BAU Journal - Health and Wellbeing

Volume 1 | Issue 2
ISSN: 2617-1635

Article 7

April 2019

PULMONARY FUNCTION TESTS IN SHISHA-ONLY SMOKERS AND ITS CORRELATION WITH INSOMNIA IN LEBANON

Nariman Salem
Faculty of Medicine, Beirut Arab University, Lebanon, n.salem@bau.edu.lb

Maha Deif
Faculty of Medicine, Beirut Arab University, Lebanon, m.dif@bau.edu.lb

Youssef Hatem
Faculty of Medicine, Alexandria University, Lebanon, usef7atem@gmail.com

PULMONARY FUNCTION TESTS IN SHISHA-ONLY SMOKERS AND ITS CORRELATION WITH INSOMNIA IN LEBANON

Abstract

Shisha smoking is continuing to be a socially acceptable method of tobacco smoking especially in the young population worldwide. The objective of this study was to determine the effect of shisha smoking on pulmonary function tests (PFT) and its correlation with insomnia in Lebanon. 382 shisha-only smokers who are less than 50 years old were recruited. A questionnaire form including inquiry about some demographic data, shisha smoking history, level of physical activity and Pittsburgh sleep quality index (PSQI) was administered to the participants after signing an informed consent. Forced expiratory volume at one second (FEV1), forced vital capacity (FVC), and FEV1/FVC ratio were recorded using a portable spirometer. More than half of the participants showed an abnormal pattern on spirometry. Two thirds of the participants showed a global PSQI score higher than 5 indicating poor sleep quality. Yet, no statistically significant values could be detected in relating longevity of shisha smoking, last time shisha has been smoked or duration of shisha smoking session and the presence of either abnormal patterns of PFT or poor sleep quality. A statistically significant correlation showed only between the level of physical activity and normal PFT. Shisha-only smokers with frequent physical activity had significantly better PFT pattern than those with no physical activity ($P < 0.011$). In conclusion, this study suggests that in population younger than 50 years old, shisha smoking seems not as harmful as widely believed especially in regards to lung functions and insomnia. Physical activity is a positive predictor of normal PFT.

Keywords

Shisha-smokers, PFT, PSQI, Physical activity, age less than 50.

PULMONARY FUNCTION TESTS IN SHISHA-ONLY SMOKERS AND ITS CORRELATION WITH INSOMNIA IN LEBANON

N. SALEM[1], M. DEIF[2], and Y. HATEM[3]

[1] Nariman Salem, Senior Lecturer of Physiology, Faculty of Medicine, Beirut Arab University, Lebanon
[2] Maha Deif, Professor of Physiology, Faculty of Medicine, Beirut Arab University, Lebanon
[3]Youssef Hatem, Professor of Physiology, Faculty of Medicine, Alexandria University, Lebanon

ABSTRACT: *Shisha smoking is continuing to be a socially acceptable method of tobacco smoking especially in the young population worldwide. The objective of this study was to determine the effect of shisha smoking on pulmonary function tests (PFT) and its correlation with insomnia in Lebanon. 382 shisha-only smokers who are less than 50 years old were recruited. A questionnaire form including inquiry about some demographic data, shisha smoking history, level of physical activity and Pittsburgh sleep quality index (PSQI) was administered to the participants after signing an informed consent. Forced expiratory volume at one second (FEV1), forced vital capacity (FVC), and FEV1/FVC ratio were recorded using a portable spirometer. More than half of the participants showed an abnormal pattern on spirometry. Two thirds of the participants showed a global PSQI score higher than 5 indicating poor sleep quality. Yet, no statistically significant values could be detected in relating longevity of shisha smoking, last time shisha has been smoked or duration of shisha smoking session and the presence of either abnormal patterns of PFT or poor sleep quality. A statistically significant correlation showed only between the level of physical activity and normal PFT. Shisha-only smokers with frequent physical activity had significantly better PFT pattern than those with no physical activity ($P<0.011$). In conclusion, this study suggests that in population younger than 50 years old, shisha smoking seems not as harmful as widely believed especially in regards to lung functions and insomnia. Physical activity is a positive predictor of normal PFT.*

KEYWORDS: *Shisha-smokers, PFT, PSQI, Physical activity, age less than 50.*

1. INTRODUCTION

Shisha smoking is known around the world by various names; this includes Waterpipe, Goza, Arghile and Hubble-bubble (Aljarrah, Ababneh, Al-Delaimy, 2009). Originating initially in the countries of South Africa, Persia, India and Ethiopia, shisha smoking became the tobacco use method traditionally associated with Asia and the Middle East region (Akl et al 2011).

A typical commercially available shisha consists of various components: a head in which the tobacco is loaded, separated from an array of coal by foil, a body, a hose and mouth piece through which the user inhales the smoke, and a glass bowl filled with water. The head of the shisha is connected to a system of airtight pipes that draw tobacco smoke into the bowl. As such, when the user inhales through the mouthpiece of the hose, air pulls through the charcoal into the bowl. This causes the smoke to be bubbled within the water, carried via the hose, and subsequently inhaled by the user (Schivo, Avdalovic, Murin, 2014).

In the past decade, shisha smoking has become a worldwide phenomenon. The global progression of this smoking practice has exceeded the worst predictions, particularly among youth. Therefore, being among the fastest growing trends in smoking, the shisha is currently considered as a global epidemic threat (Maziak, 2011). Indeed, multiple epidemiologic studies conducted in the United States and Europe pointed out that the increased prevalence of shisha smoking is mainly seen among the youth population, with up to 48% of teenagers and young adults admitting shisha use (Maziak, 2011; Maziak et al, 2015).

The escalating shisha epidemic is predominantly apparent in the Mediterranean Region and Arab world, where the prevalence of shisha smoking in Middle Eastern adolescents ranges from 6% to 34% (Maziak, 2011).

