SALIVARY PROFILE OF RECOVERING DRUG USERS IN INDONESIA

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Abstract

To determine the salivary pH and buffering capacity in recovering drug abusers. It was a cross-sectional study with descriptive research design through a study conducted in 116 residents of Rehabilitation Center of the National Narcotics Bureau, Lido, West Java. Salivary samples were analyzed using GC saliva-check buffer kit. The mean unstimulated salivary flow rate (USSFR) and stimulated salivary flow rate (SSFR) were 0.46±0.25ml/min and 1.3±0.70ml/min respectively (p<0001). 69.0% of residents had normal unstimulated salivary pH, 95.6% of residents had normal stimulated salivary pH, and while 48.3% of residents had a relatively low salivary buffering capacity. This study showed that the residents had normal salivary pH values, but tend to had low buffering capacity. There are various factors that contribute to buffering capacity of saliva, including the protein, phosphate, and carbonate buffering system, salivary flow rate, the activity of carbonic anhydrase VI, and salivary gland condition. Residents of Rehabilitation Center of the National Narcotics Bureau Lido, West Java showed had normal salivary flow rate, normal salivary pH, however had low salivary buffering capacity.

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Introduction

Saliva is a biological fluid that is secreted by salivary glands located in the head and neck region. The secretion is regulated by autonomic neurogenic system, and the salivary gland is innervated by sympathetic and parasympathetic nerves. The stimulation of the sympathetic nerve induces secretion of mucous saliva while that of parasympathetic nerve induce a serous saliva. Stimulation to both types of nerve through smells, taste or vision could increase the rate of salivary secretion. Saliva functions in maintaining neutral pH in the oral cavity and producing calcium and phosphate ions that are needed for the teeth remineralization. Saliva also protects teeth and oral mucosa from local microbial by producing many enzymes, sIgA, lactoferrin, and histatin.[1] Saliva also facilitates natural lubrication while eating, swallowing and speaking, therefore minimalizing friction or trauma to oral mucosa. Many health consequences may result from lack/reduce of salivary function. Salivary pH influences the buffering capacity of the saliva. The salivary buffering capacity defines as the ability to neutralize the pH to neutral after exposure to basic or acidic condition. Maintenance of neutral pH is gained by releasing or bonding the Hydrogen ion (H+) in acidic or basic condition. Therefore, maintaining the buffering capacity and pH in normal condition are

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important to keep intra-oral homeostasis. Disturbance in oral homeostasis would results in increasing risk of development of dental caries, oral mucosal infection, problems in eating, speaking, or stomatognatic functioning, with further gastrointestinal disturbances.

Changes in local and/or systemic condition influences the secretion of saliva include systemic diseases, drugs, radiotherapy in the head and neck region.[2] In dentistry, there several oral manifestation related to drug abuse and addiction behaviour.[3] It was shown that many therapeutic and recreational drugs have been related to oral dryness.[4-6] Study in the Indonesian National Narcotics Bureau and Universitas Indonesia's Health Research Center showed that the prevalence of drug abuse in Indonesia reached 2.2% of all 10-59-year-old people.[7] The type of drugs that are commonly abused include marijuana, methamphetamine, heroin, MDMA, and cocaine.[7,8] The residents of the National Narcotics Bureau Rehabilitation Center mostly are recovering from methamphetamine, heroin, marijuana, MDMA and cocaine, respectively.[8]

Despite extensive use of saliva as diagnostic tools for detection of recreational drugs and drug monitoring, very few studies investigating saliva profile in the drug addicts. Several studies have been shown the impact of a specific drug on oral health condition.[9] Previous study in Indonesia profiled oral health status amongst drug addicts in the prison, however study that focus on salivary profile has not been available.[10] Therefore, this study aimed to investigate the salivary flow rate, pH and buffer capacity of recovering drug addicts who were the residents of Indonesian National Narcotics Bureau. Initial data on the salivary profile of the drug abuser and drug addicts in Indonesia could be gained and compare to other countries. Possible difference in culture and pattern of drug use would influence the results. Moreover, providing useful information for long term treatment planning in the rehabilitation program using minimal intervention approach.

Methods

This study was approved by the Ethical Committtee of the Faculty of Dentistry Indonesia. This was a descriptive cross-sectional study of National Rehabilitation Center (NRC) of National Narcotics Bureau. Subjects of this study were residents of the NRC who were in the rehabilitation program in September 2013 (males, smokers with 5 cigarettes/day, mean age=29.4±7.3, range= 17–49 years). The subjects were in stable condition and voluntarily agreed to participate in the study by signing the informed consent. Subjects who had drugs-related addiction, physical illness or psychiatric illness were not included in the study. There were 116 subjects were participated in this study. The subjects were in the first three months of the rehabilitation program.

