Impact of the Smoking Duration on HbA1c and the Symptoms of Neuropathy Among Stone Carving Worker During Covid-19 Pandemic in Indonesia: An Evaluation Study

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ABSTRACT

The prevalence of smokers among traditional stone carving workers is high in Indonesia. As widely acknowledged, the long duration of smoking is known as a risk factor for diabetes. Smokers are often not aware of this effect, particularly in Indonesia. If left untreated, this will increase the prevalence of diabetes and its complications. Unfortunately, a study evaluating the long duration of smoking into diabetes biomarkers and neuropathy has not been explored. Therefore, the study aims to evaluate the smoking duration on HbA1c and the symptoms of neuropathy. The study used a descriptive design to achieve the study objective. A total of 56 participants were engaged with the specific inclusion and exclusion criteria. The regression analysis was used to predict whether smoking impacts the biomarker of diabetes. The finding of the study highlighted that smoking duration was not a predictor of the changes of diabetes biomarker and neuropathy ($p > .05$). Even though the result is not significant, the healthcare team must encourage to promote stopping smoking among the participants. Further study is required to develop an intervention to reduce smoking cessation in that population.

Keywords: Smoking Duration; HbA1c; Neuropathy; Stone Carving Worker; Covid-19 Pandemic

1. INTRODUCTION

The impact of smoking has been widely understood; unfortunately, the prevalence of smokers has always been high. The Centers for Disease Control and Prevention (CDC) reported that 34.1 million adults in America are smokers with > 100 cigarettes consumed during their lifetime [1]. A total of 31.3 million people are heavy smokers in Asian countries [2]. In Indonesia, a study highlighted that the prevalence of smokers is increased by 5.4% per year [3]. As widely known that smoking is one of the triggers of death due to the negative effects of the toxic chemical composition disrupting the body metabolism [4]. Pieces of evidence emphasized that the long duration of smoking cause diabetes and even its

devastating complications [5-7]. This is due to the cigarette damaging the blood vessels, disrupting the endothelial system along microvascular complications such as neuropathy [8]. In addition, nicotine hampers insulin metabolism leading to hyperglycemia [6]. Furthermore, there is a higher chance of poor prognosis and mortality for COVID-19 patients having diabetes [9]. Therefore, investigation to the HbA1c is important as it will measure the recent condition of glycemic index. Moreover, HbA1c is an indicator of long-term glycemic index that able to depict the cumulative glycemic history of the two to three months. In addition, HbA1c correlates well with the risk of diabetes complications [20].

The studies highlighted that the high incidence and impact of smoking on diabetes. To respond to this

phenomenon, several studies focusing on smoking cessation and diabetes have been well conducted in Indonesia. For example, a total of 65% of smokers do not know if smoking cause diabetes [10]. Likewise, a study confirmed smoking is a contributing factor to the high prevalence of diabetes in Indonesia [11]. Surprisingly, smoking became a habit as the smoker do not realize the impact on diabetes [12]. When left untreated, smoking may contribute to diabetes and life-threatening complications (e.g., neuropathy, diabetic foot ulcers) [13]. Diabetes can reduce work productivity and vice versa, increasing the economic burden [14, 15].

Although the prevalence of smokers has already been documented in Indonesia, descriptive information among traditional stone carving workers is lacking. If not well managed, this will increase the prevalence of diabetes and its complications in that population. In addition, most of them are categorized as low economic income which will disrupt their finance when suffering from diabetes. For these reasons, an investigation of the impact of long duration on biomarker and clinical neuropathy is crucial in that area. It is expected that the finding of this study will be baseline data to develop diabetes care among traditional stone carving workers in Indonesia.

2. METHOD

2.1. Design

The study used a descriptive observational design to evaluate the smoking duration on HbA1c and the symptoms of neuropathy among stone carving workers. There is no intervention provided during the study. However, laboratory analysis was applied for collecting the data, for example, the HbA1c test. Also, a monofilament test was used to assess the participants' clinical neuropathy symptoms. During the data collection process, health measures were implemented to reduce potential COVID-19 spread among participants and researchers.

2.2. Setting and sample

The study was conducted at the traditional stone carving worker in Muntilan, Indonesia for 1 month (May 1, 2021 – May 31, 2021). The inclusion criteria of the participants were working as a stone carver, active smokers, female and male, not having critically ill, and being able to communicate in Bahasa. In contrast, the exclusion criteria were participants administered in the hospitals. By considering those criteria, a total of 53 participants were involved in the study. The study used total sampling because all the participants was able to participate in the study. With this condition, using a formula for sample size calculation was not relevant in the study.

2.3. Instrument

This study used a demographic questionnaire and laboratory analysis for the HbA1c test and monofilament examination. We used diabetic screen foot test site scale to determine the neuropathy level. The instrument for the HbA1c test is routinely calibrated by the laboratory staff. The monofilament tool was changed after 2 x times used to prevent inaccurate results.

2.4. Data analysis

Descriptive statistics were used to assess the characteristics of the study participants. Kolmogorov–Smirnov and Shapiro Wilk test was also used to test the distribution of the data. Regression analysis was applied to evaluate the variables in the study. The significance level was considered at 0.05 for hypothesis testing.

