

**A STUDY OF ASSOCIATION OF SMOKING WITH SALIVARY
PARAMETERS AND COMMON ORAL DISEASES AMONG ADULTS
ATTENDING GOVERNMENT DENTAL CLINICS IN KOTA BHARU,
KELANTAN**

By:

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ABSTRAK – Bahasa Malaysia

Tajuk: Kajian hubungan merokok ke atas *parameter* air liur dan penyakit mulut yang lazim di kalangan orang dewasa yang mengunjungi klinik-klinik pergigian kerajaan dalam daerah Kota Bharu, Kelantan.

Pengenalan: Pelbagai faktor mempengaruhi *etiologi* dan *patogenesis* caries gigi dan penyakit periodontal. Kurangnya kualiti *parameter* air liur, dan merokok adalah antara pencetus kepada kejadian dan perkembangan penyakit pergigian.

Objektif: Kajian ini bertujuan untuk mengkaji kesan merokok ke atas parameter air liur dan penyakit pergigian yang lazim dikalangan mereka yang mendapatkan rawatan di klinik-klinik pergigian kerajaan di sekitar daerah Kota Bharu, Kelantan.

Metodologi: Ini adalah kajian keratan rentas melibatkan pesakit dewasa berumur 20 tahun dan ke atas yang telah datang ke klinik-klinik pergigian kerajaan dalam daerah Kota Bharu. Seramai 220 orang yang menepati ciri-ciri kemasukan dan penolakan telah dipilih pada setiap selang 10 orang dimana 73 adalah perokok dan 143 bukan perokok. Pengalaman karies gigi dikira menggunakan indeks *DMFT* manakala penyakit periodontal di ukur menggunakan indeks *CPI*. Kandungan air liur di ukur menggunakan penguji air liur jenama *BUFFER® TEST KIT-* oleh *GIC Co.* analisis data dilakukan menggunakan aplikasi SPSS versi 12.0 oleh SPSS inc. USA.

Keputusan: pH air liur semasa rehat tidak dipengaruhi oleh merokok. Aliran air liur semasa rehat ada hubungan positif dengan jumlah rokok yang dihisap dalam sehari, dengan R^2 sebanyak 0.082. Didapati merokok mempunyai hubungan positif terhadap aliran air liur yang di rangsang dengan R^2 adalah 0.088. Walaupun begitu, merokok

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menunjukkan hubungan negative dengan kebolehan menampai air liur dimana R^2 adalah 0.043.

Kaitan antara merokok dan DMFT, menunjukkan lamanya merokok menunjukkan hubungan positif dengan jumlah DMFT dengan R^2 0.368. Perokok didapati kurang bilangan gigi yang telah ditampal. Didapati merokok, mempunyai hubungan positif dengan kejadian penyakit periodontal.

pH dan aliran air liur yang dirangsang, mempengaruhi bilangan DMFT. Aliran air liur semasa rehat menunjukkan kaitan dengan kejadian penyakit periodontal, dimana berlaku pertambahan dalam aliran air liur semasa rehat dalam pesakit periodontal.

Kesimpulan: Disimpulkan bahawa jumlah rokok dalam sehari akan meningkatkan kadar aliran rehat air liur, kapasiti penampai air liur adalah kurang pada perokok. Lamanya menjadi perokok meningkatkan skor DMFT, tetapi kurang jumlah gigi yang ditampal. Merokok juga akan meningkatkan risiko penyakit periodontal.

Rendahnya pH air liur rehat dan kadar air liur yang dirangsang menyebabkan meningkatnya karies gigi. Dikalangan pesakit periodontal, kadar aliran air liur semasa rehat mereka meningkat.

ABSTRACT - *English*

Title: A study of association of smoking with salivary parameters and common oral diseases among adults attending government dental clinics in Kota Bharu, Kelantan.

Introduction: The etiology and pathogenesis of dental caries and periodontal disease are multifactorial. Reduction in quality of saliva parameters and smoking can play a role in triggering the initiation and progression of dental disease.

Objectives: To determine the effect of smoking with salivary parameters and common oral diseases among adults attending the government dental clinics in Kota Bharu, Kelantan.

Methodology: This is a cross sectional study of patients aged 20 years and above attending government dental clinics in Kota Bharu. 220 patients who fulfilled inclusion and exclusion criteria were selected at every 10th interval of which 73 were smokers and 147 non smokers. Caries experiences were calculated using DMFT index while periodontal disease was measured using CPI index score. Saliva properties were assessed using *BUFFER[®] TEST KIT-* by *GIC Co.* Data were analyzed using *SPSS* version 12.0 SPSS inc. USA .

