

Water-pipe (narguile) smokers in Lebanon: a pilot study

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مدخنو الشيشة (النارجيلة) في لبنان: دراسة ارتيادية
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الخلاصة: أجرت الباحثات دراسة مقارنة لتقييم الخصائص الديمغرافية والاجتماعية لمدخني الشيشة (النارجيلة)، وتَرافُق تدخينها مع تدخين السجائر، ومع الأمراض التنفسية المزمنة، ثم أُجريت مرتسم الاعتماد لأربع مجموعات هي: المقتصرون على تدخين الشيشة، والمقتصرون على تدخين السجائر، والذين يجمعون بين تدخين الشيشة وتدخين السجائر، والذين لا يدخنون أيًا منها. ولاحظت الباحثات أن تدخين السجائر أعلى بمقدار يعتد به إحصائياً لدى مدخني الشيشة منه لدى الذين لا يدخنونها، علماً بأن 36.5% ممن يقتصرون في تدخينهم على الشيشة يدخنونها أكثر من سبع مرات أسبوعياً. وقد أبلغ عن المرض التنفسي المزمن والتهاب القصبات المزمن بتواتر أكبر لدى من يقتصرون في تدخينهم على الشيشة منه لدى غير المدخنين للشيشة ولا للسجائر. واستنتج الباحثون أن تدخين الشيشة من عوامل الاختطار الكبرى للمرض التنفسي المزمن، شأنه في ذلك شأن تدخين السجائر.

ABSTRACT We carried out a comparative study to assess the demographic and social characteristics of water pipe (WP) smokers, the association with cigarette smoking and chronic respiratory diseases and the dependence profile on 4 groups: exclusive WP smokers, exclusive cigarette smokers, mixed smokers and absolute non-smokers. Cigarette smoking was statistically significantly higher in WP smokers than non-WP smokers; 36.5% of exclusive WP smokers smoked ≥ 7 WPs/week. Chronic respiratory disease and chronic bronchitis were reported more frequently in exclusive WP smokers than absolute non-smokers. WP smoking seems to be as great a risk factor as cigarette smoking for chronic respiratory disease.

Fumeurs de narguilé (pipe à eau) au Liban : une étude pilote

RÉSUMÉ Nous avons réalisé une étude comparative afin d'évaluer les caractéristiques démographiques et sociales des fumeurs de narguilé, le lien avec la consommation de cigarettes et les maladies respiratoires chroniques, et le type de dépendance de quatre groupes : des sujets fumant uniquement le narguilé, des sujets fumant uniquement des cigarettes, des sujets fumant les deux et des sujets ne fumant pas du tout. La consommation de cigarettes était significativement plus élevée du point de vue statistique chez les sujets qui fumaient le narguilé que chez les autres ; 36,5 % des sujets fumant uniquement le narguilé en fumaient au moins sept par semaine. On signalait davantage de maladies respiratoires chroniques et de bronchite chronique chez les sujets fumant uniquement le narguilé que chez les non-fumeurs. La consommation de narguilé semble être un facteur de risque de maladie respiratoire chronique aussi important que la consommation de cigarettes.

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Introduction

Recently, water pipe (WP) (also known as hubble-bubble, hookah, narghile, and *shisha*) smoking has become fashionable and is extensively used in the Middle East [1–3], particularly Lebanon [4], and even in Europe and the United States of America [3,5].

A common belief in the general population is that WP smoking is less harmful than cigarette smoking because the water filters the smoke [1] and because the tobacco contains “healthy” fruits [6]. Smoke filtered by water is freed from substances like acrolein (2-propenal) and phenols; the nicotine level, however, remains unchanged [7].

Narghile smoke probably contains several of the chemicals thought to be causal factors of cancer, cardiovascular disease and dependence in cigarette smokers [8]. Some studies described lower birth weights in babies of mothers who smoke WPs [9]. Others noted impairment of pulmonary function on spirometry [10], association with cancers [11], and increased pulmonary epithelial permeability [12]. Taken together, these reports suggest that WP smoking has a deleterious effect on health as well as inducing dependence on nicotine similar to that found in cigarette use.

Since few data exist regarding WP smoking in Lebanon, the objective of this pilot study was to assess the demographic and social characteristics of WP smokers compared to non-WP smokers, the association between cigarette smoking and WP smoking, the association between WP smoking and chronic respiratory disease and the nicotine dependence profile of WP smokers. This pilot study is a part of a larger project on WP use in Lebanon that is designed to further evaluate nicotine and carbon monoxide levels and nicotine dependence in smokers, and respiratory diseases related to WP smoking.