In Lebanon, a study conducted in 2005 indicated that almost 60% of 13 to 15-year-old adolescents consumed "other forms" of tobacco – most probably shisha – at least once in the previous month (Saade et al, 2008).

In opposition to the rapid spread of shisha use habit, the knowledge on its associated health hazards is only slowly developing. Users of shisha sustain many misconceptions about this type of tobacco use and largely unrecognize its health risks (Saade et al, 2008; Tamim et al, 2003). Indeed, numerous studies have reported that shisha use maintains a higher approval from society compared to cigarettes; shisha is as such perceived to be less addictive and more benign in nature. Specific positive shisha-related beliefs, whether physical, mental, societal, recreational, or cultural tend to correlate with positive attitudes toward shisha smoking (Martinasek et al, 2017).

Of the health risks identified from shisha smoking, short-term consequences include sustaining nicotine dependence, lung functional impairment, and acute respiratory diseases (Maziak et al, 2004; WHO, 2005). Long-term more serious health costs comprise developing cancers, such as lung cancer, and chronic diseases whether cardiovascular or pulmonary in origin (Maziak et al, 2004; WHO, 2005).

One study conducted by Ourari et al. in 2006 showed no significant change in pulmonary function tests in 30 shisha users compared to 10 cigarette smokers. Yet forced expiratory volume in the first second (FEV1) and total lung capacity were significantly higher. The former results of this study were challenged by a Syrian team of researchers who reported an almost permanent change of maximum mid-expiratory flow in shisha smokers when compared to cigarette users. Shisha users had also a higher proportion of chronic bronchitis (Mohammad, Kakah, Mohammad, 2008).

One Saudi cross-sectional study found a statistically significant reduction in various pulmonary function parameters, including FEV1, forced expiratory flow over the quarter and middle half of the forced vital capacity (FVC), and FEV1: FVC in shisha users compared to their matched control groups. This was seen after adjustment for various confounding factors such as age, gender, height, weight, and ethnicity (Meo et al 2014). The results of this study have been replicated multiple times. For instance, Hakim et al. in 2011 reported a decrease in FEV1 and peak expiratory flow rate in regular shisha users. Likewise, Hawari et al. in 2013 described a decline in forced expiratory flow over the middle half of the forced vital capacity among young adults using shisha tobacco. Concurrently, Boskabady et al. in 2012 found that FVC, FEV1, and other parameters in shisha smokers were significantly lower than in non-smokers. A study conducted on professional athletes in Qatar showed a significant decrease in mean values of FVC, FVC% and FEV1% in smokers (cigarettes, shisha and cigar) than non-smokers. Those who smoked shisha only had lower FEV1 % measures compared to athletes who did not smoke shisha (Chaabane et al, 2016).

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), insomnia disorder is a diagnosis assigned to any individual who experiences recurring poor sleep quality or quantity that causes clinical distress or dysfunction in daily functioning. The sleep disturbance should occur at least 3 nights every week, for at least a period of 3 months. The diagnosis of insomnia disorder is given when it does not occur within the setting of another sleep disorder (i.e. narcolepsy, breathing related sleep disorder, parasomnia, etc.) and when it is not secondary to a medical condition or the effect of drugs and medications (Association,2013).

Only 6% to 15% of patients ultimately meet the diagnosis of insomnia disorder matching the criteria of the DSM-5 (Ohayon, 2007).

Insomnia disorder has a major impact on the quality of life of the affected individuals. As a matter of fact, patients with insomnia disorder tend to rate their quality of life as poor compared to individuals who do not suffer from sleep disorders (Hajak, 2001). On a healthcare level, insomniacs consistently display higher rates of clinic visits, emergency department visits, and hospitalization compared to individuals without sleep disorders (Legar et al, 2002; Novak et al, 2004).

Insomnia disorder and sleep quality are two intertwined concepts. Sleep quality encompasses the daily pattern of sleep-wakefulness, which if appropriate, promotes the individual's bodily health and mental well-being (Buysse, 2014).

Few studies so far looked for an association between nicotine smoking and sleep quality as assessed by the PSQI. One epidemiological study showed that students who smoke cigarettes or khat had statistically significant higher odds of prolonged sleep latency (odds ratios of 1.68 and 1.72 respectively) and poor sleep efficiency (odds ratio of 1.74 and 1.91 respectively) compared to non-users (Lemma et al, 2012). In addition, ever smoking cigarettes significantly increases the odds of having poor PSQI sleep quality subscales (Lemma et al, 2012). In another cross-sectional study conducted in Yemen, the Arabic version of the PSQI was used to assess subjective sleep quality in simultaneous consumers of tobacco and khat, khat-only consumers, and non-tobacco users. Results showed that individuals simultaneously using tobacco and khat and those using khat only had higher levels of sleep disturbances compared to non-tobacco users as evaluated by the PSQI (Nakajima et al, 2014).

More recently, two studies published in 2017 confirmed the prior findings. In one study involving adult cigarette smokers, higher cigarette consumption and more frequent cravings were significantly associated with poor sleep quality as per the PSQI (Dugas et al, 2017). Similarly, a cross-sectional study of Ethiopian adults identified similar trends between khat or tobacco smoking and sleep quality (Manzar et al, 2017).

The present study aimed to examine the effect of shisha smoking on pulmonary function tests and its correlation with insomnia in Lebanon.

2. METHODOLOGY

There is an increased recognition in the literature in diagnosing pulmonary obstructive and restrictive diseases using spirometry. Tobacco smoking such as cigarette and shisha smoking has been accused for many health hazards as well as pulmonary diseases where changes in Pulmonary Function Tests (PFT) are reported. Insomnia, regarded as a sleep disorder, is sometimes related to pulmonary diseases and an increase in its prevalence is noted worldwide where many risk factors and comorbidities are identified. Nevertheless, the pathophysiology of insomnia is not yet fully explained.

