

Xerostomia and Salivary Flow Rates in Methamphetamine Abusers in Jakarta, Indonesia

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Abstract

Methamphetamine (MA) abuse appears to have an impact on oral health. No studies have reported on the salivary flow among MA abusers in Indonesia. The aim of this study was to examine associations between subjective xerostomia perception and the actual hyposalivation among MA abusers compared to nonusers. This cross-sectional study included 43 MA abusers and 43 controls matched for sex and age. Interviews were conducted to acquire data on the subjective self-assessment dry mouth (xerostomia) and drug use. Bivariate analysis was used to examine the associations between xerostomia and objective measurements of the salivary flow rate (SFR) among the 86 subjects. The SFR was determined using the spitting method.

There was no significant reduction in the stimulated SFR among MA abusers compared with nonusers (1.42 vs. 1.15 mL/min). The stimulated SFR among MA abusers and nonusers were in the normal range (88%) and the remaining were in the low category (12%). Moreover, xerostomia was reported in 84% of users and 7% of nonusers ($p < 0.05$). No significant association was found between xerostomia and hyposalivation ($p = 1.000$). Furthermore, only 12% MA abusers had a low SFR but 84% reported xerostomia compared to 3% of nonusers. Xerostomia is a subjective perception, the dentists need to pay more attention to comprehensive oral health education and treatment for MA abusers.

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Introduction

Methamphetamine (MA) is a highly addictive stimulant whose long-term use results in serious and devastating medical, psychological, oral conditions and even death in extreme cases.^{1,2} According to the National Narcotic Agency, Republic of Indonesia (BNN RI), in the 2017 National Survey 3,376,115 people (1.26% of the population) suffered from drug abuse, with the most commonly used drug being cannabis (1,742,385 cases), following by MA (1,607,962 cases).³ The long-term and widespread use of this drug is considered to be a serious public health problem. One of the complaints among MA abusers with respect to the oral cavity is xerostomia, or dry mouth.⁴

Saliva has different functions in the oral cavity, such as cleansing and protecting the oral tissue against physical and microbial insult, lubricating the oral mucosa and preventing dehydration, forming the permeability barrier, regulating calcium/phosphate balance, digestion, and aiding swallowing.^{5,6} Salivary flow is essential for these actions and reduced salivary flow can lead to an increase in the occurrence of dental caries, oral infections, and gastrointestinal complications and a decrease in the quality of life.⁷ Hyposalivation is defined as an objective reduction in salivary flow and is usually, but not always, associated with xerostomia, which is the subjective perception of dry mouth.⁸ Many cases of xerostomia have been described in patients with a normal salivary flow rate (SFR).⁷ Hyposalivation can be caused by various factors such as systemic diseases, the use of medications, radiotherapy of the head and neck, and the use of illicit drugs. MA is one of the illicit drugs associated with dry mouth.^{1,8,9}

A comparative study of xerostomia and SFR in MA abusers and nonusers has not been conducted in Indonesia. Such information is important for improving the strategies of oral

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healthcare and recovery of dependent individuals. Thus, the aim of the present study was to examine the association between xerostomia and SFR between MA abusers and nonusers.

Materials and methods

Subjects and study design. A cross-sectional study with a control group was conducted in the Drug Dependency Hospital in Jakarta. The data were collected between April and May 2018. This study received approval from the research ethics committee of the Faculty of Dentistry, Universitas Indonesia (Jakarta) (number 11/Ethical Approval/FKGUI/III/2018), and all subjects provided informed consent. Subjects were considered as eligible MA users if they were under treatment for drug dependency, had used MA for at least 1 year, and were free of neurological or psychological disorders. Each MA user was paired with a control who had never used any street drugs and was matched for sex and age (± 3 years). This group was recruited from individuals who required a drug dependence-free recommendation letter. The sample size was calculated based on previous research,¹⁰ and a minimum of 42 subjects was required for each group.

Data collection. Data on the demographics, socioeconomic, and medical-dental and drug histories were obtained from medical records. The variables were categorized as follows: age in years (\leq or >27 years, which was the median of the controls); sex (female or male); and MA use (never used/used for at least 1 year).

