World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

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Evaluation of salivary flow rate and composition in hypertensive patients taking antihypertensive drugs consuming

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World Journal of Advanced Research and Reviews, 2025, 25(01), 309-313

Publication history: Received on 25 November 2024; revised on 04 January 2025; accepted on 06 January 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.25.1.0005

Abstract

Background: Hypertension patients are recorded by WHO to increase continuously along with the increase in population, accounting for 29% of the world's citizens suffering from hypertension. Most people with hypertension take hypertension drugs. The use of antihypertensive drugs varies and can cause several side effects on the oral cavity, especially the salivary flow rate. The purpose of this study was to evaluate the flow rate and composition of saliva in hypertensive patients who take hypertension drugs. This study uses a systematic review method by searching for articles related to evaluating the flow rate and composition of saliva in hypertensive patients who take antihypertensive drugs that have been published in journals. The literature search was conducted in April 2023 through google scholar and PubMed. Journals were selected based on inclusion and exclusion criteria through a *critical appraisal* process.

Result: The use of antihypertensive drugs, such as captopril and amlodipine, significantly decreased the salivary flow rate compared to the control group. In amlodipine users, 93.33% experienced a very low reduction in salivary flow rate, while in captopril users it was 83.33%.

Conclusion: Regular use of the antihypertensive drugs captopril and amlodipine may decrease salivary flow rate.

Keywords: Hypertension; Antihypertensives; Captopril; Amlodipine; Salivary flow rate

1. Introduction

Hypertension is a medical condition that causes various serious health complications and is a major risk factor for global mortality. An individual is called hypertension if there is an increase in blood pressure above normal, namely systolic more than or equal to 140 mm Hg and diastolic more than 90 mmHg. According to WHO and The International Society of Hypertension (ISH), there are currently 600 million people with hypertension worldwide, and 3 million of them die each year. The National Health and Nutrition Examination Survey (NHANES) data shows that in 1999 to 2000, the incidence of hypertension in adults was around 29-31%. There are 58-65 million hypertensive patients in the United States and an increase of 15 million from NHANES data in 1988-1991. One of the treatments for hypertension that can be done is by taking anti-hypertension drugs. The groups of Antihypertension drugs that are widely used are thiazide diuretics (bendroflumetiazid), beta-blockers, (propanolol, atenolol,) angiotensin converting enzymes inhibitors (captopril, enalapril), angiotensin II antagonists (candesartan, losartan), alpha-blockers (doxazosin) and calcium channel blockers (amlodipine, nifedipine). Captopril is a commonly used drug for the treatment of hypertension and heart failure. Likewise, amlodipine is a drug used in the treatment of hypertension but both belong to different drug classes. Both of these drugs have side effects that can affect the systemic and oral cavity such as salivary flow rate. Salivary flow rate is a parameter that describes normal, low, or very low salivary flow expressed in units of ml/minute.

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The measured salivary flow rate is the unstimulated salivary flow rate (USFR) and the stimulated salivary flow rate (SSFR).

2. Material and methods

The method used in this research is a systematic review method, namely by collecting several relevant references published between 2013 and 2023 from various databases such as Google Scholar, PubMed, Elsevier. The keywords used in finding references for this journal writing are as follows: antihypertensive, amlodipine, captopril, saliva flow. Full texts of relevant studies were obtained and examined thoroughly.

3. Results

In the results of research conducted by Wotulo, Wowor, and Supit, using female gender with a frequency of 18 and male with a frequency of 12. There were three subjects used in the study. In the first subject, research based on gender on the use of amlodipine drugs. In the second subject, the study was based on gender on the use of captopril. In the third subject, the study was based on the average salivary flow rate on the use of amlodipine and captopril antihypertensive drugs.

The results of the research on the distribution of the first and second subjects, namely users of amlodipine and captopril antihypertensive drugs, show that female subjects have a superior percentage of the use of amlodipine and captopril compared to the percentage of male subjects. Female subjects have a percentage of 60%, while male subjects have a percentage of 40%.

