“Light” smoking and dependence symptoms in high-school students

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Summary In high-school students, prevalence of smoking is high but few studies analyzed smoking in the student population according to nicotine content of smoked cigarettes and gender. We analyzed the responses to a questionnaire, including the modified Fagerström Tolerance Questionnaire (FTQ), administered to 555 students (382 males, 173 females) of a professional high school in Palermo, Italy, to assess the prevalence in both genders of: (1) smoking “light” and high nicotine (HN) cigarettes; (2) signs of nicotine dependence and (3) respiratory symptoms. Nicotine content of habitually smoked cigarettes was considered as “light” if $<0.8\ mg$; as high if $>0.8\ mg$. Forty-four percent of students smoked, without differences between genders. Two-thirds of the total sample reported “light” cigarette smoking (76.7% of females vs. 62.0% of males, $P<0.05$). On average, “light” cigarette smoking was associated with lower pack/year and FTQ global score compared to HN smoking. However, when FTQ global score was analyzed by taking into account pack/year, no major difference was found between “light” and HN cigarette smokers. Cough with phlegm and breathlessness were more frequently reported by smoking than non-smoking students, without differences between genders. About 50% of smoking students reported having tried to quit, while only 3.4% of students were ex-smokers. “Light” smoking was common in high school students, especially among females. Dependence appeared more influenced by the smoking history than by nicotine content. Respiratory symptoms were similar in “light” and HN cigarette smokers.

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Introduction

Preventive actions against smoking are focused on the young population, because the development of physical and psychological dependence occurs early in the natural history of the smoking habit. Analysis of the effects of smoking in young subjects have addressed the issue of dependence in relation to the number of cigarettes smoked, smoking habits of friends and household members, or other social and psychological factors.

The tobacco industry has diversified its production by adding “light” cigarette brands to classic high-nicotine (HN) content brands. Several reports questioned the opportunity to use “light” as a descriptor for cigarettes, in that it suggests a reduced danger for health. Use of the “light” term has been banned in Europe because these cigarettes do not cause less damage to health. Smokers of “light” cigarettes did not inhale less nicotine and showed a CO concentration in expired air similar to that found in smokers of common cigarettes. Little is known on the prevalence of smoking low-nicotine content (“light”) cigarettes at young ages, and on the level of dependence associated with “light” compared to HN cigarettes in adolescents.

This study was designed to answer the following questions: (1) Is smoking “light” cigarettes common among high-school students or influenced by gender? (2) In this population, is “light” cigarette smoking associated with less dependence or respiratory symptoms as compared to high-nicotine cigarette smoking? To answer these questions, we analyzed the response to a questionnaire based on the modified Fagerström Tolerance Questionnaire (FTQ), administered to students attending the last three classes of a 5-year professional high school in Palermo, Italy.

Subjects and methods

The study was conducted in the “Istituto Professionale Alberghiero” in Palermo. Students mostly came from low to medium income families. The questionnaire was anonymous, did not include any specification of the class attended by the student, and was administered to all students of the 3rd, 4th and 5th (final) classes (n = 577). It included: general questions (age, gender); questions on smoking status (current smokers; ex-smokers reported having quit for 6 months or longer; non-smokers reported lifetime no smoking), number of cigarettes/day; smoke inhalation, age of initiation of smoking, and amount of nicotine in usually smoked cigarettes (to be read on the package during the session). The instrument used to assess dependence was the modified FTQ, which has been validated in adolescents. It includes seven items (How many cigarettes/day do you smoke? Do you inhale? Do you smoke more during the first 2h of the day than during the rest of the day? How soon after you wake up do you smoke your first cigarette? Which cigarette would you hate to give up? Do you find it difficult to refrain from smoking in places where it is forbidden? Do you smoke if you are so ill that you are in bed most of the day?). The global score of FTQ was calculated according to Heatherton and co-workers, and interpreted as follows: a score 0–2 indicated a very low dependence level, whereas scores of 3–4, 5, 6–7 and ≥8 indicated low, medium, high and very high dependence level, respectively.

The questionnaire also included: one question on smoking habits of household members; two questions on trials to quit smoking (did you ever tried to quit, did you quit because of health problems); five questions on respiratory symptoms (previous diagnosis of asthma, bronchitis or allergy; episodes of breathlessness or cough with phlegm in the previous year). It also included a question on the subjectively perceived level of information on smoking-related health problems, as well as the possible interest in participating to structured programs of smoking cessation.

