International Journal of Research and Review
www.ijrrjournal.com E-ISSN: 2349-9788; P-ISSN: 2454-2237

Original Research Article

Assessment of Taste Perception, Salivary Flow Rate and pH in Hypertensive Patients with or without Antihypertensive Medication - A Comparative Study

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ABSTRACT

Introduction: The present study was aimed to examine the association of antihypertensive medications with salivary flow rate and pH and detection of alterations in taste perception in hypertensive patients with or without antihypertensive medications.
Material & Methods: Total 120 patients were randomly included in the study and were divided in four groups of 30 patients each as: hypertensive patients not on any medications(A), hypertensive patients taking beta blocker group of drugs(B), hypertensive patients taking angiotensin II antagonist group of drugs(C) and healthy individuals(D i.e. control). All the patients were assessed for their unstimulated whole salivary flow rate using passive drool method and salivary pH using digital pH meter. Their taste threshold was also evaluated for four different tastes i.e. salty, sweet, sour and bitter in three different concentrations each.
Results: The salivary flow rate and salivary pH were significantly reduced in hypertensive patients with or without medications than normal individuals ($p = 0.0001$). However, the flow rate was greater in patients on angiotensin II antagonist drugs (0.36 ± 0.03 ml/min) than those on beta blocker drugs (0.317 ± 0.04 ml/min).The salty taste threshold was significantly increased in all three of the hypertensive groups than the normal individuals ($p = 0.001$). But the sweet, sour and bitter taste perceptions were not significantly altered.
Conclusion: There are significant changes in salivary flow, pH and salty taste perception as an effect of hypertension and antihypertensive medications. The angiotensin II antagonist drugs bring out comparatively more improvement in salivary flow than the beta blocker drugs. Hence, salivary flow rate, pH and taste perception should be considered as important parameters in guiding the diet and medication protocol for hypertensive patients, thus maintaining their oral and overall health and hence improving their quality of life.
Keywords: hypertension, angiotensin II antagonist, beta blocker, salivary flow, pH and salty taste perception

INTRODUCTION

Hypertension (HTN), a haemodynamic disorder, is the sustained elevation of the systemic arterial pressure. Hypertension is defined as a systolic blood pressure (SBP) ≥ 140 mmHg or/and

diastolic blood pressure (DBP) ≥90 mmHg among people who are not under antihypertensive medication, thus including those who are already consuming medications for hypertension. Among those suffering from Diabetes Mellitus or Kidney diseases a systolic blood pressure (SBP) ≥ 130 mmHg or/and diastolic blood pressure (DBP) ≥80 mmHg is considered to be Hypertension. This increased pulsatile stress produces a variety of structural changes in the arteries supplying blood to the brain, heart, kidneys and other organs, which lead to a thrombotic paradox. Hypertension is further classified into Stage 1 Hypertension: SBP 140-159 mmHg or DBP 90-99 mmHg and Stage 2 Hypertension: SBP ≥ 160 mmHg or DBP ≥ 100 mmHg. More than 90% cases of all cases of hypertension are primary or essential hypertension, due to unknown causes and the rest are secondary, due to diseases in other organs of the body like the renal, endocrine and pregnancy related disorders. [1]

Prevalence of hypertension in India is on the rise with 41.5 million people suffering from hypertension in the year 2000 which is projected to be about 46.5 million by 2025. The demographic and socioeconomic transition in India has hastened the health transition with high burdens of chronic diseases, accounting for 53% of all deaths, 44% of disability adjusted life-years (DALYs) lost and the highest loss in potentially productive years of life, due to deaths from cardiovascular disease in people aged 35–64 years.