Methods

This was a comparative study of exclusive WP smokers with cigarette smokers, mixed smokers and absolute non-smokers. It was not intended to calculate the overall prevalence of WP smoking in Lebanon.

Study population

Inclusion criteria were being Lebanese, aged ≥ 16 years and being a regular WP smoker (defined as current smoking of ≥ 1 WP per week) or a non-WP smoker.

Data collection

Data were collected by telephone interview. A list of active numbers for the whole of Lebanon was provided by the national telephone company. We randomly selected 1 per 1000 and the interviewers called the numbers with the aim of recruiting a minimum of 161 regular WP smokers and 242 non-WP smokers. This would allow for an odds ratio (OR) of at least 2.50 between WP smoking and chronic cough or expectoration, with an alpha risk of 5% and a power of 80%, assuming that WP smoking is responsible for as much chronic cough and expectoration as cigarette smoking and that prevalence of these chronic symptoms is 20% in smokers [13].

The interviewer gave a brief introduction to the objective of the study, and explained it as being a study regarding WP smoking. After verbal consent to participate, the person who answered the call was asked if he/she was eligible and a regular WP smoker: if yes, the interview was carried out with him/her. If not, he/she was asked if any present family member was a regular WP smoker and eligible: if yes, this family member was interviewed. If more than one family member were WP smokers, the one sitting closest to the phone was interviewed. If the WP smoker was absent at the time of

the call, an appointment was made to call again. If there were no regular WP smokers among family members, the interview was carried out with the person who answered the phone or the eligible family member closest to the phone. If no family members were eligible at all, the household was replaced by the next one on the list. Thus, the selected regular WP smokers represented Lebanese households where there was ≥ 1 regular WP smoker, while the group of non-WP smoker represented households which had no regular WP smokers.

Data were collected using a standardized Arabic questionnaire that was developed especially for this study. It included questions on socioeconomic factors, history of active and passive smoking, chronic bronchitis and respiratory diseases, and dependence profile. The names of the participants were not registered on the database to ensure confidentiality.

WP smoking, chronic bronchitis and respiratory disease constituted dependent variables. WP smoking was assessed by the number smoked per week and the duration of smoking. Frequency was divided into 4 exposure classes: 0, 1, 2–6 and ≥ 7 WPs per week. Using a method similar to that used to calculate cumulative exposure to cigarette smoking, cumulative WP smoking was calculated by multiplying the number smoked per week by the duration of WP smoking; the product was divided into 4 cumulative exposure classes: non-smokers, 1–3 WP years, 4–28 WP years and > 28 WP years. These classifications were chosen to obtain equivalent cumulative percentages per class of consumption.

Respiratory disease was assessed by a positive answer regarding physician-diagnosed chronic respiratory disease (PDRD). Chronic bronchitis was defined as having a morning productive cough for > 3 months a year for > 2 years [14].

Independent variables were age, sex, height, weight, body mass index (kg/m^2), education, professional status, marital status, active cigarette smoking and passive smoking.

Education was evaluated according to the years of schooling with 0–8 years considered low education, 9–15 years intermediate, and being a university student or graduate high education. Residing in a city, town or village was self-assessed. Being an active cigarette smoker was defined as smoking ≥ 1 cigarette per day. Passive smoking was evaluated by the number of smokers at home and at work. The dependence profile was evaluated by adapting the Fagerström test and DSM-IV items for nicotine dependence items to WP smoking [15,16].

Data analysis

Data entry and analyses were performed using *SPSS*, version 12.0. Two-tailed statistical tests were used: chi-squared test for categorical variables and Mann–Whitney and Kruskal–Wallis tests for continuous variables of non-homogeneous variables or non-normal distribution, and analysis of variance was used for continuous variables with normal distribution.

Tukey post-hoc comparison tests were used to allow for 2 by 2 group comparisons. A trend test was applied for dose–effect relationships between frequency of WP smoking and cumulative WP smoking on the one hand, and chronic respiratory disease and chronic bronchitis on the other.

In addition, multivariate analysis was done: backward stepwise logistic regression for WP smoking, chronic bronchitis and respiratory diseases, with adjustment for potential confounding variables (age, sex, body mass index, education, work status, marital status, active cigarette smoking, and passive smoking).

