

Original Research Article

The changes in saliva cotinine during Ramadan among a group of Muslim smokers in Malaysia

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ABSTRACT

Background: Smoking is a negative health behaviour that brought in health and social problems into the community. The effects of smoking can be decreased by promoting smoking cessation. One of the approaches in smoking cessation intervention focuses on the supportive environment that can be naturally found during the Ramadan where every Muslim is obligated to fast which included abstaining from smoking.

Methods: A total of 61 male, Muslim smokers who currently smoke cigarette on daily basis were recruited. The study was conducted by using the one-group pretest-posttest study design to evaluate the effect of Ramadan environment on saliva cotinine among a group of smokers who work at a local authority in Selangor. The data were collected three times which were one week before Ramadan, 21st of Ramadan and 21 days after Ramadan. The saliva cotinine were measured by using SalivaBio oral swab (SOS) and cotinine biomarker research salivary assay kits and protocols by Salimetrics with the sensitivity of 0.15ng/ml. Data analysis was conducted by using One-way ANOVA with repeated measures and paired t-test.

Results: The study showed a significant difference in the saliva cotinine level from before, during and after Ramadan ($p = 0.002$). From the post-hoc test, there is a significant positive changes in the saliva cotinine level from before Ramadan to during Ramadan ($t(60) = 3.66, p = 0.001$).

Conclusions: The saliva cotinine level of the smokers decreased during Ramadan. This can provide an opportunity for easier initiation of smoking cessation for the smokers.

Keywords: Smoking cessation, Month of Ramadan environment, Saliva cotinine

INTRODUCTION

Smoking has impacted negatively towards health and social aspects of the community and country. Although it is known that smoking is bad for health, in Malaysia, the prevalence of smoking remains high. Based on a survey in 2011, an overall of 23.1% or 4.7 million of the Malaysian adult populations were smokers; which 43.9% of men population and 1% of women population were smokers.¹ In Malaysia, it was estimated that 20,000 of the Malaysian population die annually due to smoking

related diseases.² Smoking has caused a great economic burden as the Malaysian Government are forced to spend more than RM 3 billion annually on treating smoking related disease.³

In order to reduce the effect and burden of smoking related diseases, promotion of smoking cessation is needed. One of the approaches that can be used to promote smoking cessation is through the supportive environment that can be naturally found during Ramadan where every Muslim is obligated to fast which included

abstaining from smoking. However, accurate measurement on the true effect of Ramadan environment on smoking cessation is needed. One of the methods used to measure the effect of Ramadan environment in smoking cessation is through the measurement of nicotine dependence. Smoking cessation is a dynamic process and the successful rate of smoking cessation is determined by the interplay of multiple factors; one of main factor is nicotine dependence.⁴ Reliable indicators of nicotine dependence such as saliva cotinine level can be used to accurately assess the efficacy of a smoking cessation programs.⁵

Cotinine is a major metabolite of nicotine and it is the most appropriate parameter to evaluate tobacco exposure and smoking status due to its higher stability and half-life compared to nicotine.⁶ The principle metabolite produced when nicotine from the tobacco smoke or cigarette went into the lungs and enter the bloodstream is cotinine.⁷ In addition, saliva cotinine has a longer half-life than nicotine and it is more specific and sensitive marker for determining the exposure to nicotine.^{7,8} Thus, cotinine have been widely used as the biological markers to determine tobacco status and estimate the exposure to environmental tobacco smoke.⁹

Cotinine from the body fluids are considered the marker of choice for the absorption of tobacco smoke.¹⁰ The cotinine level from the saliva is one of the most specific and sensitive biomarker of tobacco exposure by giving the same information about cotinine disposition in the body.^{10,11} Cotinine level can be measure through blood, saliva, urine and hair. Hair testing of cotinine is rarely performed; blood and urine test is only done when a person is suspected to experiencing nicotine overdose.¹² Saliva cotinine test were much convenience to use and had a highly sensitivity and specificity in identifying daily smoker.¹³ Saliva cotinine biomarker also predicted self-reported smoking with 100% sensitivity and 96% specificity.¹³ This article reports the effect of Ramadan environment on saliva cotinine among the smokers.