Based on the number of cigarettes and years of smoking, we calculated pack/year. Nicotine content was analyzed as a dichotomous variable: cigarettes with a nicotine content ≤0.8 mg were coded as “light”, those with nicotine >0.8 mg were considered as high nicotine (HN) content. The pack/year variable was then analyzed for individual answer to each FTQ items in the group of “light” and HN smoking students (see Fig. 2).

Statistical analysis

Data were expressed as mean ± standard deviation for continuous variables and percent of total sample for dichotomous variables, and analyzed by statistical packages (Epi-Info 2000, WHO, Geneva, Switzerland; Stata, Stata Corporation, College Station, USA). Differences between low and high nicotine content groups were assessed by $\chi^2$ test for dichotomous variables, and by unpaired-t- or Mann–Whitney test for continuous variables. Regressions of total Fagerström score vs. number of cigarettes smoked/day in “light” and HN cigarette smokers were compared by analysis of
covariance. In all tests, the value of $P<0.05$ was chosen as indicating statistical significance.

**Results**

Five hundred fifty-five questionnaires were analyzed. Twenty-two questionnaires (4.0%) resulted incomplete, and were discarded. The sample included 382 males and 173 females.

Table 1 summarizes the demographic and smoking data. Prevalence of current smoking was 44.1%, without differences between male and female students. There was no difference between genders in the mean number of cigarettes/day, the age at which subjects started smoking (frequency distribution in Fig. 1a), or the percentage of subjects reporting to always inhale smoke. Smoking of household members was frequently reported (67.6%), without significant difference between smoking (68.4%) and non-smoking students (66.9%).

The nicotine content of habitually smoked cigarettes was analyzed in 236 students (96% of the sample) answering to this question. Two thirds of students reported smoking “light” cigarettes. HN cigarette smoking was more common among males (62/163, 38%) than females (17/73, 23.3%, $P<0.05$). Again, there was no difference in prevalence of smoking of household members according to the nicotine content referred by the students (67.5% of smoking household members reported by “light” smokers vs. 70.9% reported by HN smokers).

Differences between “light” and HN cigarette smokers were analyzed according to smoking history and gender. The number of cigarettes/day was significantly lower in “light” ($12.8 \pm 6.6$) than in HN cigarette smokers ($16.3 \pm 11.8$, $P<0.05$). Smoking history was significantly longer in HN (5.0 $\pm 2.8$ years) than in “light” cigarette smokers ($3.9 \pm 2.2$ years, $P<0.05$) in males, but not in females ($3.4 \pm 1.5$ and $3.2 \pm 1.8$ years, respectively). In females, however, the number of cigarettes/day was higher in HN cigarette smokers ($15.4 \pm 6.5$) compared to “light” smokers.

**Figure 1 (A) Frequency distribution of age of smoking initiation in the entire sample of students.** About half of the sample started smoking before 15 years of age. (B) Mean pack/year value in “light” (empty bars) and high nicotine (black bars) cigarette smoking students. *indicates significant difference between the two groups.

| Table 1 Demographic and smoking characteristics in the sample. |
|---------------------------------|-----------------|-----------------|-----------------|
|                                | All students    | Male students   | Female students |
|                                | $n = 555$       | $n = 382$       | $n = 173$       |
| Age (years)                    | 17.3 $\pm$ 1.8  | 17.5 $\pm$ 1.8  | 17.0 $\pm$ 1.7  |
| Current smokers (% of total sample) | 245 (44.1%)    | 168 (44.0%)     | 77 (44.5%)       |
| Ex-smokers (% of total sample) | 19 (3.4%)       | 11 (2.9%)       | 8 (4.6%)         |
| Age at which subjects started smoking (years) | 14.0 $\pm$ 2.1 | 13.9 $\pm$ 2.4 | 14.4 $\pm$ 1.5* |
| Cigarettes/day (n)             | 14.0 $\pm$ 8.9  | 14.6 $\pm$ 9.4  | 12.1 $\pm$ 6.4  |
| Smoking duration (years)       | 4.0 $\pm$ 2.3   | 4.4 $\pm$ 2.5   | 3.2 $\pm$ 1.6   |
| Pack/year                      | 3.12 $\pm$ 3.2  | 3.6 $\pm$ 3.6   | 2.0 $\pm$ 1.5   |
| Smoke inhalation always (% of current smokers) | 217 (88.2%)   | 147 (88.0%)     | 70 (88.6%)       |

Data reported as mean $\pm$ SD.

