



Indonesian Dental Association

Journal of Indonesian Dental Association

<http://jurnal.pdgi.or.id/index.php/jida>  
ISSN: 2621-6183 (Print); ISSN: 2621-6175 (Online)



Research Article

# Oral Health Effects of Antipsychotic Agents on Residents in a Psychiatric Facility in Medan, Indonesia

Fialdy Josua Pattiradjawane<sup>1§</sup>, Sondang Pintauli<sup>1</sup>

<sup>1</sup> Department of Preventive and Public Health Dentistry, Faculty of Dentistry, University of Sumatera Utara, Indonesia

Received date: May 27, 2021. Accepted date: September 3, 2021. Published date: October 31, 2021.

## KEYWORDS

antipsychotic agents;  
caries experience;  
drugs-induced hyposalivation;  
mental illness;  
salivary pH;  
salivary flow rate

## ABSTRACT

**Introduction:** Antipsychotic agents consumed by patients with mental illnesses can have adverse effects on the oral health. These effects include altering the composition and flow of saliva, thus reducing its protective capabilities, which, in turn, increases the risk of caries.

**Objective:** This study aimed to analyze the effects of antipsychotic drug use on salivary pH, salivary flow rate, and caries incidence on psychiatric inpatients in Pemenang Jiwa Foundation, Medan, Indonesia. **Methods:** This was an observational analytical study with a cross-sectional design. The sample population comprised male and female residents in Pemenang Jiwa Foundation. The population was selected through purposive sampling, which yielded 51 participants. Usage of antipsychotics were categorized based on the duration (3-6 months, 6 months to 3 years, >3 years) and the number of daily drug consumption (1, 2, 3, >3). Oral manifestations evaluated were salivary flow rate, pH, and DMFT. Chi-square and Fisher's exact tests were used to analyze the association between the consumption of antipsychotic agents and salivary pH, salivary flow rate, and caries incidence. **Results:** There were 28 females and 23 males with a mean age of 41 years old were included in the study. More than half of the respondents (51%) had consumed antipsychotic medications daily for between 6 months and 3 years. Fewer than half of the respondents (45.1%) consumed more than three types of antipsychotic medications. There was a significant association between the quantity of antipsychotic agents consumed daily and salivary pH ( $p=0.007$ ), salivary flow rate ( $p=0.0001$ ), and caries incidence ( $p=0.006$ ). Only the duration of antipsychotic drug use and not the number of antipsychotic drugs consumed daily was associated with salivary pH ( $p=0.014$ ).

**Conclusion:** The quantity and duration of use of antipsychotic agents affects salivary pH, salivary flow rate, and caries incidence.

<sup>§</sup> Corresponding Author

E-mail address: [fialdyjp@gmail.com](mailto:fialdyjp@gmail.com) (Pattiradjawane FJ)

DOI: [10.32793/jida.v4i2.691](https://doi.org/10.32793/jida.v4i2.691)

**Copyright:** ©2021 Pattiradjawane FJ, Pintauli S. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium provided the original author and sources are credited.

## INTRODUCTION

Mental illness is generally caused by multifactorial interactions between biological, social, psychological, genetic, and environmental factors, as well as changes in cerebral neurotransmitters.<sup>1</sup> Mental illness affects approximately 17.6% of the world's population, with one in every four people likely to experience mental illness throughout their lifetime.<sup>2</sup> According to the Constitution of the Republic of Indonesia (Article No. 13, 2004), individuals with mental illnesses have the same basic rights as healthy individuals with respect to the receipt of health services, including oral health services. Oral health problems have marked physical (e.g., mastication and talking) and psychosocial (e.g., smile esthetics) impacts, which can have adverse effects on self-confidence and quality of life.<sup>3,4</sup>