METHODS

The research was conducted by using the one-group pretest-posttest study design to identify the changes of the smoker's saliva cotinine level from before Ramadan to during Ramadan and after Ramadan. The data from this study were collected three times which were at one week before Ramadan, 21st of Ramadan and 21 days after Ramadan. A total of 61 smokers who work at a local authority in Selangor, Malaysia were recruited by using systematic sampling method from the list of male workers who currently smoke during the first data collection which is before Ramadan. The respondents were then screened based on the inclusion criteria which is male, Muslim, smoke cigarette on daily basis or some days, and aged 18 and above. The respondents who smoke other form of tobacco product such as e-cigarette where excluded from this study.

The instruments that were used in conducting this research were divided into two sections. The first section is the self-administered questionnaire, and the second one is the saliva cotinine biomarker. The language of the self-administered questionnaire is Bahasa Malaysia. Demographic data that included age, marital status, ethnic, religion, educational level, income, work position, and frequency of fieldwork were asked in the questionnaire. The saliva cotinine biomarker used in this study is the SalivaBio oral swab (SOS) and cotinine biomarker research salivary assay kits with protocols from Salimetrics with the sensitivity of 0.15ng/ml. The kit in the SOS provide's SalivaBio oral swab and swab storage tube. A pilot study for the self-administered questionnaire was conducted before the actual data collection among the smokers who work at other government institute and the Cronbach's alpha is 0.85.

The data obtained from this study were cleaned before further analysing done. The analysis was conducted by using Statistical Package for the Social Sciences (IBM SPSS) Version 22.0 software for Windows. The test conducted was One-Way ANOVA with repeated measures. Post hoc test was conducted by using paired sample t-test. The saliva cotinine level for before, during and after Ramadan were test for normality and was visually confirmed by using histogram, box plot and p-p plot. Test for normality by using the Shapiro-Wilk test showed that *p* value is greater than 0.05, which indicates normally distributed data.

RESULTS

From this study, 47.5% of the respondent's age between 21 to 30 years old and another 47.5% of the respondent's age between 31 to 40 years old. Most of the respondents in this study were married, which accounted for 73.8% of the total respondents. Majority of the respondents had secondary school (67.2%) as the highest level of the education. For the family income, most of the respondents earned RM 1,000 to RM 3,999 with the mean income of the respondents as RM 2713.77. Seventy seven per cent of the respondents work in the clerical position and 55.7% of the respondent have requirement of having to go for field work more than three days per week.

The mean and standard deviation (SD) of the saliva cotinine level among respondents before Ramadan is 81.99 (21.07) with the minimum level of 8.4 and maximum level of 100.6. During Ramadan, the mean level of the saliva cotinine is lower compared to before Ramadan with mean (SD) of 73.59 (29.90). However, the mean saliva cotinine level showed slight increase after Ramadan but still lower compared to before Ramadan with the mean (SD) of 77.15 (32.13) (Table 1).

During the first data collection which is before Ramadan, most of the smokers were on the heavy smoker category. During Ramadan, there is a slight decrease in the

percentage of smoker in the heavy category as there is an increase in the percentage of respondents in the non-smoker and light smoker category. It is also found that 4.9% of the respondent saliva cotinine level falls on the non-smoker category. However, after Ramadan, the percentage of smokers in the heavy smoker category remained the same as during Ramadan and there is an increase in the percentage of non-smokers (8.2%) category (Table 2).

