

# Smoking habits and cardiovascular risk factors among adolescents in Sousse, Tunisia

by

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## **Abstract**

*We undertook an epidemiological survey on a representative sample of 1569 pupils aged between 13 and 19 years from schools of Sousse in Tunisia to study the smoking habits of school children and their links to cardiovascular disease risk factors.*

*The study objectives consisted of: first, to describe Tunisian adolescent smoking behaviour and second, to assess the influence of home environment, friends and the different socio-demographic factors in acquiring and maintaining the habit. We have also examined the clustering of cardiovascular disease risk factors among smoking school children. Students were surveyed in schools using a self-administered, anonymous questionnaire. The smoking prevalence was 7.6% of our sample and boys are significantly more touched than girls: 14.7% versus 1.1%;  $X^2 = 103.4$ ,  $p = 0.00001$ . The smoking prevalence increased with age. For boys, it raised from 3.4% at 13 years to 32.3% at 19 years;*

$X^2 = 40.9$   $p = 0.0001$ . 60.6% of school children are exposed to passive smoking at home. The smokers had higher prevalences of hypertension and obesity but with no significant difference, however they had significantly lower High Density Lipoprotein cholesterol values (HDL) ( $1.35 \pm 0.27$  vs  $1.50 \pm 0.30$  mmol/l)  $p < 0.05$ . Non-smokers had higher prevalences of Low Density Lipoprotein (LDL) and triglycerides with no significant difference. Peer smoking behaviour has a clear effect on the smoking habits of boys. These findings suggest that schools and health authorities should design specific programmes to limit the extension of tabagism among youngsters.

## Keywords

Smoking, cardiovascular risk factors, adolescent, prevention, Tunisia.

## Introduction

Smoking is considered as a major cardiovascular risk factor and is one of the main avoidable causes of death in the world (1). It is also considered as an important factor in the stimulation of the development of atherosclerosis and cardiovascular diseases (2). The studies of the pathobiological determinants of atherosclerosis in youths have shown a positive correlation between the extent of atherosclerotic lesions in the coronary arteries and rates of cholesterol, of high density lipoprotein and thiocyanate (marker of the exposure to the smoke of cigarettes) (3). Currently, Tunisia is facing the epidemiological transition with the extension of chronic diseases notably cardiovascular diseases, and smoking habits among male adults (4).

In this context, it is important to assess and monitor the evolution of smoking habits in the general population, as well as in certain particular groups such as school children and youngsters. In fact, teenagers' smoking behaviour constitutes the essential element that permits to predict the evolution of smoking in the future and therefore, the risks that are attributed (5).

The objectives of this survey were:

- to describe the smoking profile of teenagers aged between 13 and 19 years schooled in the urban area of Sousse, Tunisia,
- to explore the association between smoking and other cardiovascular disease risk factors (hypertension and dislipidemia),
- to study the main determinants of smoking habits in this age group.

## Population and methods

### *Study design and sampling method*

The studied population was composed of children aged 13 to 19 years, pupils of public secondary schools of the urban region of Sousse. A transversal type survey was carried out on a representative sample of children selected by a multistage cluster sampling procedure. The sample size calculation was based on the estimation of an unknown prevalence ( $p = 50\%$ ) of smoking with a precision of  $\pm 2.5\%$  and a confidence level of 95%. It was estimated to be 1600 children.

### *Data collection*

**General information.** All participants completed a questionnaire on their disease history and lifestyle characteristics, including a section on cigarette smoking specifying the age of beginning, the age of regular use, the age at which one stopped smoking as well as the influence of parents, and of friends on the acquirement and the maintaining of smoking habits. A smoker is called a “regular” smoker if he/she smokes at least one cigarette every day at the time of the investigation. If the consumption was not daily, the smoker is classified as an “irregular” smoker.

**Anthropometrics measurement.** Research technicians recorded body weight to the nearest 0.1 kg using a standard beam balance scale for barefoot subjects wearing light indoor clothing. Body height was recorded to the nearest 0.5 cm. Body Mass Index (BMI) was defined as the ratio of body weight to body height squared, expressed as  $\text{kg}/\text{m}^2$ .

**Arterial Pressure.** Taking into account the risk of bias due to observation, we opted for the electronic system to measure blood pressure. After 10 minutes of rest, we measured blood pressure (BP) on the right arm in a sitting position, using an appropriate cuff size. We measured blood pressure again after a 15 minute delay and the average of the two measures was used for the analysis.