Individuals with mental illnesses are more prone to oral diseases, including caries. Caries in individuals with mental illnesses are caused by decreasing function of the salivary glands, secondary to the usage of antipsychotic agents, in addition to a lack of self-care and failure to seek healthcare services due to changes in personality and self-neglect.<sup>2</sup> In terms of oral health, common long-term extrapyramidal side-effects of antipsychotic agents include xerostomia (dry mouth) and hyposalivation. Normally, the saliva bathes the oral cavity in organic and inorganic components. Saliva acts as a natural cleaning agent and provides protection against demineralization of the dental structure through a simple rinsing mechanism, antimicrobial activity, buffering capacity, calcium phosphate binding properties, and immunoglobulin secretion.<sup>5</sup> A decline in the salivary flow rate can lead to a higher incidence of caries due to increased food retention, loss of buffering capacity, and acidic conditions in the oral cavity. The resulting low pH environment supports the growth of bacteria that metabolize carbohydrates.<sup>6,7</sup> Several authors have proposed that the use of antipsychotic agents is associated with xerostomia and the Decay Missing Filling Teeth (DMFT) index.<sup>6-10</sup> However, no studies have investigated the association of antipsychotic agents with salivary pH, salivary flow rate, and the DMFT index. The aim of the present study was to investigate the effects of antipsychotic drug use on salivary pH, salivary flow rate, and caries among psychiatric inpatients in Pemenang Jiwa Foundation, Medan, Indonesia. This facility has been opened for more than 10 years and has catered patients with mental disorders ever since.

## MATERIALS AND METHODS

The study was approved by the health research ethics committee of the Medical Faculty of Universitas

Sumatera Utara, H. Adam Malik General Hospital, Medan, Indonesia (No: 0897/ TGL/KEPK FK USU-RSUP HAM/2019). This was an analytical study with a cross-sectional design. This research was conducted in Pemenang Jiwa Foundation in Medan Tuntungan, North Sumatra. All the participants provided informed consent through their attending clinician/ nurse.

### Study Population

The sample population were residents in Pemenang Jiwa Foundation. The study population was recruited via the purposive sampling method, which yielded 51 participants. The inclusion criteria were patients aged 20–55 years who had been diagnosed with mental illnesses and treated with antipsychotic agents for a minimum of 3 months. The exclusion criteria were edentulism (i.e., complete loss of all dentitions), an inability to communicate, a smoker, and systemic health conditions.

### Research Procedure

The attending clinician/ nurse of the participants was given a questionnaire, with questions on the characteristics of daily antipsychotic drug consumption (duration and quantity). They were asked to complete these questionnaires with the help of their attending clinician or nurse. Stratification of the daily antipsychotic drugs consumed were classified according to previous research by Alhaffar et al., and the number of antipsychotic drugs consumed per day (1, 2, 3, or >3), in addition to the duration of antipsychotic drug use (3–6 months, 6 months, 3 years, >3 years), was recorded.<sup>9</sup>

All the participants underwent a clinical examination onsite at the Pemenang Jiwa Foundation, and measurements were taken to provide data for three dependent variables of this research. The dependent variables were salivary flow, pH, and DMFT. Salivary samples were collected using a Saliva-Check Buffer (GC, Tokyo, Japan). Salivary samples were collected between 9:00 and 11:30 a.m., and all the participants fasted for 1 hour before collection. For sample collection, the participants were asked to sit in an upright position, with their head tilted noted slightly forward. To stimulate saliva, each participant was asked to chew paraffin wax prior to collecting the samples. Salivary sample collection was based on the spitting method, with samples collected every 1 minute for 5 minutes. At the end of the 5-minute period, the amount of saliva in the pot was measured in milliliters. The pH of the samples was determined using pH strip from the Saliva-Check Buffer (GC, Tokyo, Japan) and was recorded. The number of caries was recorded using the DMFT WHO index.