This is a cross-sectional study, approved by IRB of Beirut Arab University (2017H-0062-M-M-0230), in which a survey consisting of a demographic data and questions about shisha smoking behavior was used for data collection after signing an informed consent. A validated Arabic version of Pittsburgh Sleep Quality Index survey was also administered to participants. The Pittsburgh Sleep Quality Index (PSQI) is a self-rated questionnaire used to evaluate the quality, patterns, and disturbances of sleep in adults over a one-month period. Consisting of 19 individual items, the questionnaire assesses seven qualitative and quantitative components of sleep: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. Each component has a score range between 0 (indicates no difficulty) and 3 (indicates severe difficulty). The sum of the scores of each component yields one global score: a total PSQI score greater than 5 correlates with a diagnostic sensitivity of 89.6% and a specificity of 86.5% in distinguishing between good and poor sleep quality. A score of 21 (highest possible score) indicates the worst subjective sleep quality (Buysse, 1989; Backhaus et al, 2002). The PSQI has a high interrater reliability (kappa=0.87) for the diagnosis of patients with insomnia disorder (Backhaus et al, 2002) and has been translated and validated in the Arabic language (Suleiman et al, 2010).

Then, spirometric measures were done. The demographics form consisted of questions related to gender, age, level of exercise (None means performance of daily activities only, minimal means less than 2.5 hours per week, and frequent means 30 minutes of physical activity or more than 2.5 hours per week), medical problems and medications used, illicit drug use, residence, and level of education. Questions related to shisha smoking included the onset of shisha smoking, circumstances of onset, number of years have been smoking shisha (longevity of shisha smoking), type of shisha used, number of heads of shisha per day (light means 1-2 heads per day and heavy means 3 or more heads per day), length of shisha session per head, preferred time and place for shisha smoking, sharing shisha with others, and if shisha-smokers consider shisha harmful. Pittsburgh Sleep Quality Index survey included seven qualitative and quantitative components of sleep identified as subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. Padsy portable spirometer (Spirosound, Hamburg) to assess FEV1, FVC, and FEV1/FVC was used in participants after being fully informed about the technique of spirometry and were given the chance to practice it one time before recording measurements. A nose clip and a disposable mouthpiece (spirette) tightly enclosed by the lips allowed assurance of all air inhaled or exhaled to be measured by the spirette without allowing air leak. After maximum inhalation, participants exhaled forcefully and completely as fast as possible till no more air comes out and over a period of six seconds counted by the spirometer software. Three attempts were recorded in sitting position and the best value was taken. A new disposable spirette was used for each participant to prevent any cross infection. Data about age, weight, height, posture and ethnicity were also recorded in each report sheet for participants.

Table 1: Table depicting the differences in pulmonary function tests between obstructive and restrictive lung patterns Reference: (Swamy, 2014)

	Obstructive Pattern	Restrictive Pattern
FEV1	Markedly decreased	Normal or slightly decreased
FVC	Normal or decreased	Decreased
FEV1:FVC	Decreased <70%	Normal or increased >70%

Data collection for the main study started on 1/11/2017 and ended on 15/12/2017. Participants were recruited in coffee shops, home visits and other public places adapting a snowball technique where one participant put us in contact with other friends who are shisha-only smokers.

Shisha-only smokers who are below 50 years of age were only included while those with known pulmonary problems, those who use narcotics or antidepressants, and those with psychological problems as known sleep disorders, schizophrenia or depression were excluded. A total of 385 participants were recruited from different Lebanese governorates. Of those, the data from three participants were excluded because of meeting an exclusion criterion of having asthma. Therefore, the final sample had 382 participants.

3. RESULTS

3.1. Sample Characteristics

As stated above, a sample of n = 385 participants completed the study, and the data from three participants were excluded because of failure to meet the inclusion criterion for health condition; those participants reported having asthma. As such, the final sample of the study was n = 382 participants with n = 255 males (66.8%) and n = 127 females (33.2%) recruited from different Lebanese governorates. The age of participants ranged between 14 and 50 years with mean (M = 28.20, SD = 9.29) Table 2. Other demographic data include the following results: Participants were recruited from various regions in Lebanon; Bekaa (12.6%), Mount Lebanon (17.3%), Nabatieh (8.4%), Saida (19.4%), Beirut (16.5%), South Lebanon (4.2%), Tripoli (14.1%), Baalback (4.2%), Akkar (3.1%) and Batroun (0.3%). In addition, the majority of participants had a university level education (62.5%) whereas 37.5% of participants had a school level education. Around two thirds of participants were employed (68.5%) whereas 31.5% of participants were not employed or students or housewives. The majority of participants were single (68%), however, 31.2% of participants were married and two participants were divorced (0.5%) and one participant was a widow (0.3%). The majority of participants didn't have any history of medical illness (93.2%) while only 6.8% of participants had a history of medical illness such as hypertension or diabetes. Similarly, the majority of participants don't take medications (88.2%) while only 11.8% of participants take medications and none of the participants use illicit drugs (100%).

Table 2: Shows different sample characteristics
Reference: Authors and statistician

Table 2

Descriptive of Sample Characteristics

		n	%
Gender	Male	255	66.8
	Female	127	33.2
Physical Activity	None	73	19.7
(less than 2.5 hours per week)	Minimal	122	33.0
(30 minutes per day over 5 days or 2.5 hours per week or more)	Frequent	175	47.3
Number of Heads (light = 1-2 heads per day)	Light	293	77.3
(Heavy = 3 or more heads per day)	Heavy	86	22.7
Preferred Time	day	28	7.5
	afternoon	11	3.0
	night	262	70.4
	both	71	19.1
Last time Shisha Smoked	now to 1 hour ago	179	46.9
	today or yesterday	157	41.1
	before yesterday	46	12.0

Type of PFTs	Normal	176	46.3
	Obstructive	174	45.8
	Restrictive	30	7.9
Global PSQI	Below 5	122	31.9
	>= 5	260	68.1

3.2. Scale Descriptives

The results revealed that participants reported that they have been smoking shisha, on average, between 1 month and 37 years with mean (M = 8.29 years, SD = 7.04 years). The results also revealed that the length of shisha smoking per session ranged between 10 minutes and 240 minutes (4 hours) with mean (M = 62.11 minutes, SD = 32.00 minutes). Furthermore, the results revealed that the length of shisha smoking per day, on average, ranged between 1.4 minutes and 1200 minutes (20 hours) with mean (M = 104.99 minutes, SD = 123.31 minutes). Regarding the minutes to sleep, participants reported that, on average, it takes them between 1 minute and 340 minutes (5 hours and 40 minutes) to sleep with mean (M = 25.81 minutes, SD = 34.30 minutes). Regarding the number of hours slept, participants reported that they sleep, on average, between 1 hour and 50 minutes (110 minutes) and 11 hours and 55 minutes (715 minutes) with mean (M = 379 minutes, SD = 1.74 minutes).

