepinephrine on beta receptors in the heart, blood vessels, and other organs. Beta blockers can lower high blood pressure and heart rate. They can also be used to treat a number of other conditions, including angina, cardiac arrhythmias, migraines, and glaucoma.

Some commonly used beta-blockers include propranolol, metoprolol, atenolol, and carvedilol. Each type of beta blocker has different properties, for example propranolol can spread to the brain so it can be used to treat migraines, while carvedilol has a vasodilating effect so it can increase blood flow to the heart and improve heart function in patients with heart failure.

### 1.4. Beta blockers working mechanism

Beta blockers have benefits for lowering high blood pressure and heart rate. In addition, beta blockers can also reduce the heart's oxygen consumption and reduce the risk of abnormal heart rhythms.

In the heart, beta blockers can slow the heart rate and slow the transmission of electrical impulses through the heart. This can slow the heart rate, lower blood pressure and increase blood flow back to the heart.

In blood vessels, beta blockers can reduce vasoconstriction, which reduces blood vessel resistance and increases blood flow throughout the body. In addition, this drug can also reduce the production of renal renin, a substance that triggers the release of the hormone angiotensin II which can increase blood pressure. The effects of beta blockers on the body can also vary depending on the type of drug and the dose given. Many beta blockers, such as carvedilol, also have vasodilator effects, so they can increase blood flow to the heart and improve heart function in people with heart failure.

Although beta blockers are effective in lowering blood pressure, they can also cause some side effects such as fatigue, depression, impotence and bronchospasm in asthma patients. Therefore, the use of beta blockers must follow the doctor's advice and be closely monitored.

### 1.5. How to use beta blockers

Beta blockers function to lower blood pressure and heart rate in patients. However, like all drugs, beta blockers must be used correctly and properly to be effective and safe.

Here are some tips for the proper and correct use of beta blockers according to the American Heart Association:

#### *1.5.1. Use as directed by your doctor*

It is important to follow the dose and schedule of beta blockers prescribed by your doctor. Do not change the dose or schedule of use without first talking to your doctor.

#### *1.5.2. Take with food*

Some beta blockers can cause bloating or stomach upset. Therefore, it is advisable to take this medicine with food.

#### *1.5.3. Do not stop using it suddenly*

Stopping beta blockers suddenly can cause side effects such as headaches, stomach upset, and even increase the risk of heart attack. If you want to stop taking beta blockers, talk to your doctor first to determine the right method.

#### *1.5.4. Avoid use with other drugs*

Some drugs can interact with beta blockers and cause side effects or reduce the effectiveness of the drug. Do not take other drugs without first talking to your doctor.

#### *1.5.5. Check your blood pressure and heart rate regularly*

Beta blockers are used to lower high blood pressure and control irregular heartbeats. Therefore, it is important to check your blood pressure and heart rate regularly to ensure the effectiveness of this drug.

### 1.6. Saliva

Saliva plays a very important role in the oral cavity. The health of the oral cavity can depend on the amount or amount of saliva flow in the oral cavity. Saliva is a fluid in the oral cavity that functions to protect the tissue in the oral cavity by mechanically cleaning to reduce plaque accumulation, lubricating tooth elements, buffer capacity, bacterial aggregation that can inhibit microorganism colonization, antibacterial activity, digestion, moisture retention, and cleaning food.

Saliva functions protectively through various types of antimicrobial components such as mucin, histatin, lysozyme, and lactoferrin, and through specific antibodies against microorganisms. Antihypertensive drugs can affect salivary flow both directly and indirectly. Directly these drugs will affect salivary flow by mimicking the action of the autonomic nervous system or by reacting to cellular processes required for saliva, while indirectly antihypertensive drugs will affect saliva by changing the balance of fluid and electrolytes or by affecting blood flow to the glands. Discomfort in the oral cavity, such as pain, increased levels of dental caries and oral infections, and causing difficulty in speaking and swallowing food can be caused by a decrease in the rate of salivary flow.

### 1.7. Xerostomia

Xerostomia comes from the Greek: xeros = dry; stoma = mouth). Dry mouth is described as a decrease in the rate of salivary secretion stimulation. Xerostomia usually occurs from various factors, such as disorders of the nervous system, drug use, age, salivary gland disorders, and radiation therapy in the head and neck area (Supit, et al., 2022). In general, Xerostomia is associated with reduced salivary flow or hyposalivation. Xerostomia can cause disruption to salivary function, including as a buffer regulator, self-cleansing action, bactericidal, bacteriostatic, so that it can result in further occurrence of various diseases in the oral cavity.

Xerostomia can occur due to various factors, such as impaired salivary gland function, drugs, systemic diseases, and dehydration.

