

Tobacco use among students aged 11–16 years, in Sousse, Tunisia: A cross-sectional study with the GYTS method

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ABSTRACT

INTRODUCTION Despite tobacco control prevention programs, many adolescents start smoking at school age. The main objectives of this study were to assess the prevalence of smoking, secondhand smoke exposure, and susceptibility to smoking among middle-school students aged 11–16 years, using the Global Youth Tobacco Survey (GYTS), in Sousse, Tunisia, 2020.

METHODS A cross-sectional study was conducted among 306 students aged 11–16 years enrolled in 12 classes from 2 public middle schools in Sousse, Tunisia, during the school year 2020–2021. The Global Youth Tobacco Survey (GYTS) self-administered questionnaire on smoking was used to assess their smoking habits.

RESULTS In total, 35.3% of students reported that they had tried cigarettes in the past, while 17.6% reported currently

being cigarette smokers, with a higher prevalence among boys (30.6%) than in girls (7.6%) ($p < 0.001$). Of the students, 59.2% had been exposed to secondhand smoke at home and 66% in public places. Of the current cigarette smokers, 47.2% usually purchased their cigarettes in a store or market, and 34.5% had not been prevented from purchasing them despite their age. Overall, more than half (54%) of current cigarette smokers wanted to stop smoking immediately, and 66.7% had tried to quit smoking.

CONCLUSIONS The prevalence of smoking among adolescents in the study is high. The results suggest that adolescents have relatively easy access to cigarettes and are regularly exposed to secondhand smoke in public places. Implementing measures to stop tobacco use and its new forms of consumption among adolescents is imperative.

INTRODUCTION

According to the World Health Organization (WHO), smoking is one of the main risk factors for several non-communicable diseases, such as cancer, lung disease and cardiovascular disease¹. The WHO report 2018 reported that smoking kills more than 7 million people each year, and mortality is expected to reach 8 million in 2030, constituting a real threat to public health and weighing heavily on the global health system². Approximately 80% of smokers worldwide live in low- and middle-income countries with a significant burden of tobacco-related diseases¹.

The average age of smoking onset has been previously noted to be around 13 years³, in the North African countries, and we have witnessed a significant increase in the prevalence.

Similarly, according to the WHO, Tunisia reached the highest prevalence of tobacco consumption among Arab countries. Almost 7000 children aged 10–14 years and nearly two million people over 15 years use tobacco daily. The prevalence of tobacco consumption among students aged 13–15 years in Tunisia in 2017 was 10.1%, and 30% of them had started smoking cigarettes before the age of 10 years, while 35.1% have started smoking between the age of 12 and 13 years⁵. An international collaborative survey enrolling schoolchildren from 131 countries showed that adolescents have the highest risk for smoking initiation, with an overall prevalence of schoolchildren who are active smokers at 8.9%⁶.

Adolescence is a significant period of growth and physical development, marked by a psychological transition where the

child expresses the need to demonstrate his capacity as an adult. This vulnerable age, known for its high sensitivity to the effects of nicotine, can be a gateway period for smoking behavior in adolescents who can quickly become addicted⁷.

Therefore, assessing the smoking risk factors is an essential step toward tobacco prevention. In this sense, it seems relevant to study the problem of smoking behavior among schoolchildren to better comprehend this complex phenomenon and prevent it. Hence, this study aimed to assess smoking prevalence, secondhand smoke exposure, and susceptibility to smoking among middle-school students aged 11–16 years, in the city of Sousse, in 2020.

METHODS

Study design and population

A cross-sectional study on smoking behavior was conducted among middle-school students in two public colleges in the governorate of Sousse, Tunisia. Adolescents aged 11–16 years attending school in 2020 and residing in the governorate of Sousse were included. The sampling was based on the Global Youth Survey Tunisia GYTS 2017 (Global Youth Tobacco Survey)⁵. It was a two-stage stratified sampling. For the first level, two colleges were randomly drawn from the list of all colleges in the city of Sousse. The number of clusters (classes) needed to form the calculated sample was drawn for the second level.