Each subject completed a questionnaire with the following questions related to reduced saliva secretion: does the amount of saliva in your mouth seem to be too little?; does your mouth feel dry when eating a meal?; do you sip liquids to aid in swallowing dry food?; do you have difficulty swallowing?¹¹ Subjects who answered affirmatively to at least one of the questions were considered as being positive for subjective complaints of xerostomia, even with subjects who had not previously expressed complaints of xerostomia,¹² they were categorized in hyposalivation.^{8,11}

Salivary flow rate. The reliability of SFR measurement was verified by inter-examiner

calibration of volunteers with characteristics similar to those of the study population. The Cohen κ value exceeded 0.8, indicating very good inter-examiner agreement. Both resting and stimulated saliva were collected using the spitting method between 9:00 and 10:30 AM, during a morning fast. Subjects were asked to sit in a comfortable chair and instructed not to speak or interrupt the collection process. Unstimulated saliva was collected first for 5 min. Stimulated saliva was collected by chewing plain paraffin gum for an additional 5 min. Subjects expectorated the accumulated saliva into sterile tubes, and secretion was expressed in mL/min, which is similar to g/min because the density of saliva is close to 1. Salivary flow was determined by a trained examiner. Unstimulated salivary flow rate (USFR) was categorized as a normal (≥ 0.1 mL/min) or low (< 0.1 mL/min) and stimulated salivary flow rate (SSFR) was categorized as normal (> 0.7 mL/min) or low (≤ 0.7 mL/min). Hyposalivation was considered present when a subject exhibited both low USFR and low SSFR (< 0.1 mL/min and ≤ 0.7 mL/min).¹³

Data analysis. Data were expressed as mean \pm standard deviation and median values. The Shapiro–Wilk test was used to determine the distribution (normal or non-normal) of the data. The SFR, hyposalivation, and xerostomia were compared between MA abusers and nonusers using the Wilcoxon and McNemar tests, and $p < 0.05$ was considered statistically significant. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS, version 22.0, Chicago, IL, USA).

Results

A total of 43 MA abusers were eligible for the study, and the study population comprised 86 subjects (43 in each group). Both groups were predominantly male (80%) and 75% were smokers, with age ranging from 14 to 46 years (Table 1). A majority of MA abusers (53.5%) had previously or concomitantly taken other street drugs, such as cannabis and cocaine (46.5%).

	MA Abusers (n = 43)	Nonusers (n = 43)
Age (years), mean ± SD	27.79 ± 6.79	29.51 ± 8.95
Sex, n (%)		
Female		8 (19)
Male	40 (93)	35 (81)

Table 1. Distribution of subjects' demographics based on age and sex (n = 86).

The duration of MA use was classified into more than and under 10 years. A majority of users had been taking MA for under 10 years (36; 84%). MA abusers had not consumed only one type of drug, 20 (46.5%) abusers used other drugs (MA mixed with heroin and cannabis) and 23 (53.5%) of them had only MA. The USFR in MA abusers was similar to that in nonusers (0.57 vs 0.49 mL/min, respectively), but the SSFR was higher compared with that in nonusers (1.42 vs. 1.15 mL/min, respectively; $p < 0.001$). A total of 12% and 88% of MA abusers had low and normal SSFR, respectively ($p < 0.001$). Moreover, 84% of MA abusers perceived dry mouth compared with 7% of nonusers ($p < 0.012$; Table 2).

The majority of short-term MA abusers (< 10 years) had a normal SSFR compared to their long-term counterparts (32 vs 6, respectively; Table 4).

	Xerostomia MA Abusers	
	Yes	No
Duration of <10 years	29	7
MA Abuse >10 years	7	0

Table 3. Distribution of the duration of methamphetamine (MA) use and xerostomia.

	SSFR	
	Hyposalivation	Normal
Duration of <10 years	4	32
MA Abuse >10 years	1	6

Table 4. Distribution of the duration of methamphetamine (MA) abuse and stimulated salivary flow rate (SSFR).

Xerostomia		SSFR (mL/min)		P Value
		Hyposalivation	Normal	
MA users	Yes	4	32	1.000
	No	1	6	
Nonusers	Yes	0	3	1.000
	No	5	35	

Table 5. Association between xerostomia and hyposalivation.