The respondents were then further categorized into having positive or negative changes in their saliva cotinine level. The respondents was categorized as having positive changes in the saliva cotinine level when their cotinine level is lower at during or after Ramadan when compared to before Ramadan. The respondents were categorized as having negative changes when the saliva cotinine level at during or after Ramadan is higher or having no changed when compared to the saliva cotinine level at before Ramadan. In this study, it is found that

59.0% of the respondents have positive changes in their saliva cotinine level during Ramadan when comparing to before Ramadan. However, when comparing before to after Ramadan, only 32.9% of the respondents have positive changes in their saliva cotinine level (Table 3).

A One-Way ANOVA with repeated measures was conducted to compare the saliva cotinine level at before, during and after Ramadan environment condition. Based on the One-Way ANOVA with repeated measures test, there was a significant change in the saliva cotinine level (Wilks' Lambda = 0.814, $F(2, 59) = 6.753$, $p = 0.002$). A paired sample t-test was conducted as the post hoc test to compare the saliva cotinine level of the respondents at two different period of time. It was found that there was a significant difference in the saliva cotinine level for baseline (before Ramadan) (82.00 ± 21.07) and during Ramadan (73.59 ± 29.90) conditions; $t(60) = 3.66$, p value = 0.001 (Table 4).

Table 1: Mean and standard deviation of saliva cotinine level of the respondents (N=61).

Saliva cotinine level	Mean (SD)	Level	
		Minimum	Maximum
Baseline (Before Ramadan)	81.99 (21.07)	8.4	100.6
During Ramadan	73.59 (29.90)	1.0	102.4
After Ramadan	77.15 (32.13)	1.0	103.7

Table 2: Distribution of respondents saliva cotinine category according to time of data collection (N=61).

Categories	n (%)		
	Before Ramadan	During Ramadan	After Ramadan
Non smoker	0 (0.0)	3 (4.9)	5 (8.2)
Light smoker	3 (4.9)	5 (8.2)	3 (4.9)
Heavy smoker	58 (95.1)	53 (86.9)	53 (86.9)

Table 3: Frequency and percentage of changes in the saliva cotinine level of the respondents (N=61).

	Categories	n (%)
Before Ramadan – During Ramadan	Positive changes	36 (59.0)
	Negative changes	25 (41.0)
Before Ramadan – After Ramadan	Positive changes	20 (32.9)
	Negative changes	41 (67.2)

Table 4: The changes of saliva cotinine level of the respondents (N=61).

Variable	t-value (df)	Wilks' Lambda value	F value (df)	p value
Saliva cotinine level changes ^a	3.66 (60)	0.814	6.753 (2, 59)	0.002 ^a
Before Ramadan-During Ramadan ^b	1.63 (60)			0.001 ^b
Before Ramadan-After Ramadan ^b	-1.41 (60)			0.109 ^b

^aOne-Way ANOVA with repeated measures test ^b Paired sample t-test ; *significant at p value <0.05.

DISCUSSION

Nicotine dependence is an addiction to tobacco product caused by nicotine.¹⁴ The importance of nicotine in smoking maintenance has been acknowledged, thus led to efforts for nicotine dependence measurement.¹⁵ Nicotine is highly addictive as it is the main responsible substances for the maintenance of smoking.^{16,17} The brain systems that control the emotional and motivational behaviour which are fundamental for adaptive survival are being altered and caused addiction.¹⁸ Cotinine is the major metabolite of nicotine and one of the most appropriate parameter to evaluate the smoking status of the smoker.⁶ Saliva cotinine level is one of the most specific and sensitive biomarker of tobacco exposure.^{10,11} A good measurement of nicotine dependence are useful in providing valuable information on cigarette dependence and ways to overcome or prevent it.^{19,17}

The findings of this study showed that saliva cotinine level of the respondents was lower at during Ramadan compare to before Ramadan. However, the saliva cotinine level at after Ramadan showed a slight increased compare to during Ramadan but still remained lower when comparing to before Ramadan. It is also found that from the saliva cotinine level, the percentage of the respondents that fall into the light smoker category from before (4.9%) Ramadan to during (8.2%) Ramadan is increasing. The saliva cotinine level from before Ramadan showed that, 95.1% of the respondents are in the heavy smoker category. The percentage of the respondents in the heavy smoker category decrease at during Ramadan to 86.9% and the percentage remained the same until after Ramadan.

