



CHAPTER II

LITERATURE REVIEW

1. Dental caries overview

In the Alma Ata conference in 1978, WHO informed that the percentage of population affected with dental caries in the world was very high (90%), they began to work for program for dental health care (Petersen et al., 2005). But until now, this program has depended on social-economic condition and ability of each country, therefore, the result of this program been varied. WHO reported that dental caries experience in children is relatively high in the America (DMFT = 3.0) and in the European Region (DMFT = 2.6) whereas the index is lower in most African countries (DMFT = 1.7). In most developing countries, the levels of dental caries were low until recent years but prevalence rates of dental caries and dental caries experience are now tending to increase. The main reason for this trend is the increasing consumption of sugars and inadequate exposure to fluorides. In contrast, a decline in caries has been observed in most industrialized countries over the past 20 years or so. This result was explained by the effectiveness of fluorides together with changing living conditions, lifestyles and improved self-care practices. This report also pointed that the prevalence of dental caries among adults is high as the disease affects nearly 100% of the population in the majority of countries (Petersen et al., 2005).

According to the National Center for Chronic Disease Prevention and Health Promotion, tooth decay affects more than one-fourth of US. People aged 20 – 39 hold

an 87% lifetime prevalence of tooth decay (National Center for Chronic Disease Prevention and Health Promotion, 2007) as shown in Figure 2.

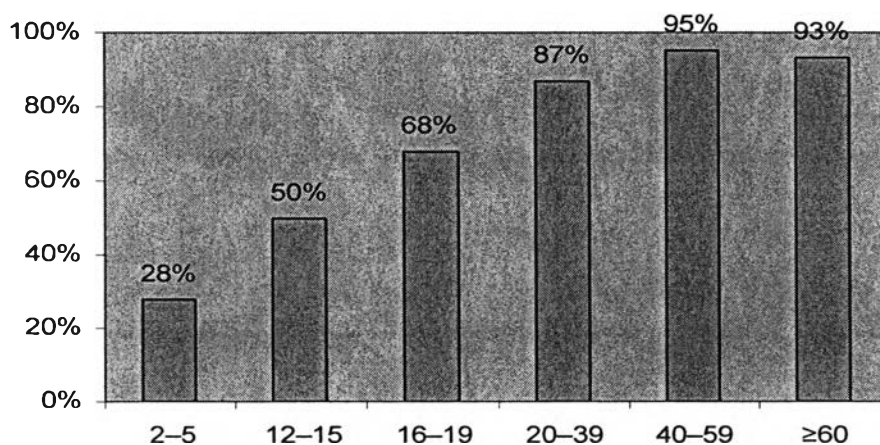


Figure 2: Tooth decay over the US residents' Lifespan

In India, the prevalence of dental caries in 12-15 years-old children, whom have permanent dentition, ranged from 80 to 87 percent. The mean DMFT was 3.03 ± 2.52 in the 12-years and 3.82 ± 2.85 in the 15-years. In there, the decay component contributed 94% and 97%, missing and filled components were almost negligible (Goyal et al., 2007)

Among young Israeli army, Shenkman found that the total DMFT and DMFS (decayed, missing and filled surfaces of teeth) were 6.09 ± 5.29 and 10.18 ± 10.28 , respectively. Active caries-free patient rate, represented by $D=0$, was 38.7%. Caries lesions were mostly moderate hold a percentage of 68.25 (Shenkman & Levin, L., 2007)

Caries prevalence was 66.7% and the mean DMFT value was 10.3 in Iasi adults aged 35 to44. Significant statistical differences in dental caries prevalence were

found by sex, province, location (urban and rural) and family income (Murariu et al., 2007).

In a sample of 200 Vietnamese refugees in Norway, which was divided into four age groups, Selikowitz found that the mean score of DMFT ranged from 8.7 in the youngest age group to 11.5 in the oldest and the high prevalence of caries was seen in the permanent first molars in all age groups (Selikowitz, 1984).

