



**PERIODONTAL HEALTH AND CARIES EXPERIENCE
OF CIGARETTE AND E-CIGARETTE USERS: A
LONGITUDINAL STUDY**

BY

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**A thesis submitted in fulfilment of the requirement for the
degree of Master in Nursing Science**

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ABSTRACT

Recently, there has been a growing trend towards a new type of alternative device where cigarette smokers use traditional cigarettes with an electronic nicotine delivery system (ENDS) or electronic cigarettes (e-cigarettes) to receive nicotine. E-cigarettes have gained popularity after they were introduced in the market, especially among young adult smokers. Though the current government policy on nicotine control is being established to include e-cigarettes, e-cigarettes are presently almost entirely unregulated in Malaysia. To date, there is little documented evidence regarding the oral effects of e-cigarette use. The effects of cigarette smoking on health have been reported in numerous past studies including in Malaysia. However, research findings of e-cigarette effects on oral health are unclear and scattered. Therefore, the aim of the study is to determine the periodontal health and caries indices of both e-cigarette and cigarette users at baseline and 6-month follow-up. A prospective longitudinal study was done on 45 cigarette users, e-cigarette users, and non-smoking persons at the Specialist Clinic, Kulliyah of Dentistry, IIUM Kuantan Campus. Oral health examination was conducted according to the World Health Organization (WHO) criteria. Dental caries was evaluated using the DMFT Index, while the periodontal parameters were assessed using plaque, gingivitis, gingival bleeding, and calculus indices. Time effect, smoking status group effect and time-smoking status group interaction were analysed using repeated measure ANOVA. Time-smoking status group interaction analysis showed significant findings at baseline between the control group and cigarette users on Gingival Index ($p = 0.008$) and Bleeding Index ($p = 0.018$), between the control group and e-cigarette users on Bleeding Index ($p = 0.009$) and lastly between cigarette and e-cigarette users on Gingival Index ($p = 0.000$) and Plaque Index ($p = 0.006$). Additionally, at the 6 month follow up, significant findings were found between the control group and cigarette users on Plaque Index ($p = 0.000$), and Calculus Index ($p = 0.003$); between the control group and e-cigarette users on Bleeding Index ($p = 0.003$); between cigarette and e-cigarette users on Gingival Index ($p = 0.000$), Plaque Index ($p = 0.008$), and Calculus Index ($p = 0.000$). In conclusion, both cigarette and e-cigarette have an impact on oral health. More research needs to be done to provide further evidence of the effects of e-cigarettes on health, specifically oral health; specifically, in a larger population and a longer longitudinal study.