2.5. Ethical consideration

The study was approved by the health organization in Magelang City. The ethical approval was obtained from the Ethical Committee Board, Faculty of Health Sciences, Universitas Muhammadiyah Magelang, Indonesia (186/KEPK.FIKES/II.3.AU/2021).

3. RESULT AND DISCUSSION

3.1. Result

The descriptive analysis showed that most participants did not have diabetes (n = 52; 98.1%); however, only one person suffered diabetes (n = 1; 1.9%). Most of the participants are smokers during 1 – 15 years (n = 27; 50.9%). Meanwhile, the clinical biomarker of diabetes in this study were HbA1c, blood glucose and neuropathy symptoms. The HbA1c test revealed that majority of participants had scores between 4 – 5.7 (n = 41; 77.3%) and 5.7 – 9.6 (n = 12; 22.6%). The blood sugar test presented most of the respondents were 40 - 100 gram/dL (n = 37; 69.8%) and 101 – 200 gram/dL (n = 16; 30.1%). Many respondents had a Body Mass Index score between 17 – 24 (n = 40; 75.4%) and 25 - 38: (n = 13; 24.6%). As of late, the neuropathy examination showed that most patients were in the low risk (n = 46; 86.6%) and high risk (n = 7; 13.2%) categories (Table 1).

The linear regression analysis found that smoking duration did not impact the neuropathy status (p > .05) (Table 2). In line with this finding, the statistical analysis also expressed that smoking duration did not affect the HbA1c score (p > .05) (Table 3). It may be concluded that the longer a person smokes, it could not be a predictor of the changes in HbA1c score and neuropathy status.

Table 1 Characteristic of respondents

Clinical variables	n	mean	%
Duration of Diabetes (years)		15	
0	52		98.1
1 – 10	1		1.9
Duration of smoking (years)		14.2	
1 – 15	27		50.9
16 – 30	26		49.1
HbA1c (%)		5.5	
4 – 5.7	41		77.3
5.7 – 9.6	12		22.6
Blood glucose (gr/dl)		98.0	
40 – 100	37		69.8
101 – 200	16		30.1
Body Mass Index		22.8	
17 - 24	40		75.4
25 - 38	13		24.6
Status of neuropathy		1.13	
Low risk	46		86.8
High risk	7		13.2

Table 2 Regression analysis of status neuropathy and duration smoking

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.000	1	.000	.000	.982[b]
	Residual	6.075	51	.119		
	Total	6.075	52			

a. Dependent Variable: Status Neuropathy
b. Predictors: (Constant), Duration_Smoking (Years)

Table 3 Regression analysis of HbA1c and duration smoking

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.296	1	.296	.570	.454[b]
	Residual	26.481	51	.519		
	Total	26.777	52			

a. Dependent Variable: HbA1c (%)
b. Predictors: (Constant), Duration_Smoking (Years)

3.2. Discussion

The study showed that the long duration of smoking could not be used as a predictor of neuropathy and HbA1c status, particularly in the traditional stone carving workers population in Indonesia. We assumed that this may cause by physical activity (e.g., carving) that is the potential to maintain the function of the peripheral nerves in the feet [16]. In addition, adequate physical activity reduces Tumor Necrosis Factor-α, C Reactive Protein (CRP) activities [17]. However, these results are contrary to several studies that smoking affects the neuropathic status or sensitivity of a person's feet [18, 19]. Because smoking increases HbA1c score, oxidative stress, systemic inflammation, and endothelial dysfunction [18, 20].

In this study, most of the participants are smokers as that condition may lead to diabetes in the future. As mentioned, smoking and diabetes increase the body's workload on toxic materials interfering the health function [21]. In addition, that conditions damage to blood vessels particularly on the heart, lungs, along with the brain [5]. Smoking increases the risk of diabetes and aggravates the vascular complications. In addition, smoking is linked with insulin resistance, inflammation along with dyslipidemia [25]. Evidence demonstrated that smoking is associated with type 2 diabetes and cardiovascular disease [26]. Smoking increases the risk for type 2 diabetes incidence as the nicotine was known to be the major pharmacologically active chemical in tobacco leading diabetes [27].

Based on these studies, smoking is potential a risk factor for diabetes because it will make insulin resistant leading to hyperglycemia. If not handled properly, the patients will have diabetes complications such as kidney failure, heart disease and even stroke. Although the finding of this study is not statistically significant, the literature proved that smoking leads to diabetes and its complications in the coming years. Therefore, comprehensive strategies to reduce smoking habits for workers are important.

The healthcare professional should encourage routinely the smokers to stop smoking or at least reduce the cigarette intake per day. Also, stakeholders and policymakers in the traditional stone carving industry need to develop strategies to deal with smoking cessation including increasing physical activities [22], innovation in healthcare [23]. In addition, when the patient experiences a diabetic foot, using a hospital bed for diabetic foot may help to deliver the wound care [24]. The arrangement of follow-up care to monitor smoking habits can be an alternative way to support smokers during the times of the COVID-19 pandemic.

4. CONCLUSION

This study concluded that the long duration of smoking does not affect the biomarker of diabetes (HbA1c and neuropathy). Also, smoking cannot be used as a predictor of changes in diabetes biomarkers and clinical symptoms of neuropathy. However, the finding of the study can be used for developing strategies to reduce smoking habits in the traditional stone carving worker. Finally, further research is needed to develop the intervention on smoking cessation in that population.

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