Regarding the seven dimension of PSQI, the results revealed that on average, participants reported having good levels of sleep quality (mean M = 1.19, SD = 0.86). Participants reported having low levels of sleep latency (mean M = 1.35 minutes, SD = 1.10 minutes). In addition, on average, participants reported having 5 to 7 hours of sleep (mean M = 1.31 hours, SD = 1.09 hours). Furthermore, on average, participants reported having high habitual sleep efficiency (>85%) (mean M = 0.12, SD = 0.41). In addition, on average, participants reported having low levels of sleep disturbances (>85%) (mean M = 1.01, SD = 0.48). Moreover, on average, participants reported having low levels of usage of medications that aid sleeping (mean M = 0.21, SD = 0.62). Furthermore, on average, participants reported having fairly low levels of daytime dysfunction (mean M = 0.89, SD = 0.89). Finally, regarding the global PSQI, it indicates on average that participants had poor quality of sleep (mean M = 6.08, SD = 2.96).

3.3. Effect of Longevity of Shisha Smoking, the Length of Shisha Smoking, and BMI on PFTs

Since the normality of the variable longevity of shisha smoking, the length of shisha smoking per day and BMI across the three groups (normal, obstructive and restrictive PFTs) was not met, then an F-Welch test was conducted to study the relation between the variable PFTs type and the variable longevity of shisha smoking and the variable length of shisha smoking per day, and BMI.

The F-Welch test revealed that that there were no differences on longevity of shisha smoking among the three types of PFTs (normal, obstructive and restrictive); F-Welch (2, 77.83) = 1.21, p = 0.31, ns. The F-Welch also revealed that there were no differences on Length of shisha smoking among the three types of PFTs (normal, obstructive and restrictive); F-Welch (2, 88.18) = 0.06, p = 0.94, ns. F-Welch for BMI and PFTs (2, 78.63) = 1.22, p = 0.30, ns.

This indicated that there is no apparent relation between longevity of shisha smoking, the Length of shisha smoking or BMI and types of PFT in this sample.

3.4. Relation between Last Time Shisha Smoked (Recency Effect), Time of Shisha Smoking (Day versus Night) and PFTs

A chi-square was conducted to study the relation between the predictor Last time shisha smoked/ time of shisha smoking and the outcome variable (PFTs type).

The chi-square test revealed that there was a non-significant relation between the variable last time shisha smoked (p = 0.21)/ or time of shisha smoking (p = 0.43) and PFTs type. This indicates that there was no apparent relation between last time shisha smoked or the time shisha smoked and PFTs in this study.

3.5. Relation between Physical Activity and PFTs

The chi-square test revealed that there was a significant relation between the physical activity and PFTs type (X2 (4, n = 368) = 13.12, p =0 .011. By looking at the cross-tabulation, it is evident that participants who had no physical activity tended to have two times more obstructive PFT pattern (60.3%) compared to normal PFT pattern (30.1%) while 9.6% of them tended to have restrictive PFT pattern. Moreover, participants who had minimal

physical activity tended to have around four times more normal PFT pattern (43.8%) and obstructive PFT pattern (44.6%) compared to restrictive PFT pattern (11.6%). Finally, participants who had frequent physical activity tended to have more normal PFT pattern (52.3%) and obstructive PFT pattern (42.5%) compared to restrictive PFT pattern (5.2%; see Table 3).

Table 3: Chi- Square test: relationship between physical activity and PFTs
Reference: Authors and statistician

		PFTs Type				
		Normal	Obstructive	Restrictive	X^2	Significance
% within PAs	None (n = 73)	30.1%	60.3%	9.6%	13.12	0.011*
	Minimal (n = 122)	43.8%	44.6%	11.6%		
	Frequent (n = 175)	52.3%	42.5%	5.2%		

3.6. Effect of Physical Activity on Global Sleep Index

A one way Analysis of Variance (ANOVA) test was conducted to study the relation between the predictor variable physical activity and the outcome variable (Global PSQI) sine the homogeneity of variance assumption was met ($F (2, 367) = 0.62$, $p = 0.54$, ns).

The ANOVA F-test revealed that that there were no differences on Global PSQI among the three levels of physical activity (none, minimal and frequent); $F (2, 367) = 0.25$, $p = 0.78$, ns. This indicated that there is no relation between physical activity and sleep patterns of participants.

3.7. Effect of the Predictors Longevity of Smoking Shisha and Length of Shisha Smoking per day on Sleep Quality

Since the normality of variables was not met thus the Spearman's Rho correlation test was conducted to study the correlations between the predictors (longevity of shisha smoking and the length of shisha smoking per day) and the outcome variables (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, daytime dysfunction and Global PSQI).

The results of the Spearman rho's tests revealed that there were no significant relations between the predictor variable (longevity of shisha smoking) and the outcome variables (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, daytime dysfunction and Global PSQI) (see Table 4).

The results of the Spearman rho's tests revealed that there were no significant relations between the predictor variable (length of shisha smoking per day) and the outcome variables (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, daytime dysfunction and Global PSQI) (see Table 4).