Results

Sociodemographic characteristics

From 448 phone calls, 425 questionnaires were completely filled and analysed; a refusal rate of 5.1% was noted. There were significant differences regarding all baseline characteristics ($P < 0.001$) except for marital status. The majority of non-smokers were women and the majority of mixed smokers men (Table 1). Mean age was highest for cigarette smokers; mixed smokers were more obese than the other groups. All

groups included highly educated individuals. Compared with other groups of smokers, more of the exclusive cigarette smokers had low education. About 75% of mixed smokers were currently working, while about half of the cigarette smokers were not working (Table 1).

Smoking characteristics

Non-smokers had a statistically significantly lower number of smokers at home ($P < 0.001$); cigarette smoking was more

Table 1 Sociodemographic characteristics of smokers and non-smokers in Lebanon

Variable	Type of smoker								P-value	Total (n = 425)	
	Non-smokers (n = 183)		Cigarettes (n = 81)		WP (n = 75)		Mixed (n = 86)			No.	%
	No.	%	No.	%	No.	%	No.	%			
Sex											
Male	71	38.8	44	54.3	36	48.0	61	70.9	< 0.001	212	49.9
Female	112	61.2	37	45.7	39	52.0	25	29.1		213	50.1
Marital status											
Unmarried	90	49.2	27	33.3	39	52.0	37	43.0	0.06	193	45.4
Married	93	50.8	54	66.7	36	48.0	49	57.0		232	54.6
Education											
Low	8	4.4	16	19.8	13	17.3	9	10.5	< 0.001	46	10.8
Intermediate	72	39.3	42	51.9	27	36.0	29	33.7		170	40.0
High	103	56.3	23	28.4	35	46.7	48	55.8		209	49.2
Work situation^a											
Working	90	49.5	35	43.2	41	54.7	64	74.4	< 0.001	230	54.2
Not working	63	34.6	41	50.6	25	33.3	16	18.6		145	34.2
Student	29	15.9	5	6.2	9	12.0	6	7.0		49	11.6
Residence											
City	113	61.7	39	48.1	50	66.7	52	60.5	< 0.001	254	59.8
Town	66	36.1	31	38.3	24	32.0	21	24.4		142	33.4
Village	4	2.2	11	13.6	1	1.3	13	15.1		29	6.8
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		Mean	SD
Age ^b (years)	35.9	15.6	48.6	17.1	35.4	15.9	39.6	14.5	< 0.001	39.0	16.4
Weight ^c (kg)	68.3	13.9	73.0	14.3	71.0	14.8	79.1	12.2	< 0.001	71.8	14.4
Height ^d (m)	168.6	9.0	170.2	9.1	170.4	9.5	174.0	8.4	0.001	170.3	9.2
BMI ^e (kg/m ²)	23.9	4.1	25.1	3.9	24.4	4.7	26.2	3.6	< 0.001	24.7	4.2

^aTotal > 183 as some students also had jobs.

^bAge Tukey post-hoc tests: non-smoker = WP smoker = mixed smoker < cigarette smoker.

^cWeight Tukey post-hoc tests: non-smoker < cigarette smoker = WP smoker < mixed smoker.

^dHeight Tukey post-hoc tests: non-smoker = cigarette smoker = WP smoker < mixed smoker.

^eBMI Tukey post-hoc tests: non-smoker < cigarette smoker = WP smoker < mixed smoker.

WP = water pipe; SD = standard deviation; BMI = body mass index.

common when there were a higher number of smokers at work. Exclusive cigarette smokers consumed more cigarettes per day and had been smoking for a longer period of time than mixed smokers. Exclusive WP smokers consumed a higher mean number of WPs per week than mixed smokers for an equivalent duration, thus had a higher cumulative exposure. However, there were no significant differences between the 2 groups regarding the number of people who would regularly share the WP and the size of the WP (small/medium/large: standard sizes on the market in Lebanon). Mixed smokers inhaled the smoke significantly more often than exclusive WP smokers (Table 2). Comparing all WP smokers with non-WP smokers, there were more cigarette smokers in the WP group (52.5% vs 28.0%) ($P < 0.0001$). Mean age for starting WP smoking was 16 years. The following reasons were given for smoking WP: pleasure (52.5%), conviviality (24.7%) and habit (10.8%). The majority of WP smokers (61.6%) had smoked for < 5 years (results not shown).

Nicotine dependence profile

A higher percentage of mixed smokers than exclusive WP smokers stated that the first WP of the day would be the most difficult to give up, and a higher number of exclusive WP smokers would leave the family on a holiday to go and buy WP tobacco ($P = 0.04$). More exclusive WP smokers had their first WP less than 1 hour after waking-up (Table 3) ($P = 0.04$). For other criteria related to nicotine dependence, there was no significant difference between exclusive WP smokers and mixed smokers.