خالصة البحث

هناك اتجاه متزايد في الآونة الأخيرة نحو نوع جديد من الأجهزة البديلة، حيث يستهلك المدخنون السجائر العادية باستخدام جهاز تسليم إلكتروني للنيكوتين، أو كما تسمى بالسجائر الإلكترونية، حيث اكتسبت شعبية كبيرة بعد طرحها في السوق، خاصة بين المدخنين البالغين. على الرغم من أن السياسة الحالية للحكومة بشأن مكافحة النيكوتين قد وُضعت لتشمل السجائر الإلكترونية، إلا أن السجائر الإلكترونية في الوقت الحالي غير منظمة بالكامل في ماليزيا. إلى الآن هناك القليل من الأدلة الموثقة المتعلقة بالآثار الفموية لاستخدام السجائر الإلكترونية. تم توثيق آثار تدخين السجائر على الصحة في العديد من الدراسات السابقة بما في ذلك في ماليزيا، ومع ذلك فإن نتائج البحوث عن آثار السجائر الإلكترونية على صحة الفم متناثرة وغير واضحة. ولذلك هدفت هذه الدراسة إلى تحديد مؤشرات صحة اللثة والتسوس في مدخني السجائر العادية ومدخني السجائر الإلكترونية بدءاً من نقطة الأساس وإلى المتابعة بعد ٦ أشهر. تم إجراء دراسة طولية استباقية على ٤٥ شخصاً من مدخني السجائر العادية، ومدخني السجائر الإلكترونية، وغير المدخنين في العيادة التخصصية لكلية طب الأسنان في الجامعة العالمية الإسلامية ماليزيا في كوانتان. تم فحص صحة الفم وفقاً لمعايير منظمة الصحة العالمية، وتم تقييم تسوس الأسنان باستخدام مؤشر DMFT، في حين تم تقييم مؤشرات اللثة على حسب كمية اللويحات، والتهاب اللثة، ونزيف اللثة، وجير الأسنان. تم تحليل تأثير الوقت، ومجموعة التدخين، وتفاعل مجموعة التدخين باستخدام تحليل التباين بالقياس المتكرر. أظهر تحليل الوقت وتفاعل مجموعة التدخين نتائج مهمة على نقطة الأساس بين المجموعة الضابطة ومدخني السجائر العادية على مؤشر اللثة (p=0,008)، ومؤشر النزيف (p=0,018)، وبين المجموعة الضابطة ومدخني السجائر الإلكترونية على مؤشر النزيف (p=0,009)، وأخيراً بين مدخني السجائر العادية ومدخني السجائر الإلكترونية على مؤشر اللثة (p=0,000) ومؤشر اللويحات (p=0,006). بالإضافة إلى ذلك، عند موعد المتابعة بعد ٦ أشهر، تم العثور على نتائج مهمة بين المجموعة الضابطة ومدخني السجائر العادية على مؤشر اللويحات (p=0,000)، ومؤشر جير الأسنان (p=0,003)، وبين المجموعة الضابطة ومدخني السجائر الإلكترونية على مؤشر النزيف (p=0,003)، وبين مدخني السجائر العادية ومدخني السجائر الإلكترونية على مؤشر اللثة (p=0,000)، ومؤشر اللويحات (p=0,008)، ومؤشر جير الأسنان (p=0,000). ختاماً، تؤثر كل من السجائر العادية والإلكترونية على صحة الفم، ومن الواجب إجراء المزيد من البحوث لتقديم المزيد من الأدلة على آثار السجائر الإلكترونية على الصحة، وخصوصاً صحة الفم؛ وبالتحديد في عدد أكبر من السكان، بدراسة طولية أطول.

APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master in Nursing Science.

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DECLARATION

I hereby declare that this thesis is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Smoking has been identified as a major risk factor for lung cancer, heart diseases, peripheral vascular diseases, and respiratory diseases (World Health Organization, 2010). Smoking has a number of well documented detrimental effects on the oral cavity such as periodontal diseases, impaired wound healing, dental caries, precancerous lesions, and risk for oral carcinoma (Smejkalova, Jacob, & Hodacova, 2003). Based on the clear evidence of the adverse effects of smoking to one's health, Muslim scholars have come to an agreement that smoking is haram and prohibited in Islam. This prohibition is based upon a hadeeth in Saheeh An-Nawawi, on the authority of Abu Sa'eed al-Khudree (may Allah be pleased with him), that the Messenger of Allah (peace and blessings of Allah be upon him) said:

“There should be neither harming (darar) nor reciprocating harm (dirar).”

And Allah says in the Quran (2: 195):

“Make not your own hands the cause of your own destruction.”

Non-communicable diseases are presently universally contingent (Jaafar et al., 2014). One of the most overlooked conditions in non-communicable disease is dental or oral disease. Dental diseases are among the major public health issues in high income countries and are fast becoming a burden as well on many low and middle income states (Williams, 2011). In 2010, the National Oral Health Survey of Adults (NOHSA) stated that the national average for decayed, missing, and filled teeth (DMFT) was 11.8 with

quite high percentages of dental caries (89.5%) and periodontal disease (94%). It was also reported that nine out of ten Malaysian adults were suffering from periodontal disease and dental caries (Bernama, 2016).

Recently, there has been a growing trend towards a new type of alternative device where cigarette smokers replace traditional cigarettes with an electronic nicotine delivery system (ENDS) or electronic cigarettes (e-cigarettes) to receive nicotine (Grana, Benowitz, & Glantz, 2014). E-cigarettes are electrical devices that vaporise a propylene or polyethylene glycol-based liquid solution into an aerosol mist containing various concentrations of nicotine (WHO, 2008). Though the current government policy on nicotine control is being established to include e-cigarettes, e-cigarettes are so far almost entirely unregulated in Malaysia. There are no product standards that control the levels of dosing, contaminants, toxins, or carcinogens in the liquid used in e-cigarettes or the aerosols they produce (Polosa et al., 2011). Because e-cigarettes are neither cigarettes nor smokeless tobacco, e-cigarettes evade the advertising bans that have been in place for decades on those tobacco products.