Table 4: Spearman`s Rho correlation test
Reference: Authors and statistician

	Subjective Sleep Quality	Sleep Latency	Sleep Duration	Habitual Sleep Efficiency	Sleep Disturbances	Sleep Medication	Daytime Dysfunction	Global PSQI
Longevity of Shisha smoking	-0.04	-0.03	0.04	0.04	-0.03	-0.05	-0.01	-0.02
Length of shisha smoking per day	0.00	0.04	0.04	0.06	0.03	0.03	0.02	0.04

3.8. Effect of the Time of Smoking Shisha on Sleep Quality

Since normality of the outcome variables (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, daytime dysfunction and Global PSQI) across groups was not met, thus eight Mann-Whitney tests were conducted to study the relations between the predictor variable time of shisha smoking and the outcome variables (sleep quality scales).

The Mann-Whitney tests indicated that participants who smoke shisha at night were not significantly different in terms of subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, daytime dysfunction and Global PSQI compared to participants who smoke shisha during the day.

3.9. Regression Analysis: Predictors of Sleep Quality

To test for hypotheses; the predictors of sleep quality, a multiple regression analysis was conducted using the forced entry method. The outcome variable was Global PSQI and the predictor variables were Physical activity, Longevity of shisha, length of shisha per day, time of shisha smoking and PFTs. The F-test revealed that the regression model which contained the predictors and which was forced into the regression equation was not significantly better than the mean in explaining the variance in the outcome variable (Global PSQI) F (5, 341) = 0.45. p = 0.81. (Table 5 & 6)

Table 5: R, R square, adjusted R square
Reference: Authors and statistician

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	0.08	0.007	-0.008	2.97	0.007	0.45	5	341	0.81	2.06

Table 6: Regression parameters
Reference: Authors and statistician

Model		***B***	***SE B***	***β***
1	(Constant)	5.58	1.37	
	Physical Activity	-0.11	0.22	-0.03
	Longevity of Shisha Smoking	-0.02	0.02	-0.04
	Length of Smoking per day	0.00	0.00	0.06
	Time of Smoking Shisha	0.32	0.61	0.03
	Type of PFTs	0.12	0.26	0.03

Note: For model 1; R2= 0.007, ΔR2= 0.007, * p< 0.05, ** p< 0.01, *** p< 0.001

By inspecting the table of coefficients; the t-tests revealed that none of the predictors were significant predictors of the outcome variable (Global PSQI).

4. RESULTS

To the best of our knowledge, this is the first study to report on PFTs and its correlation with insomnia in Lebanese shisha-only smokers without major medical or psychiatric comorbidities.

In this study, we assessed PFTs and sleep quality using a validated instrument (PSQI) in a group of shisha-only smokers. The results show that more than half of the participants (53.7%) had a non-normal type of PFTs - obstructive type (45.8%) and restrictive type (7.9%). In addition, most participants (68.1%) had a Global PSQI of 5 or above which is indicative of poor sleep quality.

4.1. Correlation between Shisha Use and Pulmonary Function Tests

The study did not identify any apparent relation between shisha characteristics and abnormal PFTs. Previous studies analyzing PFTs in shisha-only smokers are limited, have many methodological limitations, and generated inconsistent results (Ben Saad, 2009; Raad et al, 2011; Ben Saad et al, 2011). A systematic review on the chronic effects of shisha smoking on PFTs use found no association between shisha smoking, pulmonary diseases in general, and chronic obstructive pulmonary disease (COPD) in specific (Raad et al, 2011). In one specific recent study only 8% of a sample of exclusive shisha smokers had a diagnosis of COPD (Saad et al, 2013). This study is of importance as it uses characteristic Tunisian spirometry reference values rather than US-based spirometry reference value (Saad et al, 2013).This goes in agreement with prior studies supporting that COPD is uncommon in shisha users compared to cigarette smokers (Ben Saad et al, 2011; Kiter et al, 2000; Mohammad et al, 2000).

To further point out the difference between shisha and cigarette users, Ben Saad et al. (2013) compared the profiles of shisha-only male Tunisians with more than 10-year smoking history to cigarette only male users matched to age, height, and the total amount of consumed tobacco. Results showed that compared to shisha-only users, cigarette consumers had significantly poorer performance on PFTs, with characteristic lower FEV1, FVC, and FEV1/FVC. In addition, cigarette-only users had significantly higher percentages of ventilatory defect and lung hyperinflation compared to shisha users. This is suggestive that more adverse pulmonary effects are seen in the setting of cigarette-based nicotine consumption. On the other hand, shisha was infrequently approached mainly for being historically considered safe. The results of the few studies portraying low COPD prevalence in shisha-only users can be explained by the short and fast smoking pattern in which shisha smoke may not reach the peripheral airways to severely affect them (Kiter et al, 2000). In addition, shisha smoking sessions are more dispersed in time compared to the cigarette; this is thought to allow airway inflammation to heal (Kiter et al, 2000).

On the other hand, inquiry about shisha smoking in the administered questionnaire may not correlate with the real load of daily nicotine smoking. The US AUB shisha smoking model (laboratory shisha smoking model) extrapolates levels of nicotine exposure from the number of puffs per smoking session, the inter-puff time, and the volume of each puff. However, this lab setting model fails to take into consideration the real-life situation: when a person smokes shisha, his use is commonly interrupted with talking, eating, taking small volumes of the smoke, and even sharing it with others. As such, an hour of shisha smoking in a coffee shop will not be equivalent to an hour of use in the AUB model. In addition, falling under observation bias, participants in labs tend to fake their smoking habits and take larger puff volumes or more puffs per sessions than usual. Therefore, the lab setting model may exaggerate the overall exposure to shisha. In addition, our questionnaire failed to include passive smoking as an important covariate in the analysis. However, we believe that these limitations are in part mitigated by the use of anonymous questionnaires and the validated nature of the PSQI scale.