In Vietnam, the nationwide oral health survey conducted by Ministry of Health showed that the prevalence of dental caries is 75.2 (DMFT = 3.29) in the 18-34 year old population (Figure 3) (Tran et al., 2002).

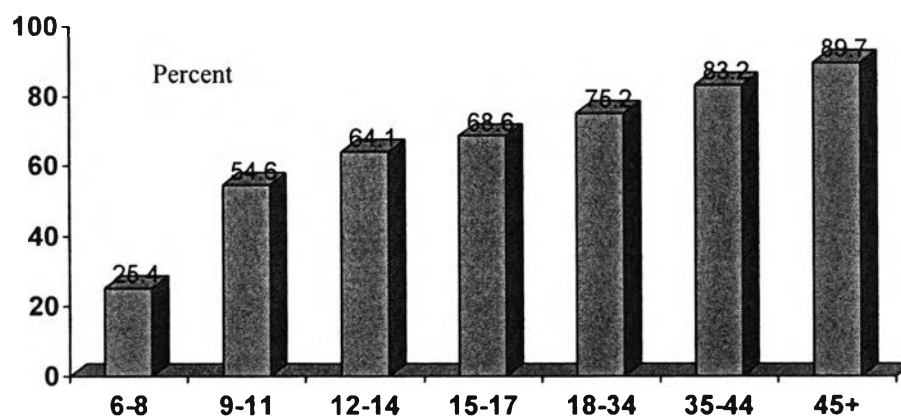


Figure 3: The prevalence of dental caries DMFT in Vietnam, 2002

The average number of teeth with cavities (DT) in 18-34 year old population range from 1.15 to 4.92 (Table 1).

Table 1: The average DMFT by age and geography, Vietnam, 2002

Region	DMFT			
	DT	MT	FT	DMFT
The Northern Highland	2.68	0.24	0.02	2.94
The Red River Delta	1.15	0.17	0.22	1.54
The Coastal Northern Center	1.46	0.24	0.10	1.80
The Coastal Southern Center	4.92	1.71	0.35	6.98
The Highland Center	1.45	0.35	0.09	1.89
The East South	2.94	1.12	0.42	4.48
The Mekong River Delta	2.17	1.42	0.22	3.81

Source: Nationwide Oral Health Survey 1999-2001 (Tran et al., 2002)

2. Dental caries – definition and related factors:

2.1 Definition of dental caries

Dental caries is a decalcification of enamel and dentine by the action of bacteria on particles of carbohydrate (particular sugar) and associated with the time for developing lactic acid dissolving tooth structure. Therefore it can be prevented by controlling the development of bacteria as well as having a healthy diet for teeth (Thylstrup et al, 1994). According to Bader, dental caries is a chronic infectious disease caused by a complex interaction of oral microorganisms in dental plaque, diet, and a broad array of host factors ranging from societal and environmental factors to genetic and biochemical/immunologic host responses (Bader et al., 2001).

So, the cause of dental caries can be described by a reference which comprises two parts, one is like biological factor and the other is social circle. In the oral cavity,

a microbial deposit will cover most tooth surfaces, which are normally present in the mouth. The bacteria convert all foods especially sugar and starch into acids. Bacteria, acid, food debris and saliva combine in the mouth to form sticky substance called plaque that adheres to the teeth. The acid in plaque dissolves the enamel surface of the tooth and creates holes in the tooth (cavity). Plaque and bacteria begin to accumulate within 20 minutes after eating. Scheie has documented that *S. mutans* prevalence was highest in plaque over caries lesions and from fissures, and lowest in plaque from smooth surfaces in immigrant Vietnamese children (Scheie et al., 1984). Caufield surmised from his study's results that lactobacilli associated with dental caries are likely exogenous and opportunistic colonizers, arising from food or other reservoirs outside the oral cavity (Caufield et al., 2007). Tare of saliva flow, buffer capacity, sugar, diet, fluoride are factors closely related with dental caries. They play the role influencing bacteria to destroy enamel of tooth to become tooth decay. Others important factors at the outer circle as mentioned before is social factors, such as education, knowledge about dental health care, behavior and attitudes of people. They play as potential factors affecting to oral disease in general or dental caries in specialty.