Saliva collection, and measurement of pH and buffering capacity

The unstimulated salivary flow rate (USSFR) was collected in the morning of approximately at 10 am. The subjects were ask to avoid eating or drinking, or teeth cleaning about 1 hour prior saliva collection. The USSFR was collected in 5 minutes time, where patient was asked to expectorate the saliva every 60 seconds. Collection of the stimulated salivary flow rate (SSFR) sample was performed by asking the patient to chew paraffin wax for 5 minutes, while expectorating the saliva every 60 seconds. The analysis of salivary pH was done using USSF and SSFR saliva sample, while buffer capacity analysis used the SSFR sample. All the procedure was carried out using Saliva-Check BUFFER Kit from GC (900200 GC America, Inc.).

Statistical analyses

Numerical data were analyzed using the Kolmogorov– Smirnov normality test, Levene's Test for Equality of Variances, Student's t-test, and one-way ANOVA. Differences were considered statistically significant when $p<0.05$. All data were tabulated, and statistical tests were performed with GraphPad Prism 5 (GraphPad Software Inc).

Results

The study showed that the mean of USSFR and SSFR for the subjects were 0.46±0.25ml/min and 1.3±0.70ml/min respectively, showing normal salivary flow rate. This study showed that 8(7%) and 21(18%) subjects were classified having hyposalivation according to USSFR and SSFR respectively, and

the difference was significant (p<0.0001) (Table 1). The subjects were then divided into 4 age groups and the mean USSFR and SSFR between groups were analyzed. The comparison between means USSFR and SSFR of the groups were shown in Table 2. There was no significant difference between means of those groups (p>0.05).

Saliva	Salivary flow rate (ml/min) Mean±SD	Number of Subjects with Hyposalivation n (%)	pH Mean±SD	Buffering Capacity Mean±SD
Unstimulated	0.46±0.25	8(7)	7.0±0.4	-
Stimulated	1.3±0.70	21(18.1)	7.4±0.3	6.90±2.60

Hyposalivation USSFR <0.2ml/min, SSFR <0.7ml.min; pH score: highly acidic= 5.0-5.8, moderate acidic= 6.0-6.6, normal=6.8-7.8; buffer capacity score: very low=0-5, low=6-9, normal=10-12

Table 1. Salivary profile of the subjects.

Age	n	Unstimulated salivary pH Mean±SD	Stimulated salivary pH Mean±SD	Buffer capacity Mean±SD
16-25	35	0.53±0.28	1.20±0.70	6.90±2.51
26-35	58	0.45±0.27	1.40±0.70	7.01±2.64
36-45	22	0.37±0.15	1.30±0.60	6.68±2.74
p value		0.06	0.3	0.87

Table 2. Salivary pH and buffering capacity of subjects in different age group.

The majority of subjects in this study had normal pH while only less than 10% subjects had very acidic pH on unstimulated salivary sample. Almost all the subjects (96%) had normal pH and the rest 4% of subjects remained having moderately acidic salivary pH on stimulated salivary sample. Despite having normal pH on stimulated saliva, low to very low salivary buffer capacity was found in approximately 90% of subjects (Figure 1). The mean salivary buffer capacity of the subjects that was 6.90±2.60, therefore the buffer capacity was considered to be low (Table 1).

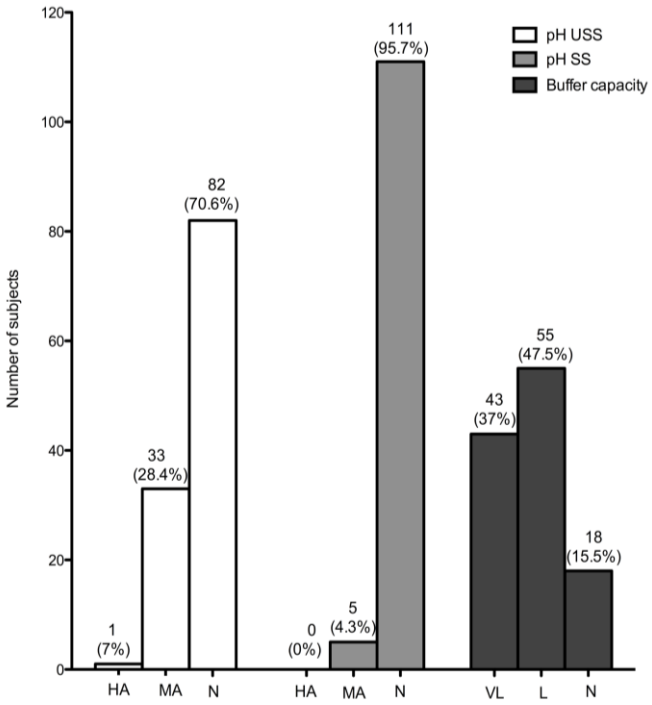

Figure 1. pH of the unstimulated saliva (USS) and stimulated saliva (SS) sample, and buffering capacity of the SS sample of the subjects. It showed that most of subjects had normal pH of USS sample and most had shift to normal pH at SS sample. Approximately 40% and 50% of subjects had very low and low buffer capacity, respectively. Only few subjects (15.5%) had normal salivary buffer capacity. [pH: HA=highly acidic (5.0-5.8), MA=moderate acidic (6.0-6.6), N=Normal (6.8-7.8)]; [buffer capacity: VL=very low (0-5), L=low (6-9) , N=normal (10-12)].