Medications, along with low salt diet and lifestyle changes over the years are the only effective measures for the control of blood pressure and prevention of the complications arising out of it. Thus, it could be simplified as pharmacological and non-pharmacological regimen. Regular physical activity, following a diet rich in fruits and vegetables while avoiding foods that are high in fat, sugar and salt, abstaining from tobacco, smoke and alcohol, and maintaining a healthy body weight need sustained efforts through high level of self-motivation at the individual level which tend to fade over time due to lack of a societal approach and a state support. Thus, pharmacological regimen-the drugs form the mainstay of therapy even today. There are five major classes of drugs which include the thiazide diuretics, β-blockers, calcium channel blockers, angiotensin-converting enzyme inhibitors and the angiotensin II receptor blockers that are generally used in the treatment of essential hypertension in ambulatory settings.

To be effective to produce a sustained lowering and maintaining of blood pressure, one needs to strictly follow the physicians advice and adhere to the prescribed drug regimen over long periods of time, which could be even lifelong. But in the long run, most of these hypertensive patients need two or more drugs for their blood-pressure control along with statins and aspirin concomitantly for risk factor reduction. In actual practice, initial antihypertensive treatment with an angiotensin II antagonist is associated with more adherence than those starting with calcium-channel blocker, β-blockers or a diuretic respectively. [2]

Saliva is important in the maintenance of oral health by exhibiting numerous host defence functions such as lubrication, anti-microbial activity, control of mineralization potential of teeth and others. The unstimulated salivary flow rate is 0.1-0.3ml/min, with an average total of 16 hours of unstimulated saliva flow being 300 ml with a pH 7.2 -7.4. Salivary flow rate during sleep is nearly zero. The maximum stimulated salivary flow rate is 1.5-7ml/min. 80-90% of the daily salivary secretion is produced by stimulated saliva. [3]

This miraculous fluid of oral cavity also reflects the systemic condition of an individual. Hypo-salivation is seen in patients with renal problems, hypertension, and diabetes. Significant changes in salivary output and its composition are also seen in anxiety, depression disorders, stress and other systemic diseases.

Buffering capacity and pH are particularly important functions of saliva through the following components: bicarbonates, phosphate, urea, amphoteric proteins and enzymes.

Taste is the sensory impression of food or other substances on the tongue. Taste is the sensation produced when a substance in the mouth reacts chemically with taste receptor cells located on taste buds. Taste, along with smell (olfaction) and trigeminal nerve stimulation (registering texture, pain, and temperature), determines flavours of food or other substances.

Some researchers evaluated the change in taste perception in hypertensive patients because of adverse effect of antihypertensive drugs that cause xerostomia and taste disturbance. [4]

Therefore, the present study is undertaken to examine the association of antihypertensive medications with salivary flow rate and pH and detection of alterations in taste perception.

MATERIALS AND METHODS

The present study was conducted in the Department of Oral Medicine and Radiology. Ethical clearance was obtained from the Institutional Ethics Committee. The subjects were informed in detail about the study. After obtaining an informed written consent, the patients were examined thoroughly and detailed case history was recorded in the proforma. The study was conducted over a period of 18 months.

The study group consisted of 120 patients between the age group of 30 - 80 years as described below-

Group A: 30 hypertensive patients not on any antihypertensive medication

Group B: 30 hypertensive patients taking beta blocker drugs

Group C: 30 hypertensive patients taking angiotensin II antagonist drugs

Group D: 30 normal individuals not suffering from hypertension or any other systemic disorders (control group)

Patients were selected randomly amongst the out patients attending the Department of Oral Medicine and Radiology of the Institute. Patient selection was done under four groups A, B, C and D.

All the patients who were hypertensive but taking drugs other than beta blockers or angiotensin II antagonists were excluded from the study. Subjects with any other systemic disorders other than hypertension and pregnant and lactating women were also excluded. Also patients with any adverse habits like tobacco chewing or smoking or alcohol consumption were not excluded.