**Blood lipids analysis.** Participant children had to fast during 12 hours before the blood taking. A breakfast was served thereafter. The blood samples were taken by a trained nurse having an experience with a pediatric population. 5 mls of blood were collected in a tube containing EDTA 1mg/ml and rapidly centrifuged. Plasma levels of HDL-cholesterol were measured after precipitation of apolipoprotein B (apoB) containing lipoproteins using the phosphotungstate-magnesium chloride

method (Roche) and concentrations of LDL-cholesterol were calculated using the Friedewald's formula. Lipid and lipoprotein values were expressed in mmol/l. The analyses were performed in the clinical chemistry laboratory, Medical Policlinic, University of Lausanne, Switzerland. Hypercholesterolemia was defined for total cholesterol  $>5.2$  mmol/l, high level of LDL  $>3.4$  mmol/l and low level of HDL  $<0.9$  mmol/l (6).

#### *Definition of overweight and obesity for children*

With no universal definition of obesity for school children and limitations on the availability of anthropometric information from previous surveys in Tunisia, we defined overweight and obesity based on BMI (Body Mass Index). We used the age- and sex-specific cut-offs corresponding to overweight (BMI  $\geq 25$ ) and to obesity (BMI  $\geq 30$ ) (7).

#### *Statistical analysis*

Statistical tests such as: Chi-square, t test of Student and ANOVA have been used. A two tailed P-value  $<0.05$  was considered statistically significant. All statistical analyses were conducted using the statistical software package SPSS 9.0.

#### *Ethical considerations*

Because of the young age of the target population, this investigation was undertaken with prudence and respect to the rights and the integrity of people. We asked for authorizations from the Ministry of National Education, the teachers, the school boards and the parents of selected children. Parents were free to refuse their children's participation and this was extremely rare (only 5 cases have totally refused to participate).

## **Results**

We clinically examined all of the 1569 sampled children (748 boys and 821 girls), but we obtained biological measurements for 1497 persons only, good for a global participation rate of 95.4%.

The distribution of school children according to age and gender is presented in table 1.

TABLE 1  
Distribution according to age and gender of 1569 school children in Sousse (Tunisia)

Age (years)	Boys		Girls		Total	
	Number	%	Number	%	Number	%
13	204	27.3	233	28.4	437	27.9
14	103	13.8	77	9.4	180	11.5
15	91	12.2	118	14.4	209	13.3
16	197	26.3	228	27.8	425	27.1
17	92	12.3	109	13.2	201	12.8
18	30	4	41	5	71	4.5
19	31	4.1	15	1.8	46	2.9
Total	748	100	821	100	1569	100

### Smoking Prevalence

The global prevalence of smoking cigarettes was 7.6% with 4% of regular smokers and 3.6% of irregular smokers. The regular smokers consumed an average of 6.5 cigarettes per day. The smoking prevalence was significantly higher among boys than girls (14.7% vs 1.1%)  $X^2 = 103.43$ ;  $p < 10^{-3}$ . The group aged between 16 and 17 years was the most touched (table 2). The regular smokers prevalence increased

TABLE 2  
Smoking habits according to age and gender of 1569 school children in Sousse (Tunisia)

Smoking Habits	Age (years)		
	13-15	16-17	18-19
	<b>Boys</b>		
<i>Regular smokers</i>			
Number	398	289	61
% of smokers	4.8	11.4	13.1
Mean consumption	4.37	7.03	10.63
<i>Irregular smokers</i>			
Number	398	289	61
% of smokers	3.8	10.4	8.1
	<b>Girls</b>		
<i>Regular smokers</i>			
Number	428	337	56
% of smokers	0.2	0.3	0
Mean consumption	1	1	0
<i>Irregular smokers</i>			
Number	428	337	56
% of smokers	0	2	0

significantly with age among boys. It raised from 4.8% for the group aged between 13 and 15 years to 13.1% for the group aged between 18 and 19 years ( $X^2 = 12,355$ ;  $p = 0.002$ ). The mean consumption of cigarettes per day raised respectively from  $4.4 \pm 4.5$  in the group aged between 13 and 15 years to  $10.6 \pm 6.9$  in the group aged between 18 and 19 years (ANOVA:  $F = 3.2$ ;  $p = 0.04$ ). 62.5% of pupils declared smoking their first cigarette by curiosity and 17.5% did it at parties and on excursions. The mean age at which the first cigarette was smoked, was  $14.02 \pm 1.72$  years among male regular smokers.

#### *Association between smoking and other cardiovascular risk factors*

The mean  $\pm$ SD body weight (kg) was significantly higher  $64.6 \pm 11.9$  and  $57.5 \pm 12.7$  for smokers and non smokers, respectively,  $t = 5.9$   $p < 0.0001$ .

Smokers had significantly lower High Density Lipoprotein Cholesterol (mmol/l):  $1.3 \pm 0.3$  vs  $1.5 \pm 0.3$  ( $t = 5.7$ ,  $p < 0.0001$ ) and Apo protein A levels (g/l):  $1.26 \pm 0.16$  vs  $1.35 \pm 0.46$  ( $t = 2.03$ ,  $p = 0.04$ ) than non smokers.