Characteristically, our results did not denote any association between longevity of shisha smoking, number of heads of shisha and the length of shisha smoking session per day, preferred time for use (day or night), last time of use before data collection, and PFTs results. About three-quarters of our participants smoked for 8 years on average, were light smokers, using 1-2 heads of shisha per day with a mean length of 1 hour per smoking session. This might ensue that once a person smokes shisha, his/her PFTs will become abnormal regardless the amount, duration, session length, and last time of use. One study tracked chronic respiratory symptoms and changes in respiratory functions in 77 Syrian female shisha smokers compared to cigarette users (Mohammad et al, 2008). Results of this study demonstrated a higher occurrence of chronic bronchitis proportional to both quantity and duration of shisha use compared to female cigarette smokers (Mohammad et al, 2008).

A conclusion about the relation between longevity or amount of shisha use and PFTs remains inconclusive.

4.2. Correlation between Shisha Use and Physical Activity

Interestingly, we identified a significant trend between physical activity and PFTs type. Indeed, participants with nil physical activity were more likely to have an obstructive PFT pattern (60.3%) compared to a normal one (30.1%). Those exerting minimal physical activity (less than 2.5 hours of exercise per week) had almost equal probabilities of normal (43.8%) versus obstructive PFTs (44.6%). Finally, more than half of participants with frequent physical activity (30 minutes of exercise five times a week or 2.5 hours per week) had a normal PFT pattern (52.3%). The association between physical activity and PFTs pattern seems to be bidirectional, one reinforcing the other. One study assessed spirometry and 6-minute walk test (6MWT) in two groups of exclusive shisha smokers (40 to 60 and 20 to 40-year-old males) (Ben Saad et al, 2014). At the end of the 6MWT, participants belonging to the older group had higher dyspnea scores, more decrease in oxygen saturation, and an overall poorer performance on the test. The physical performance on the 6MWT was significantly affected by the total body mass index, the FEV1 pattern on PFTs, and shisha consumption per year (Ben Saad et al, 2014).

The same study found that shisha users had a significantly higher BMI than matched controls. Particularly, shisha users with poor performance on the 6MWD displayed statistically significant higher BMI values compared to those with a normal test activity. This suggests that the association "shisha use-obesity" accelerates 6MWD decline (Ben Saad et al, 2014). Our results did not, however, detect any association between BMI and pattern of PFTs.

Regardless, an association between shisha smoking, BMI, and physical performance seems plausible. First, previous research has established that both acute and chronic shisha use alters physical performance by affecting the resting and exercising respiratory rates, altering the cellular physiology of airways, and accelerating lung aging (Ben Saad et al, 2011;Mohammad et al, 2008; Ko"seog"lu et al, 2006; Ben Saad et al, 2009). For instance, in the acute setting, one single 30 minutes session of shisha smoking can significantly increase the respiratory rate by 2 breaths per minute (Ko"seog"lu et al, 2006). As previously mentioned, on the long-term, chronic shisha consumption produces small and large airway obstructive ventilatory defects with a significantly higher estimated lung age compared with its chronological age (Mohammad et al, 2008). Such impairment in lung functioning is further exacerbated in obese patients; obesity often causes a restrictive ventilatory defect than an obstructive pattern on spirometry testing, with a decrease in FVC and an increase in FEV1/FVC (Zammit et al, 2010). The combined effects of shisha smoking and obesity on PFTs can explain the results of the study where shisha-only users with increased BMI display worst patterns on spirometry testing and subsequently have poorer performance on the 6MWD. This is objectively demonstrated by the significantly higher estimated lung age in shisha-only users compared to the expected chronological age (Ben Saad et al, 2014).

4.3. Correlation between Shisha Use and Sleep

In terms of sleep characteristics, the results of our study showed substantial heterogeneity in the time needed to fall asleep (from 1 minute up to almost 6 hours) and the total sleeping hours per day (between 2 and 12 hours). Interestingly, even though the participants reported, on average, fair sleep characteristics on the 7 subscale items of the PSQI, their overall quality of sleep was poor. Therefore, insomnia reported by participants was global in nature, rather than linked to a specific dimension. In addition, of interest for us, there was no significant association between shisha smoking (longevity of use and consumption per day) and global and subscale scores on the PSQI.

To the best of our knowledge, this is the first study that evaluates sleep quality and characteristics in shisha-only smokers. Most of the previous research focused on cigarette and khat smoking. For instance, one epidemiological study showed that cigarette and khat users had increased odds of prolonged sleep latency, more dependence on sleep medications, and overall poor sleep efficiency compared to non-users. Furthermore, cigarettes smoking significantly increased the odds of having lower scores on the subscale items of the PSQI (Lemma et al, 2012). Another study conducted in Yemen using the Arabic version of the PSQI demonstrated similar results. In adults who consume khat or a combination of khat and cigarettes, subjective sleep quality was significantly impaired. This was objectively translated as lower scores on PSQI subscales of sleep quality, sleep latency, sleep disturbances, and daytime dysfunction in users compared to nonusers (Nakajima et al, 2014).

Following the same trend, a case-control study showed that, compared to non-smokers, smokers had suffered from impairment in the quality of their sleep. This impairment also affected several subscale items on the PSQI, with an elevated score on the components of subjective sleep quality, sleep latency, and sleep duration. This association was maintained after adjusting for multiple confounding factors, including age, body mass index, alcohol use, and psychiatric symptoms of stress and anxiety. As such, the activating properties of nicotine, in general, seem to have a direct and strong effect on the parameters of sleep quality (Cohrs et al, 2014). The findings of all these studies go in accordance with prior reports of cigarette smokers having more difficulty to initiate sleep (Phillips and Danner, 1995; Kaneita et al, 2005) and to sustain sleep overnight (Kaneita et al, 2005).

In our study, the lack of association between shisha use and PSQI scores can be partially attributed to the nature of the instrument.