Discussion

Saliva plays a very important role in maintaining oral mucosal health. Disruption to salivary gland functions may be caused by a number of factors including head and neck radiotherapy, medications as well as many systemic diseases and conditions.[11-13] Several reports showed that abusive use of drugs have been related to reduction of salivary flow rate and responsible for many oral and dental.[4-6] The drugs are very addictive while causing stimulative effect to the central nervous systems. METH affects the reduction of unstimulated salivary flow by increasing the activity of sympathetic nerves to stimulate production of inhibitor of alpha-2 receptors. Increased inhibitor for alpha-2 receptors are responsible for reduced unstimulated salivary flow.[14,15]

Our study showed that only 8(7%) subjects were considered hyposalivation based on unstimulated saliva sample and the number of subjects was increased to 21(18.1%) when analyzed using stimulated sample. This study did not find many subjects who had hyposalivation in accordance with previous report in crack cocaine users.[9] There are several possible explanations for our result. Firstly, this study targeted group of people who were in the first three months of drug addict recovery. The duration of drug abuse could cause different oral conditions.[16]

Secondly, subjects in the current study were mixture of individuals with different types of drug adiction and already in recovery phase. Thirdly, the recovery of the nervous system responsible for restoration of salivary gland function in these recovering subjects might also be postulated. It was suggested that saliva stimulating agent and fluoride supplementation would add as preventive actions for patients with history of drug abuse.[16]

Normal physiological salivary pH varies between 6.5 to 7.4. The result of this study showed that almost 70% the residents of this rehabilitation centre were had normal USS pH, while about 30% had moderately acidic pH and less than 1% had acidic saliva. As the salivary flow increases due to stimulation of paraffin wax chewing, it automatically rises the pH. Almost 95% subjects had normal salivary pH, while the remaining 5% still had moderately acidic pH. It was said that critical salivary pH that could cause tooth demineralization is between 5.5 to 6.5, while in the GC saliva buffer kit highly acidic pH ranged from 5.0-5.8 and moderately acidic range from 6.0-6.8. Therefore, some subjects in this study who classified having moderately acidic pH in saliva sample may have critical pH that could cause enamel dissolution. Fermentation products of carbohydrate metabolism by oral microorganism could alter the value. The value of salivary pH in some of the subjects could favor development of dental caries or other conditions in the oral mucosa. Normal salivary pH found in this study probably related to the recovery stage of the subjects. Discontiuation of drug addiction in the study population would stop sugar craving, restart good oral hygiene practice, and stop the exposure of acidic nature of some drugs ingreidients.[16,17]

In contrast to salivary pH, only 1% of subject had normal salivary buffering capacity, the rest of the subjects had low or very low buffering capacity. There are 3 buffering systems that maintain salivary homeostasis: protein, phosphate and bicarbonate systems. The first two systems have more role in USS, while the latter in SS. The consentration of bicarbonate depends on the salivary flow rate and consentration of carbonic anhydrase isoenzyme VI. The amount the enzyme would catalyze conversion of bicarbonate to H_2O and CO_2 that could neutralize acid in the saliva.[18] In this study, most of the subjects had normal salivary pH, but had tendency of low buffering capacity. The possible factors include disturbances in the buffering system, salivary flow rate, carbonic anhydrase VI activity or the condition of salivary gland. Low buffering capacity has implication in the pathogenesis of periodontal disease and caries development.[11]

Individuals with low buffer capacity have more risk to have deeper periodontal pocket compared to those have higher buffer capacity.[11] Furthermore, they also have higher risk of having higher decay, missing, filling teeth (DMFT) score.[19-20] However, more detailed examination of saliva sample using sialochemstry is needed to prove the hypotheses.

Not many reports available in the literature regarding the salivary profile of subjects with drug addicts. This might be related to the difficulties in managing the population of the study. However, individuals with history of drug addiction might complain xerostomia, high prevalence of caries, and high prevalence of tooth wear related to bruxism and clenching.[6,16] Comprehensive dental management is needed for individuals recovering from drug addiction. Proper counseling for patients with history of drug addiction is needed to prevent further damage of oral condition.