METHODOLOGY

I] Determination of Salivary flow rate:

The saliva was collected by passive drool method. Patients were advised to refrain from intake of any food or beverages (water exempted) one hour before the test session. Saliva was collected between 9 a.m. to 12 noon to avoid diurnal variations. The subjects were advised to rinse his or her mouth with water and then asked to relax for 5 minutes. Detailed procedure of collection of saliva sample was explained to the patients. Then patients were asked to swallow whole saliva from the mouth and after that no movement should be made before and during the collection of saliva. Then patients were asked to lean their head forward over the funnel and graduated test tube while keeping their mouth slightly open and allow saliva to drain into test tube. Saliva was collected for 10 minutes. At the end of the collection period, patients were asked to collect any remaining saliva in the mouth and spit it into the test tube (Navazesh M et al 2008). [5]

II] Determination of pH:-

Salivary pH was measured immediately after measuring SFR using the digital pH meter (Labtronics, Model LT-11, pH – 0 - 14, Accuracy +0.01). The probe of the pH meter was inserted in the buffering solution for calibration. After calibration it was inserted into the patient's saliva which was collected into the test tube until a stable reading was obtained. The reading obtained was recorded (Kagawa et al 2013). [6]

Inference-

Normal salivary pH ranges from- 6.5 to 7.5.
If pH value is below 6.5, it indicates an acidic pH.
If pH value is above 7.5, it indicates an alkaline pH.

III] Determination of Taste:-

Spatial/localized testing, by using liquid tastants for 4 basic tastes -

Liquid tastant preparation:

Gustatory testing was done for four basic tastes (sweet, salty, sour & bitter). Three different solutions were made at three different progressive dilutions for each taste. For salt, sodium chloride (0.06 gm/ml, 0.25gm/ml, 1gm/ml), for sweet, sucrose (0.19 gm/ml, 0.75 gm/ml, 3 gm/ml), for sour, citric acid (0.15gm/ml, 0.6gm/ml, 2.5 gm/ml) and for bitter taste, quinine hydrochloride (0.0012 gm/ml, 0.005 gm/ml, 0.02 gm/ml) were used to make the tastants. Distilled water was used as solvent for making the solutions. The concentrations were numbered as 1, 2 and 3 in ascending order with 1 being the lowest concentration for each taste (Gudizol H and Hummel T 2007). [7]

Gustatory testing:

Before assessing the taste in the individuals, the subjects were asked not to eat or drink 1 hour prior the procedure. The four different tastants (salty, sweet, sour & bitter) were directly administered with a dropper over the taste buds on the dorsum of the tongue, approximately for 5 seconds. The administration was done in progressively increasing concentrations starting with the lowest concentration. The concentrations were increased until correct recognition of respective tastant occurred. The patients were asked to rinse mouth using tap water between the concentrations. The taste concentration identified by the patient was noted and recorded as the taste threshold.

STATISTICAL ANALYSIS:-

All the data on taste perception, salivary flow rate & salivary pH was obtained, tabulated and mean values were calculated. The statistical analysis was performed by using SPSS v16.0 software & statistical significance was tested at 5% level. The difference in mean values of taste perception, salivary flow rate and salivary pH was tested for statistical significance by one way analysis of variance (ANOVA) test. Further, pair wise comparison was done by Tukey's post-hoc test.

RESULTS

The mean age of individuals observed in Group A (HTN without medication), Group B (beta blockers), Group C (angiotensin antagonists) and Group D (control group) were 51.13 ±7.17 years, 50.20±7.81 years, 47.33±9.99 years and 47.20±5.49 years respectively.

The mean age observed in the study groups were compared using one – way ANOVA test. It was found that there is no statistically significant difference amongst the mean ages of the groups (p=0.119). (Table 1)

The total numbers of males in Group A and Group B were 10 (33.33%) each. While in Group C and Group D there were 18 (60%) and 12 (40%) males respectively. There were 20 (66.66%) females in Group A and B each. In Group C there were 12 (40%) females while in Group D there were 18 (60%) females.