The prevalence of alcohol consumption was significantly higher among smokers than non-smokers (58.8% versus 10.7%)  $X^2 = 125.7$ ;  $p < 0.0001$ .

Smokers had higher prevalences of hypertension and obesity. Furthermore, non smokers had higher prevalences of elevated LDL and triglycerides with no significant differences (table 3).

TABLE 3  
*Smoking habits and cardiovascular risk factors among 1569 School children in Sousse (Tunisia)*

Cardiovascular risk factors	Prevalences (%)	
	smokers	non smokers
HTA*	11.8	9.4
Obesity*	3.4	3.2
Hypercholesterolemia*	3.4	8.6
Hyper LDL*	3.4	4.0
Hypo HDL*	2.6	1.1
Hypertriglyceridemia*	0	1.4

\* No significant difference.

### *Family environment and smoking habits of school children*

The prevalence of smoking was 7% with no smokers in the family versus 7.9% with at least one smoker with no statistical difference. It was higher when the mother was smoker (9.1% versus 7.52%). It was also higher when the father or one of the brothers were smokers. However all these differences were not statistically significant.

The global smoking prevalence was significantly higher when the mother was working and absent from home during the day (20% versus 7.4%);  $X^2 = 4493$ ;  $p = 0.034$ .

When taking into account the gender, the association between smoking behaviour of boys and the mother's smoking habits became statistically significant (30% versus 14.2%);  $X^2 = 3.87$  and  $p = 0.049$ . Smoking prevalence was statistically higher among boys, if one of the brothers is a smoker (22.4% versus 13.2%);  $X^2 = 6.6$ ;  $p = 0.01$ .

## **Discussion**

With a global participation rate of 95.4%, the participation to this epidemiological study can be considered as very high. Indeed, a large sensitisation of parents, pupils and teachers has permitted to reach this high level of participation.

The study showed that the Tunisian school teenagers had a lower regular smoking prevalence (7.6%) compared to a similar Belgian population (22.1%) (8) where the same methodology has been used. Tunisian girls were protected from smoking (1.1%) contrary to other western populations (9).

As did other studies carried out on teenagers, our survey clearly showed an association between smoking habits and age. Indeed, regular smoker prevalences increased with age. This phenomenon was observed with boys (10-14) who consumed their first cigarette earlier than girls (15, 16).

The majority of smokers were encouraged by their friends, particularly during ceremonies, for the adoption of smoking behaviour, as has been noted in several other studies (17, 18).

The influence of the parents' smoking was demonstrated in most studies, usually with a relation dose-response. In fact, it was an important risk factor for the adoption of smoking habits in the adolescence (19, 20).

Some authors found that the maternal rather than paternal smoking was a stronger determinant for the smoking habits of children (19), whereas others insisted on the more powerful effect of the parent of the same sex, for the child to become smoker, especially for girls (20). In this survey, we did not find a statistical significant association between the smoking of teenagers and the smoking of parents of the same sex. On the other hand, we noted that the smoking prevalence among boys increased meaningfully in case of mother's smoking.

Pupils' smoking habits were also associated with the absence of the mother from home during the day, being at work. This observation has been reported by other studies (19). It could be explained by a less maternal control at home.

Several studies showed that the smoker has lower weight than the non-smoker and is relatively less concerned by obesity. This has been explained by the increase of the basis metabolism and the energetic cost of all physical activity related to smoking (21). In our survey the prevalence of obesity was slightly higher among smokers than non-smokers without significant difference which could be explained by the relative small duration of smoking, so that its long term effects on weight were not yet observed. Prevalences of hypercholesterolemia, elevated Low Density Lipoprotein (hyper LDL) and hypertriglyceridemia were higher among non-smokers than smokers without statistical significant difference contrary to what has been demonstrated in other studies (22-24). This could also be due in part to the low delay of exposure to smoking in our study which can not in such a short period rationally explain the influence on the lipid profile. The prevalence of the arterial hypertension (HTA) was slightly higher among smokers than among non-smokers, contrary to what was observed in other studies (25, 26). The argument of the low delay of exposure to smoking could also be invoked in this case.

Most studies noted the young age of the beginning of smoking, and in this perspective, the prevention must take place early among the young children who do not have the oppositional/rebellious character of teenagers (27).

The best way to fight (against) the smoking habits of youngsters is to warn against this behaviour before its adoption in the context of primordial prevention. Hence the necessity to undertake actions of health education from primary school onwards in health clubs that provide a platform of exchange valorising non-smoking behaviour.



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