The use of spirometry reference values commonly used by the American Thoracic and European Pulmonary Societies in this study do not reflect the characteristics of Asian and Middle Eastern populations (Redlich et al, 2014). The application of such reference values in our Lebanese population may lead to an inaccuracy in the spirometry results and a subsequent inaccurate diagnosis. Indeed, deriving population specific spirometry reference values is highly required to reach appropriate identification of lung pathology. This need stems from studies performed in Asian Pacific countries demonstrating a smaller lung volume in these populations compared with US population with considerable variability seen within a similar ethnic group (Quanjer et al, 2012). If no specific spirometry reference values exist, to account for racial or ethnic differences in lung functions, the use of a correction factor would be required (Redlich et al, 2014). Recently, Nasr et al. (2014) generated prediction equations and pulmonary function reference values for healthy non-smoker male and female Saudi adults. This allows for more accurate interpretation of lung functions in this population, particularly that a substantial difference

was found between most reference values of Saudi participants compared to subjects from Caucasian, African and Japanese ethnic groups (Nasr et al, 2014).

Of importance, as no other study uses a validated Arabic questionnaire integrating various components of sleep into one major score of overall sleep quality, the characteristically increased global PSQI score in shisha smokers may at least correspond to the generally described symptoms of insomnia. This includes feelings of non-restorative sleep, difficulty getting out of bed early in the morning (Wetter and Young, 1994), trouble maintaining sleep at night along with daytime sleepiness (Phillips and Danner, 1995), all of which described in cigarette and khat users in the previously mentioned studies. We can also postulate that the poor global PSQI score can be attributed to unfavorable lifestyle characteristics that come along with shisha smoking; this mainly reflects via the association of shisha with nightlife activity and alcohol drinking. The latter elements can strongly impact sleep hygiene and therefore the overall subjective quality of sleep.

Even though no association was established between longevity of shisha use and sleep quality in our study, a very recent trial assessing sleep in nicotine dependent young adults found a dose-related relationship between the two entities. Nicotine, being a stimulant, increases arousal. As such, as the number of smoked cigarettes increases over a specific past month, the sleep quality of users tends to decrease. To further portray this relation, for every 25 smoked cigarettes in a month, users are 11% more likely to report poor sleep compared to non-users (Dugas et al, 2017).

5. CONCLUSIONS

A. This study concludes that there is no apparent association between Shisha smoking and abnormal pulmonary function tests or insomnia in apparently healthy subjects.
B. There is a positive correlation between level of physical activity and normal pulmonary function tests.

ACKNOWLEDGMENT

A highly appreciated help from Marie-belle for allowing free use of portable Padsy spirometer and to the statistician Fahed Hassan.

REFERENCES

- Akl, E.A., et al., The prevalence of waterpipe tobacco smoking among the general and specific populations: a systematic review. BMC Public Health, 2011. 11: p. 244.
- Aljarrah, K., Z.Q. Ababneh, and W.K. Al-Delaimy, Perceptions of hookah smoking harmfulness: predictors and characteristics among current hookah users. Tob Induc Dis, 2009. 5(1): p. 16.
- Association, A.P., Diagnostic and statistical manual of mental disorders (DSM-5). 2013: American Psychiatric Pub.
- Backhaus, J., et al., Test-retest reliability and validity of the Pittsburgh Sleep Quality Index in primary insomnia. J Psychosom Res, 2002. 53(3): p. 737-40.
- Ben Saad H. The narghile and its effects on health. Part I: the narghile, general description and properties. Rev Pneumol Clin. 2009; 65: 369_75.
- Ben Saad, H., Babba, M., Boukamcha, R., Ghannouchi, I., Latiri, I., Mezghenni, S., & ... Rouatbi, S. (2014). Investigation of exclusive narghile smokers: deficiency and incapacity measured by spirometry and 6-minute walk test. Respiratory Care, 59(11), 1696-1709.
- Ben Saad H, Khemiss M, Bougmiza I, Prefaut C, Aouina H, Mrizek N, et al. [Spirometric profile of narghile smokers]. Rev Mal Respir 2009;26(3):299-314. Article in French.
- Ben Saad H, Khemis M, Bougmiza I, Prefaut C, Aouina H, Mrizek N, et al. Spirometric profile of Maladies respiratoires narghile smokers. Rev Mal Respir. 2011; 28: e39_51.
- Boskabady, M.H., et al., Comparison of pulmonary function and respiratory symptoms in water pipe and cigarette smokers. Respirology, 2012. 17(6): p. 950-6.
- Buysse, D.J., Sleep health: can we define it? Does it matter? Sleep, 2014. 37(1): p. 9-17.
- Buysse, D.J., et al., The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res, 1989. 28(2): p. 193-213.
- Chaabane, Z., et al., Tobacco Use and Its Health Effects among Professional Athletes in Qatar. Can Respir J, 2016. 2016: p. 2684090.
- Cohrs, S., et al., Impaired sleep quality and sleep duration in smokers-results from the German Multicenter Study on Nicotine Dependence. Addict Biol, 2014. 19(3): p. 486-96.
- Dugas, E.N., et al., Nicotine dependence and sleep quality in young adults. Addict Behav, 2017. 65: p. 154-160.
- Hajak, G. and S.S.G.S.o.I.i. Europe, Epidemiology of severe insomnia and its consequences in Germany. Eur Arch Psychiatry Clin Neurosci, 2001. 251(2): p. 49-56.
- Hakim, F., et al., The acute effects of water-pipe smoking on the cardiorespiratory system. Chest, 2011. 139(4): p. 775-781.
- Hawari, F.I., et al., The acute effects of waterpipe smoking on lung function and exercise capacity in a pilot study of healthy participants. Inhal Toxicol, 2013. 25(9): p. 492-7.
- Kaneita Y, Ohida T, Takemura S, Sone T, Suzuki K, Miyake T, Yokoyama E, Umeda T. Relation of smoking and drinking to sleep disturbance among Japanese pregnant women. Prev Med. 2005 Nov-Dec;41(5-6):877-82.
- Kiter G, Ucan ES, Ceylan E, Kilinc O. Water-pipe smoking and pulmonary functions. Respir Med. 2000; 94: 891_4.
- Ko¨seog˘lu N, Aydin A, Uc¸an ES, Ceylan E, Eminog˘lu O, Durak H, Gu¨ven H. The effects of water-pipe, cigarette and passive smoking on mucociliary clearance. Tuberk Toraks 2006;54(3):222-228.
- Leger, D., et al., Medical and socio-professional impact of insomnia. Sleep, 2002. 25(6): p. 625-9.
- Lemma, S., et al., The Epidemiology of Sleep Quality, Sleep Patterns, Consumption of Caffeinated Beverages, and Khat Use among Ethiopian College Students. Sleep Disord, 2012. 2012: p. 583510.
- Manzar, M.D., et al., Sleep correlates of substance use in community-dwelling Ethiopian adults. Sleep Breath, 2017. 21(4): p. 1005-1011.
- Martinasek, M.P., et al., Beliefs and Attitudes Associated With Hookah Smoking Among a United States College Population. Respir Care, 2017. 62(3): p. 370-379.
- Maziak, W., The global epidemic of waterpipe smoking. Addict Behav, 2011. 36(1-2): p. 1-5.
- Maziak, W., et al., The global epidemiology of waterpipe smoking. Tob Control, 2015. 24 Suppl 1: p. i3-i12.
- Maziak, W., et al., Tobacco smoking using a waterpipe: a re-emerging strain in a global epidemic. Tob Control, 2004. 13(4): p. 327-33.
- Meo, S.A., et al., Effect of shisha (waterpipe) smoking on lung functions and fractional exhaled nitric oxide (FeNO) among Saudi young adult shisha smokers. Int J Environ Res Public Health, 2014. 11(9): p. 9638-48.
- Mohammad, Y., M. Kakah, and Y. Mohammad, Chronic respiratory effect of narguileh smoking compared with cigarette smoking in women from the East Mediterranean region. Int J Chron Obstruct Pulmon Dis, 2008. 3(3): p. 405-14.
- Nakajima, M., et al., Habitual khat and concurrent khat and tobacco use are associated with subjective sleep quality. Prev Chronic Dis, 2014. 11: p. E86.
- Nasr A. Belacy, Abdullah H. Altemani, Mostafa H. Abdelsalam, Magdi A. El Damarawi, Bassem M. Elsawy, Noha A. Nassif, Eman El-Bassuoni; Reference Values for Lung Function Tests in Adult Saudi Population: International Journal of Internal Medicine 2014; 3(3): 43-524.
- Note, W.H.O.T.A., Waterpipe tobacco smoking: health effects, research needs and recommended actions by regulators G.W.H. Organization, Editor. 2005.