There were higher males in Group C than other groups. The Group wise gender distribution was compared using Chi-Square test. The result suggested that there was no statistically significant difference amongst the groups in their gender wise distribution (p=0.116). (Table 2)

I] Salivary Flow Rate

The mean unstimulated salivary flow rate was very much reduced in Group A subjects (HTN without medication) (0.265± 0.04 ml/min). In group B (beta blockers) flow rate was 0.317 ± 0.04 ml/min. The flow rate was 0.36 ± 0.03 ml/min in Group C (angiotensin antagonist) and 0.382 ± 0.02 ml/min in Group D (control).

The mean unstimulated salivary flow rates amongst the groups were compared using One – way ANOVA test. It was analyzed that a statistically highly

significant difference existed in the mean unstimulated salivary flow rate amongst the groups (p=0.0001). (Table 3)
Group A (HTN without medication) <Group B (beta blockers) < Group C (angiotensin antagonist) < Group D (control)

II] Salivary pH

The mean salivary pH was observed as 6.39 ± 0.30 in Group A (HTN without medication), 6.44 ± 0.27 in Group B (beta blockers), 6.49 ± 0.25 in Group C (angiotensin antagonist) and 7.01 ± 0.11 in Group D (control).

The Group wise comparison of salivary pH was done using one way ANOVA test. The analysis suggested that there exists a statistically significant difference in the salivary pH amongst the groups (p=0.0001). (Table 4)

Table 1. Mean Age of Individuals among the groups

Groups	Mean Age ±SD (in years)	Df	F – Statistic	P value
Group A	51.13 ±7.17	3	1.992	0.119*
Group B	50.20±7.81			
Group C	47.33±9.90			
Group D	47.20±5.49			

* Non Significant, Result tested using One way ANOVA test, set at 95% confidence interval and p < 0.05

Table 2. Gender wise Distribution of patients among the groups

Groups	Male	Female	X^2 Statistic	P value
Group A	10(33.33%),	20(66.66%)	5.897	0.116*
Group B	10(33.33%),	20(66.66%)		
Group C	18(60%)	12 (40%)		
Group D	12(40%)	18 (60%)		

* Non Significant, Result tested using Chi-Square test , set at 95% confidence interval and p<0.05

Table 3. Group wise comparison of Mean unstimulated Salivary Flow rate

Groups	Mean rate ±SD (ml/min)	Df	F – Statistic	P value
Group A	0.265 ± 0.04	3	63.04	0.0001*
Group B	0.317 ± 0.04			
Group C	0.36 ± 0.03			
Group D	0.382 ± 0.02			

* Highly Significant, Result tested using One way ANOVA test , set at 95% confidence interval and p < 0.05

Table 4. Group wise comparison of Mean Salivary pH

Groups	Mean pH ±SD	Df	F – Statistic	P value
Group A	6.39 ± 0.30	3	40.76	0.0001*
Group B	6.44 ± 0.27			
Group C	6.49 ± 0.25			
Group D	7.01 ± 0.11			

* Highly Significant, Result tested using One way ANOVA test , set at 95% confidence interval and p < 0.05

Table 5. Mean values of Salty Taste perception Scores

Groups	Mean score ±SD	Df	F – Statistic	P value
Group A	1.33 ± 0.47	3	8.18	0.001*
Group B	1.53 ± 0.50			
Group C	1.33 ± 0.47			
Group D	1.00 ± 0.00			

* Highly Significant, Result tested using One way ANOVA test , set at 95% confidence interval and p < 0.05

Table 6. Mean values of Sweet Taste perception Scores

Groups	Mean score ±SD	Df	F – Statistic	P value
Group A	1.00 ± 0.00	3	0.18	0.1*
Group B	1.00 ± 0.00			
Group C	1.00 ± 0.00			
Group D	1.00 ± 0.00			

* Non Significant, Result tested using One way ANOVA test , set at 95% confidence interval and p < 0.05