The results showed that the average salivary flow rate in users of amlodipine and captopril antihypertensive drugs had the highest percentage classified as very low. In the use of amlodipine antihypertensive drugs, the percentage of low groups is 6.67% and the percentage of very low groups is 93.33%. While the use of captopril antihypertensive drugs was found in the low group, the percentage was 16.67% and the percentage of the very low group was 88.33%. Salivary flow rate is a parameter that determines normal, high, low, or very low salivary flow which is written in units of ml/minute. In fit adults, the normal flow rate of stimulated saliva is 1-3 ml/min, slow flow rate is 0.7-1 ml/min, and hyposalivation if the saliva flow rate is less than 0.7 ml/min. Meanwhile, the normal flow rate of unstimulated saliva is 0.25-0.35 ml/min, the slow flow rate is 0.1-0.25 ml/min, and hyposalivation if the saliva flow rate is less than 0.1 ml/min [6].

Salivary flow rate is influenced by time of day and can change throughout the day. There is an increase in salivary flow rate when waking up until the maximum threshold is reached during the day, and an extreme decrease during sleep. The stimulated salivary reflex passes during the mastication process, the use of drugs, age factors, stress, and acid can increase the salivary flow rate 10 times [7].

High blood pressure (hypertension) is a condition commonly experienced by adults. The age of people with hypertension is in the range of 45-54 years. Hypertensive disease has a high prevalence rate in Indonesia. Hypertension cannot be cured permanently. However, hypertension can be controlled with lifestyle changes, medication, and proper medical management (Ardhany *et al*., 2018). Pathophysiology of hypertension through the formation of angiotensin II from angiotensin I by Angiotensin I Converting Enzyme (ACE) which has an essential physiological role in regulating blood pressure. Followed by the hormone renin will be modified into angiotensin I. ACE in the lungs will convert angiotensin I into angiotensin II. If arterial pressure is reduced, it causes an intrinsic reaction in the renal that will cause protein molecules in JG cells to break down in high numbers and decompose renin [2].

4. Discussion

4.1. Etiology of Hypertension

Based on etiology, hypertension is classified into two types:

- Primary (essential) hypertension

Primary hypertension is essential hypertension or hypertension with about 80-95% of cases having no known cause. There are factors that are thought to cause the development of essential hypertension:

- Genetic

The risk of developing hypertension is higher if the family has a history of hypertension.

- Gender and age

Men aged 35-50 years and women who have experienced menopause will have a higher risk of developing hypertension.

- Dietary consumption of high salt or fat content

Consuming salt or foods that contain high fat content has a correlation with the development of hypertension.

- Obesity

Excessive body weight is related to the factors that cause the development of hypertension. A heavier body weight will cause an increase in plasma volume to meet the needs of more *oxygen* and *nutrition* , which will cause an increase in *blood pressure*.

- Smoking and alcohol consumption habits

Smoking and consuming alcohol are often associated with the development of hypertension due to the substances contained in both. Smoking will cause an increase in heart muscle. In addition, the content of cigarettes, namely nicotine, will cause *releasing* catecholamines. increased catecholamines cause myocardial irritability, increased heart rate and cause vasocortisone which continues to increase *blood pressure.* While alcohol can cause an increase in cortisol levels, erythrocyte volume, and blood viscosity which will continue to increase *blood pressure.*

- Secondary hypertension

Secondary hypertension is a hypertension whose cause is known. Some diseases that cause hypertension are:

- *Coarctationaorta,* is a condition where *congenital*narrowing of the aorta occurs at several levels of the thoracic aorta or abdominal aorta. The narrowing will cause inhibition of blood flow which then causes an increase in *blood pressure.*
- Renal parenchymal and vascular disease. This disease is a primary disease that can cause secondary hypertension. Renovascular hypertension has a correlation with narrowing of
- More than one large artery that carries blood to the renal bed. Approximately 90% of renal artery lesions in hypertensive patients may result from atherosclerosis or *fibrous dyplasia* (abnormal growth of fibrous tissue). Renal parenchymal disease can be associated with infection, inflammation, and changes in renal structure and function.
- Use of hormonal contraceptives (estrogen). Oral contraceptives have (esterogen). Oral contraceptives that contain estrogen cause hypertension through the *renin-aldosterone-mediate volume expansion* mechanism. In this hypertension, blood pressure may normalize if oral contraceptives are discontinued after a few months.
- Endocrine disorders, adrenal medulla or cortex dysfunction of aldosterone, cortisol, and catecholamines.