#### *1.7.1. Impaired salivary gland function*

Xerostomia can occur due to impaired salivary gland function, such as salivary gland hypofunction caused by radiotherapy or chemotherapy, or autoimmune sialadenitis, which can affect the performance of the salivary glands. In addition, aging can also affect the performance of the salivary glands and cause xerostomia in the elderly.

#### *1.7.2. Medications*

Some medications, such as antihistamines, antidepressants, and blood pressure medications, can cause xerostomia as a side effect. These medications can inhibit saliva production or affect the quality of saliva.

#### *1.7.3. Systemic diseases*

Some systemic diseases, such as Sjogren's syndrome, lupus, and diabetes, can cause xerostomia. These diseases can affect the performance of the salivary glands and cause insufficient saliva production.

#### *1.7.4. Dehydration*

Lack of fluids in the body can cause xerostomia. Dehydration can occur due to lack of drinking or loss of fluids due to fatigue, heat, or vomiting.

Beta blockers or beta blockers are a type of drug used to treat various health conditions, including high blood pressure (hypertension), angina, cardiac arrhythmias, migraines, and other conditions involving the cardiovascular system. Beta blocker drugs can cause xerostomia (dry mouth) by blocking beta-adrenergic receptors in the salivary glands. Salivary glands have beta-adrenergic receptors involved in saliva production. Stress and sympathetic nervous stimulation can stimulate saliva production through beta-adrenergic receptors in the salivary glands. By inhibiting beta-adrenergic receptors, beta blocker drugs can reduce the production of saliva produced by the salivary glands, causing dry mouth or xerostomia. In this case, it can be said that changes in salivary flow rate such as decreased salivary flow rate have an effect on xerostomia and changes in taste in the oral cavity. However, further review is needed to confirm the relationship between the two.

## 2. Method

This study is a literature review. Data search was conducted on three databases, namely Google Scholar, Pubmed, and Science Direct with the keywords "Hypertension", "Antihypertension", "Beta blocker", "xerostomia", "hypertension", "antihypertensive drugs" and "beta blockers". The search was limited by the criteria for assessing the quality of the literature determined from several supporting factors such as the sample used, research design, similarity to the material, and the quality of data analysis

Data analysis was carried out by searching for and also collecting information about the explanation of the relationship between the use of antihypertensive drugs (Beta (β) Blockers) and conditions in the oral cavity. This information includes explanations about hypertension, Antihypertension, beta blocker antihypertensive drugs, xerostomia, the effects of changes in taste in the oral cavity due to taking antihypertensive drugs. In this data analysis, we focused on collecting data on the relationship between taking beta blocker antihypertensive drugs and oral cavity conditions.

## 3. Results and discussion

Hypertension is a very common disease that occurs in Indonesia. This disease is a condition where there is an increase in blood pressure above normal limits. According to Priscilia et al., in one of their studies, hypertension has become a

major health problem not only in Indonesia but also in several countries in the world. The prevalence of hypertension is 31.7% and around 60% of hypertension sufferers will experience a stroke. Factors that cause high blood pressure are genetic and environmental factors such as obesity, stress, excessive salt intake, smoking and alcohol. Physiological disorders that occur in the regulation of blood flow and cause hypertension, including impaired cardiac output and peripheral resistance, disorders of the renin-angiotensin system and disorders of the autonomic nervous system. (Ade & Arif. 2016). In Indonesia, the incidence of hypertension is very high, especially in the elderly who are over 60 years old with a prevalence of 60-80 percent of the elderly population. The prevalence of hypertension in Indonesia is 29% in the 25-44 age group, 51% in the 45-64 age group and 65% in the over 65 age group (Wayan et al., 2016).

**Table 1** Distribution results of respondents on the effects of antihypertensive drugs grouped based on complaints in the oral cavity (Based on research by Priscilia, et al., in 2015)

| Keluhan Rongga Mulut | n | % |
|---|---|---|
| Mulut kering | 24 | 80 |
| Gingiva bengkak | 5 | 16,67 |
| Gingiva berdarah | 0 | 0 |
| Sariawan | 1 | 3,33 |
| Total | 30 | 100 |

In a study conducted by Priscilia et al., the respondents selected were patients who had been using antihypertensive drugs for 1 year. Table 1 shows that almost the majority of respondents experienced dry mouth (80%), swollen gums (16.67%), and canker sores (3.33%). This proves that dry mouth has the greatest influence on the condition of the oral cavity of patients taking antihypertensive drugs. Xerostomia is caused by atrophy of the salivary glands in the oral cavity which will reduce saliva production and change its composition. With age, the function of the salivary glands changes and weakens, as a result the parenchyma of the glands disappears and is replaced by connective tissue and fat. This condition causes a decrease in saliva production. In addition, systemic diseases in old age and the drugs used to treat them can affect dry mouth in old age. Saliva plays a very important role in oral health because it is related to biological processes in the oral cavity (Stevany et al., 2018)