Table 7. Mean values of Sour Taste perception Scores

Groups	Mean score ±SD	Df	F – Statistic	P value
Group A	1.06 ± 0.25	3	1.1520	0.313*
Group B	1.06 ± 0.25			
Group C	1.00 ± 0.00			
Group D	1.00 ± 0.00			

* Non Significant, Result tested using One way ANOVA test , set at 95% confidence interval and p < 0.05

Table 8. Mean values of Bitter Taste perception Scores

Groups	Mean score ±SD	Df	F – Statistic	P value
Group A	1.00± 0.00	3	1.728	0.165*
Group B	1.06 ± 0.25			
Group C	1.00 ± 0.00			
Group D	1.00 ± 0.00			

* Non Significant, Result tested using One way ANOVA test , set at 95% confidence interval and p < 0.05

III] Taste Perception

On Post-Hoc analysis of intra-group taste perception it was found that in all the three study groups (A, B and C), the salty taste perception was significantly altered than bitter, sweet and sour.

The mean score for Salty taste perception was found to be 1.33 ± 0.47 in Group A (HTN without medication), 1.53 ± 0.50 in Group B (beta blockers), 1.33 ± 0.47 in Group C (angiotensin antagonist) and 1.00 ± 0.00 in Group D (control).The mean values of salty taste perception score in the study groups were compared using One – way ANOVA test. It was found that there exists a statistically significant difference (p=0.001) amongst the mean values of salty taste perception score of individuals in the studied groups. (Table 5)
Group B (beta blockers) > Group A (HTN without medication) = Group C (angiotensin antagonist) > Group D (control)

The mean score for Sweet taste perception observed in Group A ,Group B ,

Group C and Group D was the same i.e. 1.00 ± 0.00. (Table 6)

The mean score for Bitter taste perception observed in Group A ,Group B , Group C and Group D were 1.00 ± 0.0, 1.06 ± 0.25, 1.00 ± 0.00 and 1.00 ± 0.00 respectively. There existed no statistically significant difference (p=0.165) amongst the mean values of bitter taste perception score of individuals in the studied groups. (Table 7)

The mean score for Sour taste perception observed in Group A ,Group B , Group C and Group D were 1.06 ± 0.25, 1.06 ± 0.25, 1.00 ± 0.00 and , 1.00 ± 0.00 respectively with no statistically significant difference (p=0.313) amongst the mean values of sour taste perception score of individuals in the studied groups. (Table 8)

DISCUSSION

Hypertension is recognized as one of the leading risk factors for human morbidity and mortality. On a worldwide basis hypertension has been ranked on the top as a cause of disability adjusted life years. Recently, the global prevalence of hypertension (systole/diastole ≥140/90 mm Hg) was estimated for the year 2000 and the data was used to predict the global prevalence of hypertension by 2025. More than 25% of the world's adult population was hypertensive by the afore-mentioned criteria in 2000. The estimated total number of people with hypertension in 2000 was 972 million, and this is projected to increase by 60% to a total of 1.56 billion by 2025, i.e. 29% of the worldwide adult population. [8]

Hypertension is, by definition, a hemodynamic disorder. The major hemodynamic finding associated with higher levels of blood pressure is a rise in peripheral vascular resistance. This observation led to the discovery and development of increasingly complex and targeted vasodilators, although many of the earlier antihypertensive drugs, by virtue of their actions of blocking the sympathetic nervous system, had a vasodilator component to their mode of action. Amongst the many other classes of anti-hypertensive drugs, the most routinely prescribed drugs are Beta Blockers and Angiotensin II receptor antagonists.

Beta Blockers acts by blocking β1 receptors, a subdivision of sympathetic nervous system. Sympathetic Nervous System is involved in the homeostatic regulation of a wide variety of functions such as heart rate, force of contraction of the heart, vasomotor tone and ultimately blood pressure. Thus β1 receptor blockade results into decreased cardiac output. [9]

Angiotensin II receptor antagonists act on Renin Angiotensin System (RAS) which is a hormonal cascade regulating the blood volume and arterial pressure to maintain adequate organ perfusion. [10]

Saliva is important in the maintenance of oral health by exhibiting numerous host defence functions such as lubrication, anti-microbial activity, control of mineralization potential of teeth and others [V Nimma et al]. [3] It also reflects the systemic condition of an individual.