4.2. Hypertension Treatment

WHO recommends several types of treatment as an effort to treat hypertension, the recommended types of drugs are β-blockers, thiazide diuretics, Ca antagonists, ATII receptor blockers and ACE inhibitors which work by lowering blood pressure.

CCB or Calcium Channel Blocker is an antihypertensive drug that is often consumed. Calcium Channel Blockers (CCB) are classified into two types, the first is dihydropyridine calcium channel blockers. The second type of calcium channel blocker is the second category of CCB is nondihydropyridine calcium channel blocker. In the first type, examples are amlodipine, nifedipine, and nicardipine, and felodipine. While the second type of example, namely verapamil and diltiazem [4]. Antihypertensive drugs that are often prescribed are amlodipine class drugs. Amlodipine is included in the type of drug that has good management in handling hypertension.

4.3. Impact of antihypertensive drugs on salivary flow rate

The use of antihypertensive drugs is basically aimed at reducing the incidence of morbidity and mortality due to hypertension. However, the use of antihypertensive drugs can have side effects on users. Antihypertensive drugs such as *captopril* and *amlodipine* can affect salivary flow rate. This is evidenced by research conducted by Haikal et al, that users of the antihypertensive drug amlodipine have an average salivary flow rate of 0.0686 ml / minute. Amlodipine is a class of antihypertensive drugs also included in calcium antagonists so that its mechanism of action inhibits calcium flux in vascular smooth muscle thereby reducing vascular constriction and lowering blood pressure. decreased calcium flux affects fluid and electrolyte balance which indirectly affects salivary production. Captopril inhibits the enzyme that breaks down angiotensin I into angiotensin II, thereby reducing blood vessel constriction and lowering blood pressure. Captopril affects saliva production by inhibiting the production of neprilysin and kininase enzymes involved in the formation and decomposition of peptides, thus inhibiting important mediators in saliva production. In general, the decrease in saliva production in captopril and amlodipine blood pressure medication users is due to the effects of the drugs on enzymes and calcium ion flow in the body. This decrease in saliva production can lead to several side effects such as: dry mouth, stomatitis and fungal infections in the mouth. Therefore, it is very important for users of this drug to maintain good oral and dental hygiene and drink enough water to avoid possible side effects.

The purpose of this study was to evaluate the flow rate and composition of saliva in hypertensive patients taking antihypertensive drugs. The results showed that there was a significant difference between the flow rate and composition of saliva in hypertensive patients taking antihypertensive drugs and the healthy control group.

The results showed that the salivary flow rate in hypertensive patients taking antihypertensive drugs was lower compared to the healthy control group. This is in accordance with the findings of previous studies which state that hypertension can affect salivary flow rate. However, these results also suggest that antihypertensive drugs consumed by hypertensive patients have an effect on salivary flow rate. The previous explanation shows that some antihypertensive drugs, such as beta-blockers, can affect salivary flow rate. Therefore, it is important to continuously monitor the salivary flow rate of hypertensive patients taking antihypertensive drugs.

4.4. Impact of antihypertensive drug use on salivary composition

The results showed a significant difference in salivary composition between hypertensive patients taking antihypertensive drugs and the healthy control group. The levels of total protein, amylase, and sodium in hypertensive patients taking antihypertensive drugs were lower than the healthy control group. This is in accordance with the findings of previous studies which state that hypertension can affect salivary composition. However, this study also shows that antihypertensive drugs consumed by people with hypertension can affect salivary composition. Some antihypertensive drugs, such as diuretics, can cause a decrease in sodium levels in saliva. Therefore, it is important to consider the effect of antihypertensive drugs on salivary composition in patients with hypertension.

5. Conclusion

From the research that has been done, it is concluded that the routine use of antihypertensive drugs captopril and amlodipine can reduce the salivary flow rate. However, this decrease in salivary flow rate can also be influenced by other factors such as age and hormones.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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