The sample size was defined using the SCHWARTZ formula⁸, which is suitable for calculating the sample size for a descriptive study. The minimum sample size comes down to 263. Dividing this number by the average cluster size (class of 25 students), we found 11 clusters.

The sample elements are therefore divided into clusters (Classes) of 25 students: two classes of each level in each college, for a total of twelve classes. Therefore, the study was conducted in the colleges 'Ajmi Ben Saad' of Kaala Kebira and 'Mohamed el Aroui' of Jawhara Sousse and included 12 classes in the two colleges. The number of secondary school students registered in the classes concerned by the survey was 325.

Variables definitions

Frequent cigarette smokers were defined as students who reported smoking cigarettes on ≥ 20 days out of 30 days, current cigarette smokers as those who reported any cigarette smoking during the past 30 days, while ever cigarette smokers as those who have ever smoked cigarettes, even if only once or briefly. With regard to electronic cigarette use, a similar approach was followed with frequent electronic cigarette smokers those who reported using electronic cigarettes on ≥ 20 days out of 30 days, and current electronic cigarette smokers those who reported using electronic cigarettes at any time during the past 30 days. Similarly, frequent hookah smokers as those who reported using a hookah on ≥ 20 days out of 30 days, current hookah smokers as those who reported using a hookah any time during the past 30 days.

Data collection

We used a self-administered questionnaire, validated in Arabic, used in the national survey on smoking among young people attending public colleges (GYTS) in Tunisia in 2017⁵.

Data collection was carried out during the second week of March 2020. We surveyed at the start of each hour, with the teacher's permission, before the start of class. The self-administered questionnaires were completed under the supervision of a medical doctor to clarify and explain some points when needed.

The legal guardians of the adolescents were notified through the college administrations before the investigation took place. In addition, data analysis was conducted respecting the anonymity and confidentiality of schoolchildren.

Data analysis

Statistical analysis was performed using SPSS.24. The results of continuous variables are presented as mean \pm standard deviation or median and interquartile range. Categorical variables are presented as percentages. A chi-squared test was performed for categorical variables in independent samples. Values of $p < 0.05$ were considered statistically significant.

RESULTS

The number of students who completed the questionnaire was 306, with a response rate of 94.2%. The sociodemographic characteristics of participants are summarized in Table 1.

Tobacco use

In total, 35.3% of participants reported frequent cigarette smoking (boys, 49.2%; girls, 24.4%), whereas 82.4% reported ever having smoked even one or two puffs (Table 2).

The prevalence of current hookah smoking was 24.2%, while the prevalence of current electronic cigarette smoking was 15.6% (Table 3).

Exposure to secondhand smoke

More than half of the students (59.2%) were exposed to tobacco smoke at home, and almost two out of three students (66%) reported being exposed to secondhand smoke inside an enclosed public place such as a restaurant, shopping mall, or theatre (Table 4).

Most students (78.1%) reported having seen someone smoking inside the school building or outside on school property. Besides, 70.5% of students favored banning smoking in public places (Table 4).

Other risk factors

Overall, 71.3% of participants reported having seen an anti-tobacco media message on media during the past 30 days, and 58.2% noticed anti-tobacco messages on tobacco packages (Table 4). However, 77.1% of students reported seeing anyone using tobacco on television, video or movies.

Table 1. Sociodemographic characteristics of students aged 11–16 years, participating in the tobacco cross-sectional survey with the GYTS method, Sousse, Tunisia, 2020 (N=306)

Characteristics	n	%
Age (years)		
<13	48	15.7
13–15	231	75.5
≥16	27	8.8
Gender		
Boys	134	43.8
Girls	172	56.2
Grade		
7th	94	30.7
8th	110	36
9th	102	33.3
Pocket money per week (TND)		
0–1	42	13.7
1–3	69	22.5
3–9	127	41.5
>9	68	22.3

TND: 100 Tunisian Dinars about US\$32.