Chemosensory functions, like taste is the major pathway for mammals to sense and respond to chemical compounds in the environment like flavour and stimulant. The chemosensory process involves several signalling mechanisms, which may be associated with the development of some diseases; however, this process is relatively under-examined in general populations. Studies suggested that mammalian epithelial sodium channels located in taste receptor cells have also been found to participate in sodium sensing by the tongue and blood pressure regulation. Furthermore, people with a decreased ability to taste sodium may have higher risk of developing hypertension due to higher sodium intake. [11]

Thus keeping in mind the aforementioned views, the present study evaluated the effect of hypertension, and anti-hypertensive drugs viz. Beta blockers and Angiotensin II receptor antagonists on salivary parameters like salivary flow rate and pH and taste perception.

Total 120 patients were included and divided in 4 groups i.e. 30 hypertensive patients not on any medications (Group A), 30 hypertensive patients taking β-blockers (Group B), 30 hypertensive patients taking Angiotensin II antagonists (Group C) and 30 healthy individuals (Group D).

In the present study the mean age of patients suffering from hypertension without any medication (Group A) was 51.13 years and that of hypertension with medication (Group B and Group C) was 50.20 years and 47.33 years respectively. Thus the mean age of patients suffering from hypertension is found to be late 4th and early 5th decade, which is in accordance with Shukla A. et al (2015) [12] who found the prevalence to be 40% in patients more than 40 years of age.

Also there were 38 males out of 90 hypertensive patients (Group A, B and C) and 52 females which shows a higher predilection for females which is in accordance with Kearney PM et al (2005) [13] whose analysis of worldwide data for the global burden of HTN stated that 20.6% of Indian men and 20.9% of Indian women were suffering from HTN in 2005. The rates for HTN in percentage are projected to go up to 22.9 and 23.6 for Indian men and women, respectively by 2025. However, the higher predilection for females in our study can also be attributed to the small sample size and the random sampling technique used in the study.

In the present study, we observed a statistically significant difference in the mean whole salivary flow rate between Group A (0.265 ± 0.04 ml/min) and Group D (0.382 ± 0.02 ml/min) respectively. The findings of our study are in agreement to the findings of Van Hoff M et al (1984), [14] Tahrir N.N. (2006), [15] whereas our findings are in contrast with the findings of Kagawa R et al (2013). [6] The disparity in the findings could be attributed to the difference in the study design of respective studies while most of studies were cross sectional in nature, the results could be subjected to confounding bias.

In our study, we observed a statistically significant difference in the mean whole salivary flow rate between Group B (0.317 ± 0.04 ml/min) and Group D (0.382 ± 0.02 ml/min) respectively. The findings of our study are in agreement to the findings of Tahrir NN (2006), [15] De Mates LF et al (2010), [16] Van Hoff M et al (1984). [14] The findings were attributed to the mechanism of action of beta blockers on sympathetic nervous system thereby decreasing the salivary flow rate.

In the present study, we observed no statistically significant difference in the mean whole salivary flow rate between Group C (0.36 ± 0.03 ml/min) and Group D (0.382 ± 0.02 ml/min) respectively, but the flow rates in Group C were lower than the control group. To the best of our knowledge, till now no study reported the effect of Renin Angiotensin II inhibitor alone on the salivary flow rate. Our findings could be due to the accumulation of bradykinin tissular mediator in the glands owing to the blockade of Angiotensin Converting enzyme, ultimately resulting in reduced salivary flow rate.