The salivary flow rate was classified based on the Saliva-Check Buffer (GC, Tokyo, Japan) classifications, such as normal (>5.0 ml/5 minutes), low (3.5–5.0 ml/ 5 minutes), or hyposalivation (<3.5 ml/5 minutes).<sup>11</sup> Salivary pH was classified as acidic (pH: 5–5.8), normal (pH: 6–6.6), and basic (pH: 6.8–8.0). Salivary flow rate and pH classification was based on the Saliva-Check Buffer (GC, Tokyo, Japan). The incidence of caries was classified based on the WHO classifications for DMFT, such as very low (<5), low (5–8.9), moderate (9–13.9), or high (>13.9).<sup>12</sup>

### Statistical Analysis

All the data were analyzed using Statistical Product and Service Solutions (SPSS) for Mac, version 26 (IBM Corp., NY, USA). Nonparametric data were analyzed by univariate and bivariate analyses. Data of gender, age, antipsychotic drug usage duration and daily drug consumption, salivary flow, pH, and DMFT in the univariate analysis are presented as frequencies. Fisher's exact tests were conducted for bivariate analysis to analyze antipsychotic drug usage (duration and daily drug consumption) towards salivary pH, flow rate, and DMFT. The significance level was set at  $p < 0.05$ .

## RESULTS

### Descriptive Data

In terms of the sex ratio of the study population ( $N=51$ ), it was more or less equal (males,  $n=8$ ; females,  $n=23$ ). Table 1 provides information on the demographic characteristics, antipsychotic drug use and duration, salivary pH and flow rate, and caries incidence in the study population.

### Salivary pH

Table 2 shows the association between the number and duration of use of antipsychotic drugs and salivary pH. The results revealed a trend whereby an increase in the quantity of antipsychotic agents and duration lowered the pH to a more acidic state. There was a significant association between the quantity and duration of use of antipsychotic agents and salivary pH ( $p=0.007$  and  $p=0.014$ , respectively).

### Salivary Flow Rate

As shown in Table 3, the consumption of antipsychotic agents affected the salivary flow rate, and an increase in the number of daily drugs consumed was associated with an increase in hyposalivation. Daily consumption of one antipsychotic agent was associated

**Table 1.** Demographic characteristics, antipsychotic drug use and duration, caries incidence, and salivary pH and flow rate in the study population

Demographic characteristics	N = 51
<b>Sex (%)</b>	
Male	28 (54.9%)
Female	23 (45.1)
<b>Daily consumption of antipsychotic drug (%)</b>	
1	7 (13.7)
2	12 (23.5)
3	23 (45.1)
> 3	9 (17.6)
<b>Duration of antipsychotic drug use (%)</b>	
3–6 months	15 (29.4)
6 months to 3 years	26 (51)
> 3 years	10 (29.6)
<b>Salivary pH (%)</b>	
Basic	38 (74.5)
Normal	11 (21.6)
Acidic	2 (3.9)
<b>Salivary flow rate (%)</b>	
Normal	0 (0)
Low	9 (17.6)
Hyposalivation	42 (82.4)
<b>Caries incidence (%)</b>	
Very low	5 (9.8)
Low	6 (11.8)
Moderate	23 (45.1)
High	17 (33.3)

**Table 2.** Association of antipsychotic agents with salivary pH.

Antipsychotic agents	Salivary pH N (%)			p-value
Daily consumption of antipsychotic drug	Basic	Normal	Acidic	
1	7 (100)	0 (0)	0 (0)	0.007
2	11 (91.7)	0 (0)	1 (8.3)	
3	13 (56.5)	10 (43.5)	0 (0)	
>3	7 (77.8)	1 (11.1)	1 (11.1)	
Duration of antipsychotic drug use	Basic	Normal	Acidic	p-value
3–6 months	13 (86.7)	1 (6.7)	1 (6.7)	0.014
6 months to 3 years	21 (80.8)	4 (15.4)	1 (3.8)	
> 3 years	4 (40)	6 (60)	0 (0)	

with a low salivary flow rate (85.7%), whereas the daily consumption of >3 antipsychotic agents was associated with hyposalivation (100%). Only the quantity of antipsychotic agents consumed was related to the salivary flow rate and not the duration of antipsychotic drug use was related to the salivary flow rate ( $p = 0.0001$ ).