Respiratory disease

There were significant differences regarding PDRD, particularly for chronic bronchitis, asthma and respiratory allergy. Exclusive

WP smokers and mixed smokers had more PDRD than cigarette smokers, and much more than non-smokers. In parallel with mucolytic use, symptoms of chronic bronchitis were mostly reported by mixed smokers (41.9%), followed by cigarette smokers (37.0%); the difference between WP and cigarette smokers was not statistically significant ($P > 0.20$) (Table 4).

For dose-effect relationships, a higher frequency of WP smoking and cumulative exposure were statistically significantly associated with higher risk of having chronic bronchitis and PDRD (Table 5).

Multivariate analysis

In multivariate analysis (Table 6), WP smoking was correlated with older age, currently working, number of smokers at home, active cigarette smoking and lower education.

For the presence of PDRD, WP smoking was a risk factor [adjusted OR (OR_a) = 1.95], along with the number of smokers at home and marital status. WP ($OR_a = 1.89$) and cigarette smoking ($OR_a = 2.62$) were both correlated to reported chronic bronchitis, in addition to older age, city residence, lower and intermediate education.

Use of mucolytics to treat chronic cough was associated with WP smoking ($OR_a = 3.07$) and cigarette smoking ($OR_a = 1.45$; $P > 0.05$). Village residence and higher education were also retained in the model as associated with this behaviour.

Discussion

The mean age of exclusive WP smokers in our study was 35.4 years, and 46.7% were university graduates, which is concordant with previous studies done in Lebanon [17–19]. There were as many males and females in exclusive WP smokers (52%), indicating

Table 2 Active and passive smoking characteristics in smokers and non-smokers in Lebanon

Variable	Type of smoker								P-value	Total (n = 425)	
	Non-smokers (n = 183)		Cigarettes (n = 81)		WP (n = 75)		Mixed (n = 86)				
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		Mean	SD
No. of smokers at home ^{a,b}	0.7	1.0	1.6	1.2	1.8	1.3	1.9	1.1	< 0.001	1.3	1.2
No. of smokers at work ^{b,c}	0.4	1.3	1.5	2.8	0.9	2.2	1.8	2.6	< 0.001	1.0	2.2
No. of cigarettes/day ^b	NA		22.4	17.8	NA		20.8	15.5	< 0.001	8.5	14.8
Duration of cigarette smoking ^b	NA		21.9	15.6	NA		14.9	11.9	< 0.001	7.2	12.6
No. WP/week ^b	NA		NA		5.5	7.0	3.6	3.7	0.03	4.5	5.5
Duration of WP smoking ^b	NA		NA		7.7	10.9	6.4	7.0	0.37	7.0	9.0
Cumulative dose ^b	NA		NA		68.2	168.2	23.6	37.4	0.02	44.3	120.0
No of persons sharing ^b	NA		NA		1.7	1.2	1.5	1.3	0.39	1.6	1.2
					No.	%	No.	%		No.	%
Persons smoking:	NA		NA								
1 WP/week					26	35.1	23	28.0	0.04	49	31.4
2–6 WP/week					21	28.4	42	51.2		63	40.4
≥ 7 WP/week					27	36.5	17	20.7		44	28.2
Inhales WP smoke	NA		NA								
Never					51	68.0	26	31.3	< 0.001	77	48.7
Sometimes					13	17.3	38	45.8		51	32.3
Always					11	14.7	19	22.9		30	19.0
Size of WP	NA		NA								
Small					11	14.7	22	26.5	0.15	33	20.9
Medium					54	72.0	54	65.1		108	68.4
Large					10	13.3	7	8.4		17	10.8

^aNumber of smokers at home Tukey post-hoc tests: non-smokers < cigarette smokers = WP smokers = mixed smokers

^bMean and SD are reported in groups of comparison.

^cNumber of smokers at work Tukey post-hoc tests: non-smokers = WP smokers < cigarette smokers = mixed smokers.

Cumulative dose = no. of WP weekly × duration (years).

WP = water pipe; SD = standard deviation; NA = not applicable.

an increase in the prevalence of smoking among females from 13% in 1992–93 [20]. Despite WP smoking being time-consuming, 55% of WPS were currently working; the 33% who were not working comprised mainly women at home, who socialized by smoking WPs. This epidemic-like rise in WP smoking seems to predominate in

urban areas since 67% of WP smokers lived in cities.