Results: No association between smoking and resting pH. Number of cigarette consumed have positive association on resting salivary flow rate with $R^2=0.082$. Smoking shows positive association with stimulated salivary flow rate with $R^2=0.088$; smoking and sex showed negative association with buffering capacity of saliva but the association was weak with $R^2=0.043$.

Regarding smoking influence on DMFT; duration of smoking showed positive association with $R^2=0.368$. For number of filled tooth, smoking has negative association. Smoking showed positive association with increase risk of developing periodontal disease.

Resting pH and stimulated flow rate have association with DMFT score. However, only resting saliva flow rate have significant association with periodontal disease, i.e. increase saliva flow was observed in periodontal disease patients.

Conclusions: It was concluded that increasing number of cigarettes consumed per day will increase resting saliva flow, and, smokers have low saliva buffering capacity. Smoking duration has positive association with DMFT score, i.e. number of filled tooth was less in smoking group. There is increase risk of having periodontal disease among smokers. Reducing saliva pH and stimulated flow rate will increase the risk for caries formation. Positive association was observed between resting saliva and periodontal disease.

1. INTRODUCTION

Good health is a major component/element for social, economic and personal development and an important dimension of quality of life. Hence, it influences the development and ability to improve economic status of the community and country as a whole. WHO defined health as a “state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity”(WHO, 1946).

Oral health is a fundamental factor for quality of life (WHO, 2005). A healthy mouth enables people to speak, eat and socialize without pain, discomfort or embarrassment (Locker, 1988). Moreover, the psychosocial impact of oral diseases often significantly diminishes quality of life (Petersen, 2003). It influences eating, sleeping, working and social roles (WHO, 2005, MOH, 2002). Oral health is defined as “the well being of the oral cavity, including the dentition and its supporting structures and tissues, the absence of disease and the optimal functioning of the mouth and its tissues, in a manner which preserves the highest level of self-esteem and interpersonal relationships” (WHO, 1999). Thus, dental health indices also contribute as indicators for healthy life (Centers for Disease Control and Prevention, 2000).

1.1 Oral health and oral diseases

Oral health is not merely having healthy teeth and gum. A person can also be affected by a range of other conditions including diseases of oral mucosa, cancers of the mouth and throat, malocclusion, birth defects, temporo-mandibular joint problems, or trauma to the jaw or face (AHMC, 2004). The two most common oral diseases in the world and which can be prevented are dental caries and periodontal disease (Petersen, 2003, Watt, 2005). These diseases could cause difficulty in chewing, swallowing and speech. It could also disrupt sleep and productivity by compromising the ability to work. They could affect the way a person socializes, with significant impact on self-esteem, employment and general well being.

The relationship between oral diseases and systemic diseases is bi-directional. A number of general health conditions or diseases are associated with oral symptoms and diseases. For example, periodontal disease may contribute to cardiovascular disease, preterm birth and low birth weight, while diabetes can cause periodontal disease (Grossi *et al.*, 1994, Periodontology, 1996). Apart from that, oral disease is also associated with pneumonia, hepatitis C, HIV infection, infective endocarditis, otitis media, and nutritional deficiencies in children and older adults (Winkler and Robertson, 1992, Pihlstrom *et al.*, 2005).

Dental caries and periodontal disease share certain risk factors with other major preventable diseases including cardiovascular disease, cancer, and diabetes (Sheiham

and Watt, 2000, Petersen *et al.*, 2005). Among shared risk factors include tobacco smoking, inappropriate diet, alcohol consumption, poor oral hygiene and other exposure (WHO, 1980, Petersen *et al.*, 2005, Watt, 2005).

Dental diseases could be cumulative (Donald *et al.*, 2006) and become more complex over time. The diseases and their consequences posed major burdens worldwide and their impacts constitutes a major pandemic (Edelstein, 2006). The burden is extensive and may be particularly severe in vulnerable populations. It was well known that dental diseases contribute to high cost health care services, accounting for between 5% and 10% of total health care expenditures (Petersen, 2005b) and exceeding the cost of treating cardiovascular disease, cancer and osteoporosis in industrialized countries (Centers for Disease Control and Prevention, 2000, Widström and Eaton, 2004). In low-income countries, the cost of traditional restorative treatment of dental disease would probably exceed the available resources for overall national health care (Yee and Sheiham, 2002, Watt, 2005).