**Table 2** Distribution of Xerostomia based on age according to Gracecylia, et al., 2015)

| Usia (Tahun) | n | % |
|---|---|---|
| 60 – 64 | 2 | 6,6 |
| 65 – 69 | 20 | 66,7 |
| 70 – 75 | 8 | 26,7 |
| Total | 30 | 100 |

The prevalence of xerostomia in the general population is still uncertain due to the small number of studies conducted. Several countries have also reported the prevalence of xerostomia, such as the United States 17.2%, Sweden 6.0%, New Zealand 10%, Japan 8.3%, while in Indonesia itself, even in North Sulawesi, there is no definite data on the prevalence of xerostomia (Gracecylia et al., 2015). However, according to Stevany's research in 2018, the age group that experienced xerostomia the most was in the 65–69-year age range, which was 20 people (66.7%), followed by the 70-75 year age range, which was 8 people (26.7%), and the least was in the 60-64 year age range, which was 2 people (6.6%).

**Table 3** Distribution of respondents' complaints based on dental and oral health questions related to quality of life due to xerostomia (Kalsum, et al., 2020)

| Dampak akibat *xerostomia* | Ya | | Tidak | |
|---|---|---|---|---|
| | n | % | n | % |
| Gangguan mengunyah | 14 | 70 | 6 | 30 |
| Gangguan mengecap | 18 | 90 | 2 | 10 |
| Gangguan menelan | 12 | 60 | 8 | 40 |
| Gangguan berbicara | 2 | 10 | 18 | 90 |
| Lidah terasa terbakar | 7 | 35 | 13 | 65 |
| Bibir kering | 15 | 75 | 5 | 25 |
| Bau mulut | 18 | 90 | 2 | 10 |
| Kurang percaya diri saat makan | 3 | 15 | 17 | 85 |
| Kurang percaya diri saat berbicara | 18 | 90 | 2 | 10 |

Based on research by Kalsum., et al. in 2020, it showed that most respondents experienced taste disorders, namely 14 respondents with a percentage of (70%), 18 (90%) respondents experienced bad breath and 18 (90%) respondents felt less confident when speaking due to xerostomia. This study was conducted in March 2020 at the Bukit Indah Elderly Posyandu, Ilir Barat District, RT 53, Ilir Barat I District, Bukit Lama Village, Palembang. Sampling using total sampling where the population is the same as the number of samples, which is 28 respondents. The mechanism of xerostomia that affects taste disorders is thought to be related to changes in the concentration of organic and inorganic compounds in the mouth due to decreased saliva production. Saliva plays an important role in helping to transport chemicals contained in food and drinks to taste receptors on the tongue, which then signals the brain about the taste felt. When saliva production decreases, chemicals in food and drinks cannot be transported effectively, which can cause taste disorders. Based on the journal de Matos,

L.F. et al. (2010) entitled "Relationships of beta-blockers and anxiolytics intake and salivary secretion, masticatory performance and taste perception" obtained results of patients using beta-blockers showed a decrease in unstimulated salivary flow. beta-blockers reduce sympathetic flow by inhibiting the action of catecholamines (adrenaline and noradrenaline), reducing adrenergic nerve transmission or response to sympathetic stimulation of alpha and beta receptors, thereby reducing the stimulus of salivary gland secretion. The use of beta blocker drugs is correlated with decreased saliva production and changes in taste in patients with high blood pressure. This study concluded that the effect of beta blocker drugs on the salivary glands can cause decreased saliva production and contribute to changes in taste (Almstahl A & Wikstrom M, 2014). The mechanism of beta-blockers that affect changes in taste in the oral cavity is thought to involve blocking beta-adrenergic receptors in the digestive tract, including the oral cavity. Beta-adrenergic receptors play an important role in regulating salivary glands and salivary gland function. Beta-blockers such as propranolol can block the action of epinephrine and norepinephrine on beta-adrenergic receptors, reducing salivation and saliva secretion, and causing xerostomia.

In addition, beta-blockers can also affect the function of taste receptors on the tongue and taste buds in the oral cavity. Several studies have shown that beta-blockers can change the taste in the oral cavity, reducing the perception of sweet tastes and increasing the perception of bitter tastes. The exact mechanism of this relationship is not fully understood, but is thought to be related to the effects of beta-blockers on the gastrointestinal tract and autonomic nervous system.

## 4. Conclusion

The use of antihypertensive drugs can affect salivary flow both directly and indirectly. One of the antihypertensive drugs is beta blockers. beta blockers can reduce the production of saliva produced by the salivary glands, causing dry mouth or xerostomia and also affecting the ability to taste.

## Compliance with ethical standards

*Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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