The majority of WP smokers (61.6%) had smoked for less than 5 years, indicating the recent nature of the trend.

Living with smokers at home was associated with WP smoking, showing the incentive effect of this habit on people

Table 3 Nicotine dependence profile in water pipe smokers in Lebanon

Variable	WP smoker (n = 75)		Mixed smoker (n = 86)		P-value	Total (n = 161)	
	Mean	SD	Mean	SD		Mean	SD
No. of days can stay without WP	21.0	29.7	13.6	21.9	0.08	17.1	26.0
No. of times stopped WP for > 7 days	5.1	2.9	4.9	2.9	0.66	5.0	2.9
Time spent searching for WP tobacco (hours)	8.4	21.2	5.5	15.4	0.36	7.0	18.5
Price ready to pay for WP tobacco (US\$)	8.0	6.4	8.3	14.0	0.83	8.0	11.2
Age started regular WP smoking (years)	29.0	11.8	32.4	12.0	0.07	30.8	12.0
	No.	%	No.	%		No.	%
Feeling disturbed if smoking not allowed	20	27.4	18	22.2	0.46	38	24.7
Cannot give up the first WP of the day	3	4.1	11	13.6	0.04	14	9.1
Smokes WP more in the morning	9	12.3	8	9.9	0.63	17	11.0
Smokes WP even if very sick	4	5.5	3	3.7	0.60	7	4.5
Would leave the family on a holiday to buy WP tobacco	16	22.2	8	9.9	0.04	24	15.7
Prefers WP to sport or other activity	28	38.4	23	28.4	0.19	51	33.1
Ready not to eat but smoke WP	15	20.5	13	16.5	0.52	28	18.4
Delays smoking WP after waking up							
More than 1 hour	66	90.4	74	91.4	0.04	140	90.9
Less than 1 hour	7	9.5	7	8.6		14	9.1

Mean and standard deviation (SD) are reported in groups of comparison.

WP = water pipe.

in the same environment. In WP smokers, there were significantly more cigarette smokers compared with non-WP smokers. This might signify that WP smoking is a smoking behaviour per se: WP is one of

the tobacco tools of smokers, not just a social habit [21,22]. Mixed smokers may regulate their nicotine intake by the amount consumed of each tobacco type. Chaouachi noted that people in countries like Lebanon

Table 4 Respiratory symptoms and diseases in smokers and non-smokers in Lebanon

Variable	Type of smoker								P-value	Total (n = 425)	
	Non-smoker (n = 183)		Cigarettes (n = 81)		WP (n = 75)		Mixed (n = 86)			No.	%
	No.	%	No.	%	No.	%	No.	%			
PDRD	11	6.0	7	8.6	11	14.7	14	16.3	0.03	43	10.1
Allergy/asthma	5	2.7	5	6.1	6	8.0	7	8.1	0.03	23	5.4
Chronic bronchitis	4	2.2	2	2.4	4	5.3	7	8.1		17	4.0
Chronic bronchitis symptoms	27	14.8	30	37.0	20	26.7	36	41.9	< 0.001	113	26.6
Ever used mucolytic for chronic expectoration	9	4.9	7	8.6	7	9.3	22	25.6	< 0.001	45	10.6

WP = water pipe; PDRD = physician diagnosed respiratory disease.

Table 5 Dose–effect relationship between respiratory disease and exclusive water pipe consumption in Lebanon

Condition/WP exposure	Respiratory disease				OR	Trend test P-value
	No		Yes			
	No.	%	No.	%		
<i>PDRD</i>						
0 WP/week	171	94.0	11	6.0	1.00	0.012
1 WP/week	25	92.6	2	7.4	1.24	
2–6 WP/week	17	81.0	4	19.0	3.66	
> 6 WP/week	22	81.5	5	18.5	3.53	
<i>PDRD cumulative exposure (WP years)</i>						
0	173	93.5	12	6.5	1.00	0.016
1–3.5	20	90.9	2	9.1	1.44	
4–28	23	88.5	3	11.5	1.88	
> 28	19	79.2	5	20.8	3.79	
<i>Chronic bronchitis</i>						
0 WP/week	156	85.2	27	14.8	1.00	0.002
1WP/week	23	85.2	4	14.8	1.00	
2–6 WP/week	15	71.4	6	28.6	2.31	
> 6 WP/week	17	63.0	10	37.0	3.40	
<i>Chronic bronchitis cumulative exposure^a</i>						
0	159	85.5	27	14.5	1.00	0.0002
1–3	19	86.4	3	13.6	0.93	
4–28	20	76.9	6	23.1	1.77	
> 28	13	54.2	11	45.8	4.98	

^aCumulative exposure (WP years) is calculated by multiplying weekly frequency of WP smoking by duration of WP smoking in years.