Discussion

In the present study, the SFR was compared between MA abusers and nonusers and no significant differences were found between the USFR and SSFR. The increased occurrence of xerostomia in users of illicit drugs has been reported in previous studies,^{10,14} which is in agreement with the present findings. However, one study comparing the salivary characteristics between crack cocaine abusers and controls found changes in the salivary pH but not in the salivary flow or buffering capacity ($p > 0.05$).¹⁵

No statistically significant difference was found in the amount of unstimulated and stimulated saliva between MA abusers and nonusers (Table 2). MA abusers had undergone clinical withdrawal therapy for an average of 21 days previously. It assumed the salivary gland function had not been effected by the drugs. This may explain why reduced salivary secretion was not found in 88% of MA abusers.

The majority of MA abusers reported xerostomia (84%). Xerostomia is a subjective feeling or sensation that may or may not be accompanied by a reduction in normal salivary flow¹⁶ and has not been found to be significantly associated with a reduction in salivary flow (hyposalivation).¹⁷ The results of the present study suggest that the sympathomimetic effects of MA contribute to xerostomia experienced by MA users.¹

The mean standard stimulated salivation is considered to be 1–2 mL/min, with salivation of > 0.7 mL/min considered as rather low.¹³ In our study, the mean SFR was 1.4 mL/min among the 43 chronic MA abusers. Furthermore, the majority of all MA abusers experienced a dry mouth from the beginning of MA abuse. Thus, chronic MA abuse appears to carry a high risk of xerostomia. The mechanism by which MA induces xerostomia is still unknown. However, the sympathomimetic effects of MA on the alpha-2-receptors of the brain appear to be the responsible factor.^{1,14} The direct stimulation of the inhibitory alpha-2-adrenal receptors of the salivary glands by MA as a possible mechanism is, nevertheless, considered to be controversial.^{1,18} We did not evaluate the pathogenic mechanism of dry mouth symptoms, but it is likely that its development is due to a combination of the factors described above.

The gold standard for determining the distinction between normal and abnormal salivary flow has not been established in the literature. However, a normal SFR is considered to be between 0.7 and 1.5 mL/min.¹² Some authors consider a SSFR <0.7 mL/min to be indicative of hyposalivation, whereas others consider 0.2 mL/min to be the cutoff point.¹⁴

The findings of our study need to be viewed in the context of a few limitations. We collected data in a subject population that previously had undergone withdrawal for at least 21 days, it assumed that MA abusers had recovered from MA effect in oral cavity. Other limitations were the fact that saliva qualities, such as pH and buffering capacity, were not investigated and that the cross-sectional design did not allow for the establishment of a relationship of causality. Despite these limitations, the study design and its findings exhibit several strengths, including a systematic clinical evaluation of a study population that is usually difficult to reach and for which systematic study designs rarely exist. The large sample size of this study provides high significance to the examined parameters. In the future, additional research involving active chronic MA abusers, preferably with standardized indices and a longitudinal study design, would be desirable to confirm the findings of this study and to gain a

clearer view of the association between xerostomia and SFR.

Conclusions

Xerostomia was not significantly associated with a reduction in salivary flow (hyposalivation), possibly because the SFR may have recovered in MA abusers who underwent withdrawal treatment. Xerostomia is a subjective perception that highlights the need for dentists to pay more attention to comprehensive oral health education and treatment.

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Declaration of Interest

The authors declare no conflicts of interest.

Variable	MA Abusers (n = 43)	Nonusers (n = 43)	p
Average Unstimulated Salivary Flow (mL/min)			<0.001*
Mean ± SD	0.57 ± 0.31	0.49 ± 0.18	0.446
Median	0.5	0.5	
Average Stimulated Salivary Flow (mL/min)			<0.001*
Mean ± SD	1.42 ± 0.63	1.15 ± 0.41	0.031
Median	1.40	1.16	
Salivary Flow			
Unstimulated Normal (<0.1 mL/min)	43 (100%)	0 (0%)	
Stimulated Normal (> 0.7 mL/min)	38 (88%)	38 (88%)	1.000
Low (≤ 0.7 mL/min)	5 (12%)	5 (12%)	
Xerostomia			<0.012**
Yes	36 (84%)	3 (7%)	0.000
No	7 (16%)	40 (93%)	

Table 2. Comparison of salivary flow rate and xerostomia between MA drug abuser and nonusers (n=86).

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