1.2 STATEMENT OF THE PROBLEM

E-cigarettes have gained popularity after their introduction in the market, especially among young adult smokers (Herzog & Gerberi, 2013). This phenomenon brings with it a new unhealthy lifestyle which worries the public. Hence, in light of the absence of evidence for e-cigarettes as an effective strategy for quitting smoking and the emerging concerns about threats to individual health, some professional organisations have issued evidence-based clinical practice guidelines advising against their promotion.

To date, there is little documented evidence regarding the oral effects of e-cigarette use. A short observational study conducted in 2011 reported mouth irritation, sore throats, dry mouths, and mouth ulcers after four weeks of use (Caponnetto, Auditore, Russo, Cappello, & Polosa, 2013). Although clinical studies on periodontal health and caries effects of e-cigarette use are scarce, the high levels of nicotine dosing suggest these products may increase the user's risk of experiencing periodontal damage. The effect of cigarette smoking on health has been reported in numerous past studies, including in Malaysia. However, findings of e-cigarette effects on periodontal health and caries are unclear and scattered. Therefore, the researcher's intention is to determine periodontal health and caries experience of both e-cigarette and cigarette users. Additionally, with the rising trend of e-cigarette use, there is an urgent need for longitudinal studies to better understand the detrimental effects of e-cigarette usage, especially among youths.

1.3 SIGNIFICANCE OF STUDY

This study aims to determine and compare the periodontal health and caries experience between cigarette and e-cigarette users and to investigate the detrimental effect of e-cigarette usage on oral health. E-cigarettes have now become trendy and popular among smokers. E-cigarettes markedly gained in popularity after they were introduced in the market, especially among young adult smokers.

This phenomenon has brought into existence a new unhealthy lifestyle which worries the public. However, little is known whether or not e-cigarette use is an effective strategy for quitting smoking. Hence, this study will assess the periodontal

health and caries experience of cigarette and e-cigarette users as well as provide baseline data for the periodontal health and caries experience of e-cigarette users.

The literature is clear on the dangers of smoking and chewing tobacco, but little is known among health professionals and the public about the detrimental effects of e-cigarettes. Thus, this study provides an insight into the detrimental effects posed by e-cigarettes on periodontal health and caries experience since this study also evaluates the adverse effects of cigarette and e-cigarette usage on periodontal health and caries experience over time. To date, there is scarce and limited evidence concerning the adverse effects of e-cigarettes on periodontal health and caries experience. With attention to this matter, this study aims to assess the periodontal health and caries experience among cigarette and e-cigarette users, and to evaluate the adverse effects of e-cigarette usage on periodontal and caries experience over time.

1.4 RESEARCH QUESTIONS

The research questions that have been formulated:

1. Is there any difference of mean periodontal and caries experience within a group based on time?
2. Is there any significant difference of mean periodontal and caries experience between smoking status groups regardless of time?
3. Is there any significant difference of mean periodontal and caries experience between smoking status groups based on time/ with regards to time?

1.5 RESEARCH OBJECTIVES

General Objective

To determine the difference of mean periodontal health and caries experience of cigarette and e-cigarette users.

Specific Objectives

Specific objectives are as follow:

1. To determine the difference of mean periodontal and caries experience within a group based on time.
2. To identify the significant difference of mean periodontal and caries experience between smoking status groups regardless of time.
3. To identify the significant difference of mean periodontal and caries experience between smoking status groups based on time/ with regards to time.

1.6 RESEARCH HYPOTHESES

The hypotheses are as follows:

1. There is difference of mean periodontal and caries experience within a group based on time.
2. There is significant difference of mean periodontal and caries experience between smoking status group regardless of time.
3. There is significant difference of mean periodontal and caries experience between smoking status groups based on time/with regards to time.

Null hypothesis:

1. There is no difference of mean periodontal and caries experience within a group based on time.
2. There is no significant difference of mean periodontal and caries experience between smoking status group regardless of time.
3. There is no significant difference of mean periodontal and caries experience between smoking status groups based on time/with regards to time.

1.7 DEFINATION OF TERMS

Periodontal Health

Inflammatory diseases that affect soft and hard tissues around the mouth area.