- Novak, M., et al., Increased utilization of health services by insomniacs--an epidemiological perspective. J Psychosom Res, 2004. 56(5): p. 527-36.
- Ohayon, M.M., [Prevalence and comorbidity of sleep disorders in general population]. Rev Prat, 2007. 57(14): p. 1521-8.
- Ourari, B.Z., A.; Mehiri, N.; Cherif, J.; Khalsi, S.; Enaifer, E.; Daghfous, J.; Louzir, B.; Boubaker, S.; Beji, M. , Cytologie alvéolaire et fonction respiratoire chez le consommateur de narguilé Rev. Mal. Respir., 2006. 23(86).
- Phillips BA, Danner FJ. Cigarette smoking and sleep disturbance. Arch Intern Med. 1995 Apr 10;155(7):734-7.
- Quanjer PH, Stanojevic S, Cole TJ, Baur X, Hall GL, Culver BH, Enright PL, Hankinson JL, Ip MS, Zheng J, et al.; ERS Global Lung Function Initiative. Multi-ethnic reference values for spirometry for the 3–95-yr age range: the global lung function 2012 equations. Eur Respir J 2012;40:1324–1343.
- Raad D, Gaddam S, Schunemann HJ, Irani J, Abou Jaoude P, Honeine R, et al. Effects of water-pipe smoking on lung function: a systematic review and meta-analysis. Chest. 2011; 139: 764_74.
- Redlich, C. A., Tarlo, S. M., Hankinson, J. L., Townsend, M. C., Eschenbacher, W. L., Von Essen, S. G., & ... Weissman, D. N. (2014). Official American Thoracic Society technical standards: spirometry in the occupational setting. American Journal Of Respiratory And Critical Care Medicine, 189(8), 983-993.
- Saad, H. B., Khemiss, M., Nhari, S., Essghaier, M. B., & Rouatbi, S. (2013). Pulmonary functions of narghile smokers compared to cigarette smokers: a case–control study. The Libyan Journal of Medicine, 8,10.3402/ljm.v8i0.22650.
- Saade, G., et al., Patterns of tobacco use: results from the 2005 Global Youth Tobacco Survey in Lebanon. East Mediterr Health J, 2008. 14(6): p. 1280-9.
- Schivo, M., M.V. Avdalovic, and S. Murin, Non-cigarette tobacco and the lung. Clin Rev Allergy Immunol, 2014. 46(1): p. 34-53.
- Suleiman, K.H., et al., Translating the Pittsburgh Sleep Quality Index into Arabic. West J Nurs Res, 2010. 32(2): p. 250-68.
- Swamy, S. Interpretation of ABGs and Spirometry. 2014 [cited 2018; Available from: https://www.slideshare.net/ShivashankarS1/understanding-abgs-and-spirometry.
- Tamim, H., et al., Tobacco use by university students, Lebanon, 2001. Addiction, 2003. 98(7): p. 933-9.
- Wetter DW, Young TB. The relation between cigarette smoking and sleep disturbance. Prev Med. 1994 May;23(3):328-34.
- Zammit C, Liddicoat H, Moonsie I, Makker H. Obesity and respiratory diseases. International Journal of General Medicine. 2010;3:335-343. doi:10.2147/IJGM.S11926.