2.2 Related factors to dental caries

Risk factor was defined by Beck and adopted for the World Workshop on Periodontics in 1996 as "an environmental, behavioral, or biologic factor confirmed by temporal sequence, usually in longitudinal studies, which if present directly increases the probability of a disease occurring, and if absent or removed reduces the probability. Risk factors are part of the causal chain, or expose the host to the causal chain. Once disease occurs, removal of a risk factor may not result in a cure." (Beck,

1998). Recent decades, the most frequent risk factors of dental caries have pointed out by numbers of scientific evidences is social-economic status, oral hygiene, eating habit and fluoride supplement. Tobacco smoke exposure has also documented as a related factor to dental cavity. However, the agreements are different from study to study.

2.2.1 Social-economic status related to dental caries

The socio-behavioral risk factors have been found to play significant roles in the occurrence of dental caries in both children and adults worldwide (Petersen et al., 2005)

Other social factors relating to dental caries also were concluded in Basto's study that low level of schooling, low maternal schooling and low monthly family income were statistically associated with dental caries. He found that individuals with eight or less years of study (OR 8.1: CI95% 1.9-34.7), raised by mothers with eight or less years of study (OR 2.9 : CI 95% 1.7-5.0) were more likely to have dental caries. Subjects whose families earned less than six Brazilian minimum wages per month were also more likely to have dental caries (OR 2.3 : CI95% 1.4-3.8) (Bastos et al., 2007).

On the other hand, Browns' study indicated that there was no different of DMF permanent teeth between 6-to-18-year children who were at or below poverty level and those at above poverty level (DMFT = 1.87 for the former and 1.89 for the latter). However, children at or below poverty level has the average of 59.7 filled permanent teeth compare with the 75.4 higher of this indicator in their counterpart. Poverty level in this study was defined as the ratio of family income to the federal poverty line (Brown et al., 2000). In the early 1990s, children above the poverty level

and children at or below the poverty level experienced about the same level of caries with number of DMFT of 2.28 and 2.57 teeth, respectively. Older children (12 – 18 years of age) exhibited more caries than their younger counterparts whose age was from 6 to 11 years. Their DMF permanent teeth are 6.65 and 1.67, respectively. This is because older children have more permanent teeth that have been at risk for a longer time and because caries is a cumulative disease whose damage is irreversible at the stage it is measured in epidemiologic surveys (Brown et al., 2000)

In Vietnam, the association between social-economic status and dental caries in children was documented in few studies. Bui's studied in 25-36 month aged children has indicated that the prevalence of dental caries of those whose mother's occupation is farmers is significant higher than those whose mother are officers. The prevalence is 71.9% for the former and is 42.5% for the latter (Bui, 2006)

2.2.2 Oral hygiene practice relates to dental caries

A number of studies in recent decades have emphasized the positive effects of healthy behavior of individuals on improving oral health in general as well as dental health in specific (Hugoson et al., 2007). Vehkalahti et al. conducted a study in 1988 to find out if there is a relationship between the occurrence of untreated root caries and a subject's dental health habits, such as the frequency of tooth-brushing, the avoidance of sugar, and regularity of dental visits. The result shows that a high frequency of tooth-brushing was strongly related to a low occurrence of root caries for both men (OR = 4.3, p value < 0.001) and women (OR = 4.1, p value < 0.001). Regular dental check-up behavior was also strongly related to an infrequent occurrence of root caries. For those who check-up at least once in two years (OR =

3.4, p value < 0.001) in women and (OR = 4.5, p value < 0.001) in men (Vehkalahti & Paunio, 1988).