Although there are commonalities in the philosophy of all scientific research, biologic laws tend to be less universally true than are physical laws. The set of circumstances that lead to a heart attack in one person may not necessarily do so in another person of the same age, sex, and race. Biologic variation, that produced the difference in disease susceptibility between individuals, leads us to search for grouping the particular characteristic of the patients. Epidemiologists have identified these characteristic

patterns which were related to heredity, biology, physical environment, social environment and also lifestyle (Hobdell *et al.*, 2003, Donald *et al.*, 2006).

Even though the determinants of health and factors influencing formation of oral diseases were identified, the prevalence is still relatively high. Much effort had been put in for so many years to reduce the diseases. The approach, however, had been mostly on curative and not so much on oral health promotion and prevention. WHO in 2000 had endorsed Fifty-third World Health Assembly resolution (resolution WHA 53.17) which stated that priority is to be given to diseases linked by common, preventable and lifestyle related risk factors, including oral health (WHO, 2000). Socio-environmental is among the key factors that had been highlighted in the resolution. It was stated that high relative risk of oral disease relates to socio-cultural determinants such as poor living conditions; low education; lack of traditions, belief and culture in support of oral health. In addition to the distal socio-environmental factors, it also emphasizes the role of intermediate, modifiable risk behaviors' i.e. oral hygiene practices, tobacco use as well as sugar consumption (Petersen, 2005a, Watt, 2005).

There are profound oral health disparities across regions and within countries that relate to socioeconomic status, race or ethnicity, age, gender or general health status (Petersen, 2005a). Although common dental diseases are preventable, not all of the community members were able to benefit from the existing healthcare system. This situation is obvious by looking at the polarization of common dental diseases especially dental caries affecting certain groups of population. Therefore, this study was

conducted to specifically study the effect of smoking, as modifiable risk behaviour, on saliva and common oral disease (dental caries and periodontal diseases), among those who utilizes government dental services in Kota Bharu District of Kelantan, Malaysia.

1.2 Saliva as biomarker for dental diseases

Saliva is the body fluid produced by salivary glands (Dodds *et al.*, 2005). Recently, saliva has gain popularity as one of biomarker for health. There is a growing interest in saliva as a diagnostic fluid, due to its relatively simple and minimally invasive collection. Study has shown that many proteins in human saliva, could pave the way for more diagnostic tests based on saliva samples (Wong, 2006). The same proteins present in blood are also present in saliva from fluid leakage at the gum line (Dodds *et al.*, 2005). It is considerably easier, safer and more economical to collect saliva than to draw blood, especially for children and elderly patients (Taba *et al.*, 2005). Even though saliva tests cannot replace blood tests for all diagnostic applications, in the future they could prove to be a potential alternative to detect diseases where early diagnosis is critical, such as certain cancers. Saliva collection also may be the only practical way to screen large numbers of patients in developing nations (Taba *et al.*, 2005).

In oral cavity, saliva plays important role in maintaining oral environmental balance. Among which is buffering the pH changes in mouth (Batsakis, 1982). Saliva quality such as pH, flow rate, viscosity and buffering capacity is important in preserving good

oral health and free from oral diseases (Dodds *et al.*, 2005, Cogulu *et al.*, 2006, Gopinath and Arzreanne, 2006, Hirotsomi *et al.*, 2006). According to Gopinath (2006), saliva is vital for the integrity of the teeth as well as the soft tissues (Gopinath and Arzreanne, 2006). Thus, evaluating saliva will provide information in assessing risk factor for dental diseases (Edgar, 1992, Shirley, 2007).

1.3 Smoking and oral diseases

There is insufficient evidence of any direct etiological relationship between tobacco use and caries. However, it was found that often lower resting salivary pH, buffer capacity and also, a shift of bacterial population towards lactobacillus and the cariogenic streptococci in smokers could be noticed (WHO, 1998a, Johnson, 2000).

Numerous investigations of the relationship between smoking and the periodontal diseases have been performed over the past 15 years and both cross sectional and longitudinal studies provide strong epidemiological evidence that smoking confers a considerably increased risk of periodontal disease. An analysis of data from the 1971-75 National Health and Nutritional Examination Survey in the United States showed a clear relationship between smoking and periodontitis (Klokkevold, 1999).

1.4 Smoking and quality of saliva

Secretion of saliva is a result of tactile, mechanical, and gustatory stimulation of intra-oral reflexes; olfactory stimuli; and direct stimulation of the sympathetic and parasympathetic nervous systems (Nachlas and Johns, 1985). The regulation of salivary flow and its composition is under control of the autonomic nervous system, but many factors had been shown to influence this control. These include psychological factors, circadian rhythm, age, hormones, diet, drugs (Nachlas and Johns, 1985, Roland, 1992, Fischer and Ship, 1999), and smoking (Wikner and Soder, 1994, Ghulam *et al.*, 2000). Saliva provides a protective buffer between toxins and the lining of the mouth as it contains enzymes that neutralize harmful substances (Tabak, 1995). Bicarbonates is an acid-neutralizing chemical in saliva, but, saliva of smokers contains smaller amounts of bicarbonates, thus reducing the ability of the saliva to neutralize the acid (Kivela, 1999).