Caries

Decaying of tooth

Cigarette User

A person who smokes conventional cigarettes.

E-cigarette User

A person who simulates the experience of smoking, using a cartridge with a heater that vaporises liquid nicotine instead of burning tobacco.

DMFT Index

A key measure of caries experience in dental epidemiology (D: Decay; M: Missing; F: Filled; T: Tooth).

Gingival Index

An index of periodontal disease that relates to the severity and location of the lesion.

Plaque Index

An index for estimating the status of oral hygiene by measuring dental plaque that occurs in the areas adjacent to the gingival margin.

Gingival Bleeding Index

An index to record the presence or absence and the number of sites where gingival bleeding is present.

Calculus Index

The amount of calculus found on the buccal and lingual surfaces of each of the three segments of each dental arch.

1.8 CONCLUSION

As the smoking population keeps on growing larger every day, our country's health status is affected, including periodontal health and caries experience. Since an e-cigarette is something new and its effects towards health are not well documented, it is crucial to provide a baseline data of periodontal health and caries experience among e-cigarette users and determine the detrimental effects posed by e-cigarettes on periodontal health and caries experience. There is an urgent need for longitudinal studies so that the detrimental effect of e-cigarette usage is better understood, especially among youths. In this chapter, an overview of the research has been given including the

background of the study, the statement of the problem, the purpose, aim, and objectives as well as the significance of the study. In addition, the research assumptions are met.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

All over the world, people are striving to be healthy. Leading a healthy lifestyle, having a positive mind, and practising cleanliness are some of the ways to live healthier. Periodontal health and caries experience is a branch of healthy living as it is part of oral health that is more essential than we recognise. Oral health is the gauge and gateway to our health status as it provides a clue of overall health. This chapter introduces various articles or journals related to oral health that focus on periodontal health and caries effects from the use of cigarettes and e-cigarettes.

2.2 METHOD

2.2.1 Literature Search Strategies

The aim of this literature review is to analyse, summarise, and synthesise the outcome of periodontal and caries experience based on the different smoking statuses through reviewing the relevant available literature. The factors that influenced the periodontal health and caries experience on smoking status were also identified. The relevant studies were reviewed and analysed to highlight the knowledge gap and justify the relevance of the current study. In order to avoid being overwhelmed by the data, the literature review process was guided by literature review questions and objectives.

2.2.2 Objectives of Literature Review

The objectives of the literature review are:

1. To understand the periodontal health and caries experience in different smoking statuses.
2. To identify the factors that influences the periodontal health and caries experience based on smoking status.

2.2.3 Questions for Literature Review

1. What is the periodontal health and caries experience in different type of smoking status?
2. What are the factors that influence the periodontal and caries experience based on smoking status?

2.2.4 Search Strategies

The literature review was carried out in a systematic process starting from September 2016 and completed in March 2018 to identify any research published during the course of the study. An electronic database search was employed to access the library databases and to search online for nursing, dental and medical journals that were published between 2008 and 2018. The year 2008 was selected as the starting year because the aim was to look at any published articles dated ten years back from 2018.

A wide range of database sources were used in this systematic search such as PubMed, Scopus, and Ovid MEDLINE with the assistance of the librarian at the International Islamic University Malaysia (IIUM). The terms used were ‘oral health status’, ‘oral health’, ‘smoker’, ‘e-cigarette’, and ‘vaper’. The results of each category

were combined using Boolean terms ‘AND’ or ‘OR’ to narrow down the search findings.

The selected journals were full-text journals only and those that were published in English between 2008 and 2018. In addition, to maintain the focus of the review and to limit the search, inclusion and exclusion criteria were made. The inclusion criteria were (1) focused on the effect of oral health status, (2) the data focused on subjects aged ≥ 18 years old, and (3) focused on cigarette smokers, e-cigarette smokers, and non-smoking persons. The exclusion criteria were (1) studies on adolescents who are still in school and (2) empirical and opinion papers.