Table 2. Cigarette smoking characteristics of students aged 11–16 years, participating in the tobacco cross-sectional survey with the GYTS method, Sousse, Tunisia, 2020 (N=306)

Cigarette smoking status	Total n (%)	Boys n (%)	Girls n (%)	p
Frequent smokers ^a	108 (35.3)	66 (49.2)	42 (24.4)	<0.001
Current smokers ^b	54 (17.6)	41 (30.6)	13 (7.6)	<0.001
Ever smokers ^c	252(82.4)	93 (69.4)	159 (92.4)	<0.001

^a Smoked cigarettes on ≥20 days in the past 30 days. ^b Smoked cigarettes anytime during the past 30 days. ^c Ever smoked cigarettes, even one or two puffs.

Table 4. Distribution of tobacco use risk factors among students aged 11–16 years, participating in the tobacco cross-sectional survey with the GYTS method, Sousse, Tunisia, 2020 (N=306)

Factors influencing tobacco use	n	%
Secondhand smoke		
Exposure to tobacco smoke at home in the past 7 days	181	59.2
Exposure to tobacco smoke inside any enclosed public place in the past 7 days	202	66.0
Students who saw anyone smoking inside the school building or outside on school property in the past 30 days	239	78.1
Knowledge and attitudes		
Students who definitely thought it is difficult to quit once someone starts smoking tobacco	50	16.3
Students who thought other people’s tobacco smoking is harmful to them	176	57.5

Continued

Table 3. Smoking behaviors other than cigarette smoking of students aged 11–16 years, participating in the tobacco cross-sectional survey with the GYTS method, Sousse, Tunisia, 2020 (N=306)

Other smoking behaviors	n	%
Electronic cigarette smokers		
Frequent ^a	64	20.9
Current ^b	10	15.6
Hookah smokers		
Frequent ^c	91	29.7
Current ^d	74	24.2

^a Used electronic cigarettes on ≥20 days in the past 30 days. ^b Used electronic cigarettes anytime during the past 30 days. ^c Used hookah on ≥20 days in the past 30 days. ^d Used hookah anytime during the past 30 days.

Table 4. Continued

Factors influencing tobacco use	n	%
Students who favored prohibiting smoking inside public places	215	70.5
Tobacco advertising		
Students who saw any one using tobacco on television, video or movies in the past 30 days	235	77.1
Anti-tobacco advertising		
Students who noticed anti-tobacco messages in the media during the past 30 days	218	71.3
Students who noticed anti-tobacco message on tobacco packages during the past 30 days	178	58.2
Students who thought about quitting among those who noticed warning labels on cigarette packages in the past 30 days (N=178)	60	33.7
Students who were taught in school about the dangers of tobacco use in the past 12 months	199	65.0
Access and availability (N=252)		
Cigarette smokers who bought cigarettes from a store shop, street vendor, or kiosk, the last time they smoked cigarettes in the past 30 days	119	47.2
Cigarette smokers who were not prevented from buying cigarettes because of their age among those who tried to buy cigarettes during the past 30 days	87	34.5
Students who got cigarettes from other people during the past 30 days	42	16.7
Students who bought cigarettes as individual sticks based on the last purchase, among those who bought cigarettes during the past 30 days	37	14.7
Cessation (N=54)		
Current tobacco smokers who tried to stop smoking in the past 12 months	36	66.7
Current tobacco smokers who wanted to stop smoking immediately	29	54
Current tobacco smokers who thought they would be able to stop smoking if they wanted to	39	72.2

Furthermore, almost half of current cigarette smokers (47.2%) usually purchased their cigarettes in a store or market and, 34.5 % of them had not been prevented from purchasing cigarettes despite their young age (Table 4). Finally, with regard to cessation, over half (54%) of current cigarette smokers wanted to stop smoking immediately. Additionally, 66.7% had tried to quit smoking. Furthermore, 65% of the participant students reported having been taught about the dangers of smoking in school during the past year (Table 4).

DISCUSSION

Adolescence is a period in life characterized by the need to explore the unknown and adopting risky behaviors, such as cigarette smoking⁹. However, although not all adolescents who try cigarettes become smokers, experimentation is the first step toward future adherence to regular consumption of tobacco products.

We assessed the prevalence of smoking, secondhand smoke exposure, and susceptibility to smoking among middle-school students aged 11–16 years, in the city of Sousse in 2020. The findings of the study shed light on several significant trends in youth tobacco use. A concerning 35.3% of participants were identified as frequent cigarette smokers, with an increasing prevalence among girls (24.4%).