1.5 Study area

Kota Bharu is the state capital of Kelantan. It is also the name of a district in which Kota Bharu Islamic City is situated. The name means 'new city' or 'new castle/fort' in Malay. Kota Bharu is in the northeastern part of Peninsular Malaysia, and lies near the mouth of the Kelantan River. It is one of the ten administrative districts in the state of Kelantan and is the most highly populated district in Kelantan. In 2004, it had an

estimated population of 280,000 (Jabatan Perangkaan Malaysia, 2007). The population is made up of three main ethnic groups namely Malay, Chinese and Indians and a few minority groups including the Siamese, with Malays forming the majority group. In this district, the dental services are available in various *mukim*, or sub-districts. There are eight government dental clinics in this district, providing services to the community (namely Klinik Pergigian (KP) Jalan Mahmood, Klinik Pergigian (KP) Wakaf Che Yeh, Klinik Pergigian (KP) Badang, Klinik Pergigian (KP) Kedai Lalat, Klinik Pergigian (KP) Ketereh, Klinik Pergigian (KP) Pengkalan Chepa, Klinik Pergigian (KP) Lundang Paku and Klinik Pergigian Hospital Universiti Sains Malaysia). The service provided comprises of curative, conservative, rehabilitative and preventive services.

1.6 Rationale of the study

The focus of this study was to gain better understanding of the influence of smoking, and salivary parameters on oral health. Many studies demonstrated that smokers are more likely to developed caries (Hirsch *et al.*, 1991, Kelbauskas *et al.*, 2005), periodontal disease (Chen *et al.*, 2001, Deborah, 2001, Johnson, 2004, Susin *et al.*, 2004), and alter salivary characteristic (Heintze, 1984, Johnson, 2000). Since smoking is well accepted as a risk factor for most chronic diseases, thus, this phenomenon is also applicable in the oral cavity (Linden and Mullally, 1994, Machuca *et al.*, 2000, Minsk, 2000). Therefore in this study one of the objective was measuring salivary parameters among respondents, according to their smoking status.

Although many studies (Zambon *et al.*, 1996, Wikner and Soder, 1994, Zuabi *et al.*, 1999, Tomar and Asma, 2000, Chen *et al.*, 2001) were done to search for association between smoking with saliva parameters and dental diseases, the findings were inconclusive (Heintze, 1984, Parvinen, 1984, Wikner and Soder, 1994). These inconclusive findings may be due to the difficulties in proving direct relationships between smoking habit, saliva, hygiene practice and other socio-demographic characteristic against dental caries or periodontal diseases due to interactions between several factors. Many researchers found that, studies that include only one factor provided limited evidence compared to those considering multiple factors simultaneously (Aleksejuniene, 2002).

It is hoped that with this study done among the local population, actual situation could be gauged and thus provide local data base. In Public Health perspective, the findings of this study could be an added value and evidence for oral health practitioners to include smoking status of their patients in managing them. Smoking needs to be one of the factors considered in treatment planning and the saliva test be made as a tool of risk assessment. The results would also help in understanding the determinants influencing the formation of dental diseases and thus, provide a basis for prevention.

1.7 Conceptual Framework

The complexity of dental caries and periodontal disease etiology is undisputed. Apart from diet, genetic and oral hygiene practice (Burt and Eklund, 2005), other determinants had been probed in depth over the past ten years. Among determinants that had been suggested as causes of caries frame work are: social structure and individual behavior (Holst, 2005), daily tooth brushing and irregular dental visit (Aleksėjuniene, 2002), as well as social class (Schou, 1991). Aleksėjuniene *et al.*, (1996) suggested gender, psychosocial factors, frequency and efficacy use of a fluoride-containing dentifrice, education together with awareness and attitudes to health care and their economic status were also suggestive determinant factors (Walsh, 2000, Selwitz *et al.*, 2007). Recently, the importance of saliva quality has emerged as potential biomarker for caries and periodontal disease risk assessment (Gopinath and Arzreanne, 2006, Shirley, 2007). It was shown that reduced salivary quality was a determinant for the development of dental diseases (Leone and Oppenheim, 2000).