**Table 3.** Association between antipsychotic drug use and salivary flow rate.

Antipsychotic agents	Salivary Ph N (%)			p-value
	Normal	Low	Hyposalivation	
Daily consumption of antipsychotic drug				
1	0 (0)	6 (85.7)	1 (14.3)	0.0001
2	0 (0)	1 (8.3)	11 (91.7)	
3	0 (0)	2 (8.7)	21 (91.3)	
> 3	0 (0)	0 (0)	9 (100)	
Duration of antipsychotic drug use				
3–6 months	0 (0)	5 (33.3)	10 (66.7)	0.014
6 months to 3 years	0 (0)	4 (15.4)	22 (84.6)	
> 3 years	0 (0)	0 (0)	10 (100)	

**Table 4.** Association between antipsychotic drug use and caries incidence

Daily consumption of antipsychotic drug	Caries incidence N (%)				p-value
	Very low	Low	Moderate	High	
1	4 (57.1)	2 (28.6)	1 (14.3)	0 (0)	0.006
2	1 (8.3)	2 (16.7)	5 (41.7)	4 (33.3)	
3	0 (0)	2 (8.7)	12 (52.5)	9 (39.1)	
> 3	0 (0)	0 (0)	5 (55.6)	4 (44.4)	
Duration of use					
3–6 months	3 (20)	2 (13.3)	6 (40)	4 (26.7)	0.76
6 months to 3 years	2 (7.7)	3 (11.5)	13 (50)	8 (30.8)	
> 3 years	0 (0)	1 (10)	4 (40)	5 (50)	

## DISCUSSION

In this study on 51 inpatients with mental illnesses in Pemenang Jiwa Foundation, the majority of the patients had basic salivary pH, and most of the patients were categorized as having hyposalivation (Table 1). Theoretically, pH levels are aligned with the salivary flow rate, with a lower pH linked to a lower flow rate.<sup>13</sup> However, this was not found in our study. This finding is

similar to that reported by Almeida et al., where users of cocaine had a basic pH of  $7.11 \pm 0.212$ .<sup>14</sup> It is also in accordance with a study by Ngo et al., where antipsychotic users had a salivary flow rate of  $0.2 \pm 0.3$  ml/min.<sup>15</sup> These findings appear to support the idea that antipsychotic agents blocks muscarinic receptors, thus altering the composition by increasing potassium ions resulting in pH alteration to basic pH. Flow rate alterations were caused due to these drugs being a competitive inhibitor of the acetylcholine released by parasympathetic nerves on the acinar cells, resulting in alteration of flow rate.<sup>16</sup>

Alterations in the composition and flow of saliva in this study can explain the moderate to high DMFT index of most of the respondents, with alterations induced by the consumption of antipsychotic agents decreasing the protective function of saliva, leading to a high incidence of caries. The effect of mental illness on self-care, including oral hygiene, likely also contributed to high DMFT index.<sup>1,5</sup>

In this study, we found a significant association between the daily consumption of antipsychotic drugs and salivary pH, flow rate, and caries incidence. Similar findings were found by Krunic et al. and Alhaffar et al., with both reporting a possible dose-responder relationship, where an increase in the quantity/dosage has a negative impact on the oral cavity (e.g., lowering salivary flow and increasing the incidence of caries).<sup>17,10</sup> In the present study, the quantity of antipsychotics consumed daily was significantly associated with the salivary profile and a higher caries incidence. Of the dependent variables investigated in the present study, only the duration of use of antipsychotic agents was significantly associated only with salivary pH and not any other parameters. Ngo et al. and Djamaluddin et al. reported similar findings, finding no significant association between the duration of antipsychotic use and salivary flow rate.<sup>15,18</sup> Ngo et al. and Alhaffar et al. also found no significant association between the duration of antipsychotic use and caries incidence.<sup>15,10</sup> This finding may be explained by the half-life of antipsychotic drugs (i.e., between 3 and 17 hours) and peak concentration in plasma (1-hour post consumption). Thus, the effect of drug use is most apparent shortly after consumption. This also may explain why the daily consumption of antipsychotic drugs has a more significant effect than the duration of use.

## CONCLUSION

Both the quantity and duration of use of antipsychotic agents affected salivary pH, salivary flow rate, and caries incidence. By affecting the salivary pH and flow rate, antipsychotic agents further increase the risk of caries.