WP = water pipe; OR = odds ratio; PDRD = physician diagnosed respiratory disease.

smoke WP and cigarettes indiscriminately, and there should be more concern regarding mixed smokers and those who switched from cigarettes to WPs [23,24].

Concerning the dependence profile in WP smokers, since the majority smoked less than 7 WPs/week and could refrain from smoking WPs for several days, and 91% smoked for pleasure, for social reasons or by habit, WP smoking appears to reflect mainly the third component of dependence: social dependence [25].

Our results also indicate that WP smoking may be a risk factor for chronic respira-

tory disease and symptoms, as is cigarette smoking. There was no difference between these 2 categories of smokers, but there was a difference for PDRD between exclusive WP smokers and absolute non-smokers. This should be regarded with caution because the patients themselves reported that they had PDRD, which increases the likelihood of information bias. However, WPs being considered less harmful than cigarettes by smokers [6,20,26] allows us to conclude a non-differential bias. The limitation is less robust for the question addressing symptoms of chronic bronchitis,

Table 6 Multivariate analysis for water pipe (WP) smoking and respiratory diseases and symptoms in Lebanon

Variable	OR _a	95% CI	P-value
<i>WP smoking</i>			
Older age	0.98	0.96–0.99	0.016
Working	3.83	1.67–8.77	0.002
City residence	NR		
Marital status	NR		
Smokers at home	1.90	1.54–2.34	< 0.001
Smokers at work	NR		
Cigarette smoking	1.72	1.04–2.78	0.03
Low education	2.69	1.09–6.62	0.03
<i>Physician diagnosed respiratory disease</i>			
WP smoking	1.95	0.99–4.05	0.05
Older age	NR		
Working	NR		
City residence	NR		
Unmarried status	0.12	0.02–0.74	0.02
Smokers at home	1.37	1.06–1.76	0.02
Smokers at work	NR		
Cigarette smoking	1.14	0.41–2.28	0.71
Low education	NR		
<i>Reported chronic bronchitis</i>			
WP smoking	1.89	1.16–3.07	0.01
Older age	1.02	1.00–1.03	0.04
Never worked	NR		
Village residence	0.19	0.06–0.62	0.006
Marital status	NR		
Smokers at home	NR		
Smokers at work	NR		
Cigarette smoking	2.62	1.61–4.26	< 0.001
Low education	2.51	1.09–5.74	0.03
Intermediate education	1.87	1.11–3.18	0.02
<i>Mucolytic use for chronic expectoration</i>			
WP smoking	3.07	1.49–6.36	0.002
Older age	1.04	1.01–1.06	0.003
Never worked	NR		
Village residence	5.29	1.85–15.11	0.002
Marital status	NR		
Smokers at home	1.27	0.97–1.67	0.08
Smokers at work	NR		
Cigarette smoking	1.45	0.70–2.97	0.32
Low education	0.23	0.06–0.88	0.03
Intermediate education	NR		

OR_a = adjusted odds ratio; CI = confidence interval; NR = not retained in the model.

which included a high degree of precision [14]: WP smoking was independently associated with chronic bronchitis according to multivariate analysis and dose–effect relationship. No difference was found between exclusive WP smokers and cigarette smokers in this regard. An additive effect could explain what was seen in mixed smokers where chronic bronchitis symptoms were more frequent than in exclusive WP smokers. The use of mucolytics to improve cough and sputum production had the same distribution pattern as chronic bronchitis, and mixed smokers used more mucolytics than exclusive WP smokers and cigarette smokers. In Lebanon, it has been noticed in pharmaceutical practice that people with chronic productive cough use mucolytics as over-the-counter drugs instead of seeking

medical advice; this may be an indication of underdiagnosed chronic bronchitis.

Our study had several weaknesses. Cross-sectional data do not allow evaluating over time, but the dose–effect relationship decreases the impact of this problem on causality. The telephone interview method may also be a source of selection bias, since telephone owners can be of a higher socioeconomic status than non-owners. In addition, recall bias is possible, as for all questionnaire-based epidemiological studies. However, these biases are non-differential, and may only direct the results towards the null. On the other hand, we could not draw conclusions about nicotine dependence despite the fact that a minority of WP smokers in this population had signs of dependence.

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