2.2.5 Findings of the Search

The database showed 104 articles related to the research. After removing duplicate and irrelevant articles, 89 abstracts were retrieved. Then, through an assessment of the abstracts and availability of the articles in full-text form that are related to the research, ten studies consisting of eight quantitative studies and two reviews were included in this review (Figure 2.1). Next, further tools were used to appraise each type of the studies. In quantitative studies, the critical appraisal guide provided by Coughlan, Cronin, & Ryan (2007) was used. Meanwhile, for systematic and narrative reviews, the Critical Appraisal Skills Program Checklists (CAPS) (2009) were used.

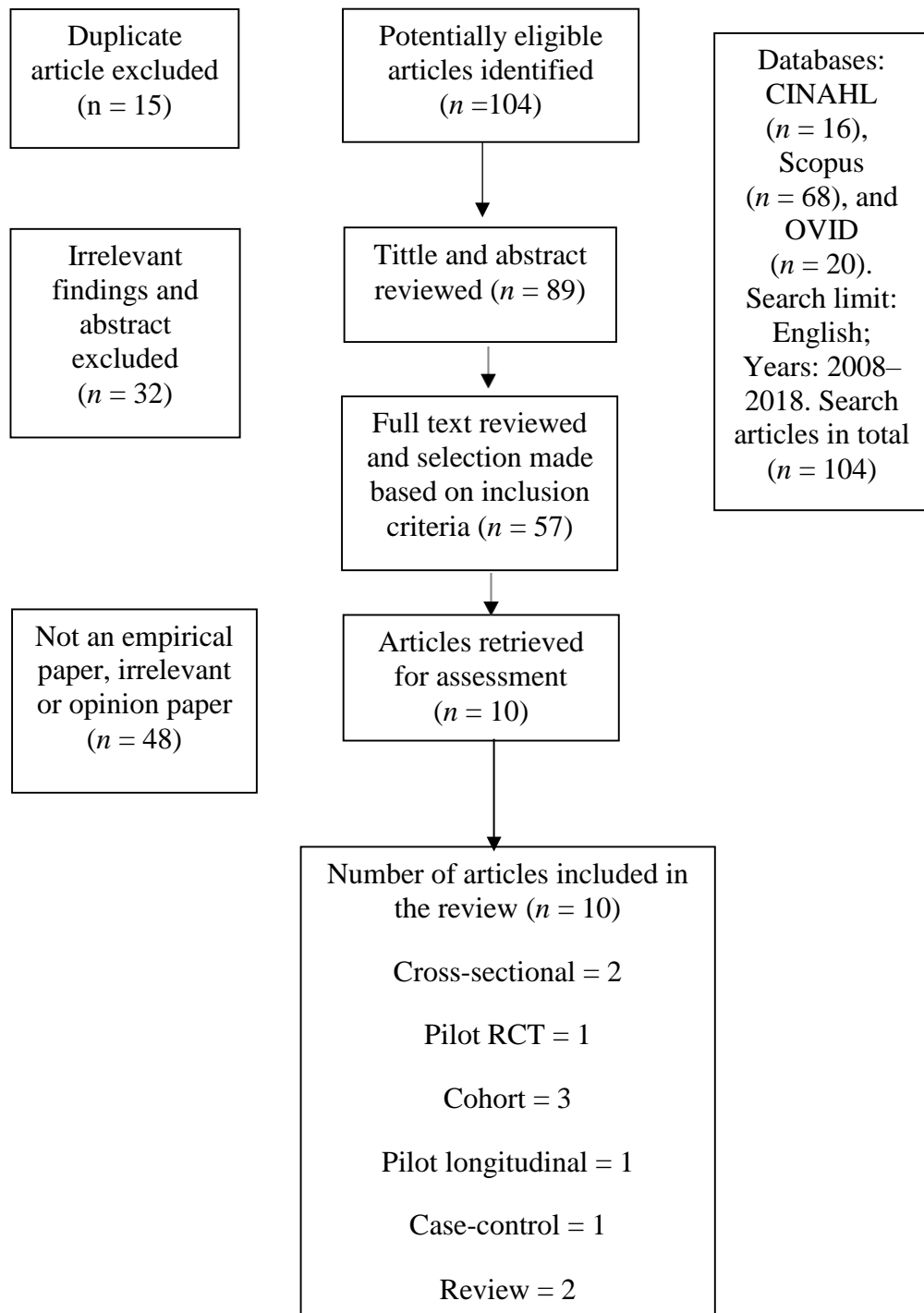


Figure 2.2: Flowchart of Review Search