## Conflict of Interest

There is no conflict of interest in this study.

## REFERENCES

1. Scully C. Scully's handbook of medical problems in dentistry (7th ed). Churchill Livingstone, Edinburgh 2016, pp. 294-6.
2. Torales J, Barrios I, Gonzalez I. Oral and dental health issues in people with mental disorders. *Medwave*. 2017; 17(8): 7045.
3. Kebede B, Kemal T, Abera S. Oral health status of patients with mental disorders in Southwest Ethiopia. *Plos One*. 2012; 7(6): e39142.
4. Matevosyam NR. Oral health of adults with serious mental illness: a review. *Community Ment Health J*. 2010; 46: 553-62.
5. Hegde MN, Attavar SH, Shetty N, Hegde ND, Hegde NN. Saliva as a biomarker for dental caries: a systematic review. *J Conserv Dent*. 2019; 22(1): 2-6.
6. Kisely S, Quek LH, Pais J, Lalloo R, Johnson NW, Lawrence D. Advanced dental disease in people with severe mental illness: systematic review and meta-analysis. *Br J Psychiat*. 2011; 199: 187-93.
7. Eltas A, Kartalci S, Eltas SD, Dundar S, Uslu MO. An assessment of periodontal health in patients with schizophrenia and taking antipsychotic medications. *Int J Dent Hygiene*. 2013; 11: 78-83.
8. Veerabhadrapppa SK, Chandrappa PR, Patil S, Roodmal SY, Kumarswamy A, Chappi MK. Evaluation of xerostomia in different psychological disorders: an observational study. *J Clin Diag Res*. 2016; 10(9): 24-7.
9. Ramon, T, Grinshpoon A, Zusman SP, Weizman A. Oral health and treatment needs of institutionalized chronic psychiatric patients in Israel. *Eur Psychiat*. 2003; 18(3): 101-5.
10. Alhaffar BA, Abbas G, Latiefeh Y, Hamadah O. The oral manifestations of psychiatric disorders. *OHDM*. 2018; 17(4): 1-6.
11. GC America Inc. Saliva check buffer testing mat [Internet]. America: GC America Inc; 2012 [Updated 2012; cited 2021 Oct 27]. Available from: [http://www.gcamerica.com/products/preventive/Saliva\\_Check\\_BUFFER/Saliva\\_Check\\_TestingMat.pdf](http://www.gcamerica.com/products/preventive/Saliva_Check_BUFFER/Saliva_Check_TestingMat.pdf)
12. World Health Organization. Oral health surveys. Basic methods (5th ed). World Health Organization, 2013, pp. 74.
13. Humphrey SP, Williamson RT. A review of saliva: normal composition, flow, and function. *J Prosthet Dent*. 2001; 85: 162-9.
14. de Almeida Pdel V, Grégio AM, Brancher JA, Ignácio SA, Machado MA, de Lima AA, Azevedo LR. Effects of antidepressants and benzodiazepines on stimulated salivary flow rate and biochemistry composition of the saliva. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2008;106(1):58-65.
15. Ngo DYJ, Thomson WM, Subramaniam M, Abdin E, Ang KY. The oral health of long-term psychiatric inpatients in Singapore. *Psychiatry Res*. 2018; 266: 206-11.
16. Woyceichoski, Costa CH, de Araújo CM, Brancer JA, Resende LC, Vieira I, et al. Salivary buffer capacity, pH, and stimulated flow rate of crack cocaine users. *J Investig Clin Dent*. 2013; 4: 160-3.
17. Kronic J, Stojanovic N, Ivkovic N, Stojic D. Salivary flow rate and decayed, missing, and filled teeth (DMFT) in female patients with schizophrenia on chlorpromazine therapy. *J Dent Sci*. 2013; 8: 418-24.
18. Djamaluddin N, Anwar AI, Sadad RP, Dwisari FRAP, Wulansari DP. The effect of duration of antipsychotics medicine use toward the salivary flow rate of schizophrenics in special hospital of South Sulawesi province. *ICER-PH*. 2018: 1-6.