Additionally, the study found prevalence rates of 24.2% for current hookah smokers and 15.6% for electronic cigarette users. The pervasiveness of tobacco exposure emerged as a significant concern, with 59.2% of students encountering secondhand smoke at home and 66% in enclosed public spaces. Media influence was also pronounced, as 77.1% of students reported witnessing tobacco use in television shows, videos, or movies. The research also underlined a disconcerting lack of age-related purchasing restrictions, with unrestricted access to cigarettes noted. Encouragingly, 54% of current cigarette smokers expressed an immediate intention to quit, while 66.7% had attempted smoking cessation. These findings underscore the pressing need for targeted interventions to address the complex factors influencing youth tobacco use behaviors.

Overall, the majority of participants were aged 13–15 years, with a slight preponderance of females. Our study cohort consisted of college students, and their educational distribution was fairly even: 30.7% in 7th grade, 35.9% in 8th grade, and 33.3% in 9th grade.

Comparing our findings with prior research, it is noteworthy that adolescents aged 13–15 years who initiate tobacco use are more susceptible to becoming habitual consumers and facing tobacco-related risks compared to those who start smoking later in life¹⁰. This highlights the

vulnerability of the majority of our participants to the adverse effects of smoking.

Regarding financial aspects, approximately one quarter of the students received weekly pocket money ranging 3–9 Tunisian Dinars (about 1–3 US\$), and another quarter received >9 TND. Multiple studies have indicated that having access to pocket money is associated with an increased risk of smoking among adolescents¹¹.

The definition of a smoker used in the present study is the one recommended by the WHO¹². The prevalence of smoking among students was 35.3%, with 17.6% reporting daily smoking. Notably, smoking prevalence was significantly higher among boys compared to girls. Our results show not only a rise in smoking prevalence but also an upsurge among girls compared to the 2017 national tobacco use survey⁵. This alarming trend signifies a considerable increase in smoking prevalence among the youth, increasing from 7.6% in 2002¹³ to 10.1% in the 2017 national survey⁵. This surge underscores the persistence of tobacco use among young individuals in Tunisia, which ranks the highest in tobacco consumption among Arab countries¹.

Our investigation revealed a fourfold increase in the prevalence of current electronic cigarette users in Tunisia compared to the 2017 national survey (4.9%)⁵. This global trend is evident elsewhere; a study in Canada noted an increased prevalence of electronic cigarette users from 8.4% to 14.6% between 2017 and 2018¹⁴. The WHO explains the use of electronic cigarettes worldwide as an emerging trend among young people¹⁵.

The second most prevalent form of tobacco consumption among our participants was hookah, with 24.2% currently using it. Globally, hookah affects over 100 million people daily, predominantly in Africa, Asia, and the Middle East, particularly among adolescents aged 15–20 years¹⁶. In Tunisia, the hookah use rate was 20.5% in 2017¹⁷. Adolescents are often enticed to experiment with hookah due to its allure, novelty, packaging aesthetics, diverse flavors, and social opportunities¹⁸.

Concerning exposure to passive smoking, a substantial proportion reported exposure at home, while two-thirds of the students experienced secondhand smoke in enclosed public spaces, and 78.1% witnessed smoking within the college premises. Passive smoking, according to the WHO, endangers both smokers and non-smokers with lung cancer and coronary artery disease due to the inhalation of exhaled smoke in confined spaces¹⁹. Our survey underscores the significant exposure to passive smoking among students, particularly at home and in public spaces, emphasizing the need for interventions targeting both families and the general population²⁰. A majority of college students were cognizant of the health risks associated with passive smoking, with 70.5% supporting public smoking bans. Effective tobacco control strategies should encompass smoke-free environments, public smoking bans, and heightened awareness among families regarding smoke exposure.