Some dental health programs which focused on improving oral hygiene habit positively results in the improvement of oral cleaning, particularly plaque cleaning (Hugoson et al., 2007)

2.2.3 Eating habits related to dental caries

Eating habit refers sweet is a risk factor of dental caries in children was proved by many researches (Goyal et al., 2007; Pitayarangsarit, 1996). This factor also has documented as a risk factor of dental caries in adult in some studies. The use of sugar in coffee or tea was a common habit in Vehkalahti's findings, both in women (48%) and in men (72%). Root caries occurred more frequently among the users (20%) than the non-users (12%). This habit was associated with root caries occurrence, showing an odds ratio of 2.2 among men . Every third subject reported some use of sweets. This habit was moderately related to root caries occurrence in men (OR = 0.8, p value < 0.05) but not in women (OR = 1, p value > 0.05) (Vehkalahti & Paunio, 1988).

There is a general consensus today that the consumption of fermentable carbohydrates has been a key etiological factor behind caries ever since prehistoric times. However, it is difficult to specify this factor's precise role in modern society in epidemiological and clinical data, and to determine a clear link between sugar intake and caries at population level. This is partly due to the large variations that occur in sugar intake. Our diet has become more complex. The consumption of pure sugar is progressively decreasing, while consumption of sugary drinks and foods is on the rise (Lingstrom, 2006).

According to Lingstrom, food intake frequency plays an important role in development of dental caries. A high intake frequency means longer periods of demineralization and only short periods when teeth have a chance to remineralise (Lingstrom, 2006).

2.2.4 Tobacco smoking related to dental caries

Arbes reported that environmental tobacco smoke (ETS) has been shown to be associated with periodontal disease in adults. Exposure to ETS at home only, work only, and both was reported by 18.0%, 10.7%, and 3.8% of the study population of 6611 persons 18 years and older who had never smoked cigarettes or used other forms of tobacco, respectively. Besides, the adjusted odds of having periodontal disease were 1.6 (95% confidence interval = 1.1, 2.2) times greater for persons exposed to ETS than for persons not exposed (Arbes et al., 2001).

Tobacco smoke contains agents which can impair immune system. Thus it would be a risk factor for development of tooth decay, which is an oral infectious disease (Edwards et al., 1999).

In addition, environment tobacco smoke is associated with decreased serum vitamin C levels and decreased levels of vitamin C are associated with growth of cariogenic bacteria (Tribble et al., 1993). In children, after adjusting for age, gender, vitamin C intake, and multivitamin use, environmental tobacco exposure remained significantly associated with lower levels of serum ascorbic acid in children who were exposed to both high and low levels of (Strauss, 2001).

2.2.5 Fluoride supplement related to dental caries

In the study of Goyal, 80.2% Chandigarh school children examined still were using non-fluoridated toothpastes and 99% did not know the importance and effect of fluorides on teeth in spite of the regular advertisements on TV regarding the importance of using fluoridated toothpaste by the dentifrice manufacturing companies. Lack of awareness on role of fluoride on dental caries prevention and the increasing of sugary stuff consume results in the high prevalence of tooth decay in this population (Goyal et al., 2007)

Yoder et al., found that the majority of Indian dental professionals surveyed had misunderstood of fluoride's predominant posteruptive mode of action through remineralization of incipient carious lesions. The researchers also suggested that educational efforts was needed to promote the appropriate use of fluoride (Yoder et al., 2007).

In Vietnam, according to the Natiowide Oral Health Survey from 1999 to 2000, most of province in northern part of Vietnam has low fluoride concentration in underground water, from 0.4 – 0.8 ppm (Tran et al., 2002). WHO suggested the standard level of fluoride in drinking water is 0.7ppm. Dao reported that in Vietnam, Hochiminh city was the first city that applied water fluoridation with fluoride concentration in drinking water ranging from 0.7 ppm to 0.1 ppm. After running the program for 4 years, the prevalence of dental caries reduced from 76% to 30% (Dao, 1995). The most common source supply fluoride in Vietnam is from toothpastes. Other fluoride supplements are fluoride gel, fluoride tablet and fluoride vitamin but they are not common sources of supplement.

The fluoridated drinking water program in Vietnam is being run in only two province of southern part. None of these provinces, the study subjects came from. Because of limitation of time and other resource, fluoride concentration measuring in drinking water was not included in the survey.