The counselling should includes avoidance of high carbohydrate consumption, practicing good oral hygiene, drinking a lot of water, and chewing sugar-free gum. Prescription of oral moisturizers that are available in the market would provide improvement in salivary flow. Lastly, rehabilitation of the presence of teeth damage should also important for them to regain self esteem.[16]

Conclusion

Investigation of salivary profile of individuals who are recovering from drug addiction had successfully done in this study. This study provide the first information regarding salivary profile in this specific population. This study did not find high number of subjects with hyposalivation, however it revealed low buffering capacity of the stimulated saliva of the subjects despite normal salivary pH. Attention for this finding and measures to overcome the effects on dental health should be the goal of treating this specific group of patients.

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Declaration of Interest

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References

1. Amerongen AV, Veerman EC. Saliva: the defender of the oral cavity. Oral Dis. 2002;8,12-22.
2. Panchbhai AS, Degwekar SS, Bhowte RR. Estimation of salivary glucose, salivary amylase, salivary total protein and salivary flow rate in diabetics in India. J Oral Sci. 2010;52,359-68.
3. Mateos-Moreno MV, Del-Río-Highsmith J, Riobóo-García R, Solá-Ruiz MF, Celemín-Viñuela A. Dental profile of a community of recovering drug addicts: Biomedical aspects. Retrospective cohort study. Med Oral Patol Oral Cir Bucal. 2013;18,e671-9.
4. Scully C. Drug effect on salivary glands: dry mouth. Oral Dis. 2003;9,165-76.
5. Kurniawan A, Wimardhani YS, Rahmayanti F. Oral health and salivary profiles of geriatric outpatients in Cipto Mangunkusumo General Hospital. J Dent Indones. 2010;2:53-7.
6. Brown C, Krishnan S, Hursh K, et al. Dental disease prevalence among methamphetamine and heroin users in an urban setting: a pilot study. J Am Dent Assoc. 2012;143,992-1001.
7. Iskandar S, Kamal R, De Jong CA. Psychiatric comorbidity in injecting drug users in Asia and Africa. Curr Opin Psychiatry. 2012;25,213-8.
8. Butar DB. [Condition of narcotics usage in Indonesia at the of 2011] Jakarta: Badan Narkotika Nasional Republik Indonesia; c2012 [cited 6 Jun 2013]. Available from: http://www.slideshare.net/agus-popi/data-narkoba-5-tahun-terakhir. Indonesian.
9. Woyceichoski IE, Costa CH, de Araújo CM, et al. Salivary buffer capacity, pH, and stimulated flow rate of crack cocaine users. J Investig Clin Dent.2013; 4,160-3.
10. Gunadi I, Subita GP. [Oral health status of narcotics users in Indonesian prison] Jakarta: FKG UI, [thesis]. 2009. Indonesian.
11. Kitasako Y, Ikeda M, Burrow MF, Tagami J. Oral health status in relation to stimulated saliva buffering capacity among Japanese adult above or below 35 years of age. J Med Dent Sci. 2006;53,175-80
12. Seraj B, Ahmadi R, Ramezani N, Mashayekhi A, Ahmadi M. Oro-dental health status and salivary characteristics in children with chronic renal failure. J Dent (Tehran). 2011;8, 146-51.
13. Villa A, Wolff A, Aframian D, et al. World Workshop on Oral Medicine VI: a systematic review of medication-induced salivary gland dysfunction: prevalence, diagnosis, and treatment. Clin Oral Investig. 2015 Sep;19(7):1563-80.
14. Saini T, Edwards PC, Kimmes NS, Carroll LR, Shaner JW, Dowd FJ. Etiology of xerostomia and dental caries among methamphetamine abusers. Oral Health Prev Dent. 2005;3,189-95.
15. Curtis EK. Meth mouth: a review of methamphetamine abuse and its oral manifestations. Gen Dent. 2006;54,125-9.
16. Goodchild JH, Donaldson M, Mangini DJ. Methamphetamine abuse and the impact on dental health. Dent Today. 2007;26,124-31.
17. Navarro M, Pichini S, Farré M, et al. Usefulness of saliva for measurement of 3,4-methylenedioxymethamphetamine and its metabolites: correlation with plasma drug concentrations and effect of salivary pH. Clin Chem. 2001;47,1788-95.
18. Bardow A, Moe D, Nyvad B, Nauntofte B. The buffer capacity and buffer systems of human whole saliva measured without loss of CO_2. Arch Oral Biol. 1999;45,1-12.
19. Aminabadi NA, Najafpour E, Razavi RZ, Sighari DA, Ghojazadeh M, Jamali Z. J Oral Sci. 2013;55, 337-42.
20. Preethi BP, Pyati A, Dodawad R. Evaluation of flow rate, pH, buffering capacity, calcium, total protein and total antioxidant levels of saliva in caries free and caries active children –an in vivo study. Biomed Res. 2010;21,289-4.