The mean salivary pH in Group A was observed to be 6.39 ± 0.30 and 7.01 ± 0.11 in Group D respectively. There exists a statistically significant difference between the mean values of both the groups. Our findings are in agreement with the observations by Kagawa R et al (2013) [6] and V Nimma et al (2016). [3] The cause of decreasing salivary pH might be a change in the general status secondary to hypertension. The blood pressure influences the general condition in several ways, which our results helped to demonstrate.

In present study, a statistically significant difference was observed between the mean Salivary pH values of Group B (6.44 ± 0.27) and Group D (7.01 ± 0.11).The findings are in agreement to the findings of NN Tahrir (2006) [15] and contrast to the findings of RPC de Araujo et al (2013). [17] The disparity in the findings could be attributed to the difference in methodologies used in the contrasting

studies whereas they observed stimulated saliva and have not reported the timing of the saliva collection as circadian variations were observed in the salivary pH.

The mean salivary pH in Group C was observed to be 6.49 ± 0.25 and 7.01 ± 0.11 in Group D respectively. There exists a statistically significant difference between the mean values of both the groups. Review of literature revealed that till now no study reported the effect of Angiotensin II inhibitor alone on the salivary pH. Our findings could be due to the sodium channel blocking action of angiotensin II antagonists, ultimately resulting in decrease Na+ concentration in the saliva and thereby decreasing the pH.

The intergroup comparison of salt taste perception resulted in statistically significant difference amongst the mean values of salty taste perception score of individuals in the studied groups (p=0.001) (Table 14). The findings of our study suggest that individuals suffering from hypertension with or without its medication have significantly altered perception for salty taste as compared to normal individuals ($p<0.05$) . These findings are in concordance with the findings of de Matos LF et al (2010); [16] Suliburska J et al (2012). [18] The observations could be attributed to the genetically determined sodium channel disorder; Environmental disturbance; or abnormality of Na+ transfer in tongue papillae, kidney tubules and/or vascular smooth muscle cells, or a down-regulation of Na+ transporter(s) secondary to hypertension (Lefrancq s et al 2007). [19]

The intergroup comparison of sweet, sour and bitter taste perception resulted in statistically no significant difference amongst their mean values ($p>0.05$). To the best of our knowledge, ours is probably the first study till now to evaluate the effect of hypertension and its medications viz. Beta blockers and angiotensin II antagonist on the aforementioned tastes. Our results could be the result of mechanism of gustatory sensations for sweet, sour and bitter taste. Increased arterial blood flow and sodium channel receptors have no added effect on other taste sensation pathways.

Within limitations of the present study, it can be observed that hypertension and anti-hypertensive medications i.e. Beta blockers and Angiotensin II antagonists do affect the salivary parameters viz its flow rate and pH and salty taste perception as compared to normal individuals.

CONCLUSION

To conclude from the present study it can be stated that hypertension leads to reduced salivary flow rate and pH. Anti-hypertensive drugs commonly prescribed like beta-blockers and angiotensin II antagonists improve the salivary flow rate but not upto the levels of the healthy individuals. Since, angiotensin II antagonists showed higher salivary flow rate than beta-blockers, they should be preferred over beta-blockers for improvement of the oral health of the patients.

Also there was increased salty taste threshold in hypertensive patients as compared to healthy individuals. This can be correlated to the restricted sodium intake advised to hypertensive patients. But since higher salty taste threshold can lead to increased sodium intake, such patients should undergo dietary counseling for maintaining appropriate dietary sodium levels.

Hence, salivary flow rate, pH and taste perception should be considered as important parameters in guiding the diet and medication protocol for hypertensive patients, thus maintaining their oral and overall health and hence improving their quality of life.

However, studies with larger sample size and also correlating salivary parameters with different stages of hypertension are recommended.

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How to cite this article: Khandelwal V, Sathawane R, Lanjekar A et.al. Assessment of taste perception, salivary flow rate and pH in hypertensive patients with or without antihypertensive medication - a comparative study. International Journal of Research and Review. 2019; 6(12):189-197.

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