In this study, it is also found that from before to during Ramadan; there is a significant change of the saliva cotinine level of the respondent. It is found that majority of the respondents have positive changes (59%) in their saliva cotinine level. This finding showed that the abstinence of smoking during Ramadan does help to reduce the exposure of cotinine and nicotine dependence of the smokers. The reduction of cotinine level shows that there is less cigarette smoke intake. Smoking abstinence during Ramadan had shown that there is decreasing of the number of cigarette smoked by the smokers thus led to lower level of saliva cotinine. The fasting environment during Ramadan that gives advantage of the annual daytime smoking abstinence can provide unique opportunity for smoking cessation.²⁰ The enforcement of smoking abstinence during Ramadan will enhance withdrawal for many regular smokers.²¹

The environment where most of the respondents need to abstain from smoking does help in reducing the cotinine disposition in the body of the respondents. Fasting during Ramadan which including abstaining from smoking has been associated with a positive change in health behaviour of the individual. During the month of Ramadan, the environment where most of the smokers

are abstaining from smoking is somewhat similar with the smoke free law environment. Prohibition from smoking during the day of Ramadan and the absence of other smoker influence could assist in smoking cessation attempt.²² It is also found in other study that the environment of the smoke free law after the legalization; which is somewhat similar to the month of Ramadan does reduce the salivary cotinine concentration of the non-smoker, which is secondary smoker up to 80%.²³

As the environment during Ramadan does help in reducing the saliva cotinine level of the smoker, however, it is also found in this study that there is no significant changes of the saliva cotinine level of the respondents from before Ramadan to after Ramadan. From the total respondents, it is found that most of them have negative changes (67.2%) in the saliva cotinine level from before to after Ramadan. Sadly, only 32.9% of the respondents have positive changes in their saliva cotinine level during the timeline. Even most of the respondents have positive changes of cotinine level during Ramadan, the changes did not sustain after Ramadan. It is also found that most of the respondent saliva cotinine level at after Ramadan increased or have no changes compared to before Ramadan.

As most of the smokers are obligated or abstaining from smoking during Ramadan, studies have found that force abstinence of smoking does not lead to permanent cessation in most of people.^{24,25} Many Muslim smokers in Malaysia feel that they are able to quit smoking during Ramadan.²⁶ However, only minority of them perceived Ramadan as a motivator in smoking cessation.^{27, 28} If the smokers were given support through the smoking cessation programmes, they might be able to maintain reduction of number of cigarette intake like they perceived during Ramadan thus lead to permanent saliva cotinine reduction. As the environment during Ramadan is similar with smoke-free law environment, study has shown that one of the strategies in enhancing the smoke-free laws is through religious observances with incentive and moral justifications.²¹

Most of the smokers had positive changes in their saliva cotinine level during the month of Ramadan. The lower the saliva cotinine level, the lower the nicotine dependence of the smoker. The less nicotine dependent smokers may be able to quit smoking easily compare to the dependent smokers that may need more intensive smoking cessation programmes.²⁹ The reduction of the cotinine level will help the smokers to have higher chances in successful smoking cessation as the lower the nicotine dependence, the easier the smoking cessation.

CONCLUSION

These study finding suggest that, if the smokers received enough social and moral support through the smoking cessation programmes that promoting the smoking cessation during Ramadan, the successful rate of smoking

cessation will increased. If the nicotine dependence of the smokers keeps reducing after Ramadan, they might be able to quit smoking for real. Therefore, the environment during the month of Ramadan does provide the golden opportunity for the smokers in smoking cessation.

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