Looking at media influence, the predominance lot of participants encountered anti-tobacco messages within the past month, noticed such messages on tobacco packages, or received tobacco prevention education within the last year. Conversely, a significant portion saw tobacco advertising messages in the same timeframe. Comparatively, the 2017 Tunisian national survey reported exposure rates of 64.4% for anti-smoking messages and 50.4% for tobacco education⁵, yet smoking prevalence rose from 10.1% to 17.6% according to our study. The orientation towards 'Health promotion' helps to reduce the mechanism of resistance to anti-tobacco messages, improve anti-smoking communication and enriching young people's knowledge of their health. This suggests that impactful anti-smoking initiatives might require a shift from fear-inducing messages to emphasizing the benefits of quitting²¹.

Regarding tobacco acquisition, nearly half obtained tobacco from retail points, 16.7% from individuals, and, remarkably, 34.5% of middle school students managed to purchase cigarettes despite their age. Easy access to tobacco has been identified as a key contributor to early smoking initiation²². This parallels findings from a Canadian study in 2016, where a substantial proportion of young smokers bought cigarettes in stores or received them for free²³. In Tunisia, the 2017 survey indicated that 63.4% of smokers purchased tobacco from retail shops, with 76.1% managing to buy it despite their young age⁵. When assessing smokers' attitudes toward smoking cessation, more than half indicated a desire to quit. Only 18.5% received tobacco cessation education. This contrasts with the 2017 survey's findings, where 74% intended to quit and 73.6% made cessation attempts within the previous year⁵. Additionally, 72.2% believed they could quit, indicating a promising level of self-confidence that warrants further support.

Strengths and limitations

The strengths of our study were that the sample size was adequate and the sample was chosen at random, which could guarantee a certain representativeness of the population. Besides, the questionnaire used in our study was the one used in the national survey on smoking among young people enrolled in public colleges (GYTS Survey Tunisia 2017), which ensures the validity of the results. However, a number of limitations must be acknowledged. First, the survey was limited to students in two schools located in the city of Sousse. Consequently, the potential for generalizing these findings to encompass all youths aged 11–16 years might be constrained. Second, we acknowledge that within our study's participant group, the presence of recall or reporting bias cannot be excluded. Finally, the questionnaire was quite long which may have hampered the concentration of students when completing it.

CONCLUSIONS

Our findings illustrate the prevalence of smoking and

other tobacco-related behaviors within the population of adolescent students, accompanied by a notable increase in smoking prevalence among female students. Additionally, the utilization of alternative tobacco products, such as electronic cigarettes and hookah, was also noted. Our observations also indicate a substantial frequency of exposure to secondhand smoke, occurring both within domestic environments and public spaces, including educational institutions. Furthermore, instances of smoking portrayal in diverse media platforms were found to be prevalent. In addition, a majority of students reported having received education concerning the detrimental effects of smoking, and a significant proportion expressed their intention to quit smoking.

The findings emphasize the need for multifaceted interventions targeting various aspects, including awareness, access, prevention, and motivation to quit smoking, to address the growing tobacco consumption trend among the youth. We also recommend to advance tobacco-free educational institutions with active involvement of all stakeholders, to prohibit smoking among educational personnel and tobacco sales to minors, and to strengthen public policies to reduce adolescent exposure to cigarettes through legal measures, age restrictions, marketing bans, and tailored cessation programs.

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CONFLICTS OF INTEREST

The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none was reported.

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ETHICAL APPROVAL AND INFORMED CONSENT

Ethical approval was validated by the "Faculty of Medicine of Sousse, Medical Ethics Committee". The legal guardians of the adolescent participants were notified through the college administrations. Data analysis was conducted respecting the anonymity and confidentiality of the participants (Date: March 2020).

DATA AVAILABILITY

The data supporting this research are available from the authors on

reasonable request.

AUTHORS' CONTRIBUTIONS

All authors contributed to the manuscript and were involved in study planning, data acquisition, analysis, and interpretation. SB and RB participated in the research concept and design of the work, data analysis and interpretation, and writing the manuscript. ABC contributed at the collection and assembly of data and the critical revision of the article. HG contributed to the writing and the critical revision of the manuscript. SK supervised the collection and/or assembly of data and contributed to the critical revision of the manuscript. BR and HSL supervised the critical revision and the final approval of the manuscript.

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