*Indicate $P = 0.05$ vs. male students.
The pack/year value was significantly higher in HN than in “light” cigarette smokers, such difference being entirely due to the male gender (Fig. 1, panel B). Mean age at the time of the study or at smoking initiation did not differ between “light” and HN cigarette smokers in either gender.

Fig. 2 reports the analysis of single items of the modified FTQ according to pack/year of “light” and HN cigarette smokers. Smoking within 30 min after awakening (panel C) was associated with a higher pack/year in both “light” and HN cigarette smokers; in both groups a lower pack/year was associated with smoking the first cigarette at later times during the day (P<0.01 in both groups). Overall, no significant difference was found between responses provided by “light” and HN cigarette smokers.

The total FTQ score in the entire sample was 4.9±1.9 points, but resulted significantly lower in “light” (4.3±1.6) compared to HN cigarette smokers (6.1±2.0, P<0.0001). About 50% of “light” smokers reported low (≤4) total FTQ scores as opposed to 19% of HN smokers (Fig. 3, panel A). However, similar total FTQ scores were found in “light” and HN smokers for similar pack/year values reported (Fig. 3, panel B). Moreover, the regression equations of FTQ score vs. number of cigarette/day did not differ for either slope or intercept between “light” and HN smokers (Fig. 3, panel C). Therefore, the apparently lower total FTQ score in “light” cigarette smokers was entirely due to less intense smoking habit (i.e. pack/year), rather than the nicotine content of cigarettes smoked.

As for respiratory symptoms, episodes of breathlessness and cough with phlegm in the previous year

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Figure 2 Pack/year values in “light” (left bars) and high nicotine (right bars) cigarette smoking students according to responses to single items of modified FTQ (see text for details). *indicate significant difference between responses. (A) Do you inhale?; (B) Do you smoke more during the first 2h of the day?; (C) First cigarette after awakening; (D) Which cigarette would you hate to give up?; (E) Difficulty in refraining from smoking forbidden; (F) Smoking if sick.
were more frequently (two- to three-fold) reported by smoking than non-smoking students (Table 2 first two columns on the left); however, no difference was evident between light and HN cigarette smokers (Table 2, columns on the right). Prevalence of previous diagnosis of bronchitis, asthma and allergy was similar in smokers and non-smokers (Table 2). The pack/year, but not the “light” or HN cigarette type, was positively associated with breathlessness ($P<0.01$), but not with cough with phlegm.

Among smoking students, 48.5% of subjects reported to have tried quitting. Pack/year and nicotine content were similar in subjects who had or had not tried quitting (data not shown). Most students (85.7%) considered good their knowledge on the dangers of smoking, and 68.5% of them were interested in preventive programs based on information and/or treatment to quit smoking.

Discussion

This cross-sectional study investigated the smoking habits of students attending a professional high-school in Southern Italy. In particular, the prevalence of smoking “light” vs. HN cigarettes and the associated signs of dependence and respiratory symptoms were evaluated. Adult “light” smokers are known to show misperception about the risk related to smoking, as they consider “light” cigarettes safer or less addictive compared to usual HN cigarettes. A similar misperception has been recently reported in a sample of 14-year-old students. Moreover, smoking low-yield brands may reduce the intention to quit smoking or increase initiation among non-smokers, the latter point being especially relevant in young people.

Overall prevalence of smoking in our sample compared well with the 42% figure obtained in Palermo schools in low- to medium-income students aged 13.7 years. The latest statistics on smoking in Italy (April 2004) reported prevalence of 32.9% and 26.7%, respectively, for men and women aged 15–24 years. The mean age of smoking initiation in our sample (13.9 years in males and 14.4 years in females) was lower than the respective values of 16.8 and 18.2 years of the National statistics, suggesting a high pressure to initiate smoking at young age, at least in some social groups. Data from the US also support this interpretation.

The high prevalence of smoking in our students may reflect the known effect of socio-economic factors, such parental smoking. In our sample, smoking of household members was similarly high in the families of both smoker and non-smoker adolescents, in line with previous results by other investigators.

About two thirds of our students reported to be “light” cigarette smokers. The issue of “light” smoking in adolescents has mostly been addresses
in terms of number of cigarettes per day, rather than use of low-yield brands. Adult “light” cigarette smokers do not appear less addicted compared to HN cigarette smokers due to the “compensation” phenomenon. Indeed, smokers of low-nicotine cigarettes frequently increase the number of cigarettes/day and/or the puffs for every cigarette. Whether similar compensation mechanisms are operational at young age is still unknown.

As an instrument to assess nicotine dependence, we used the modified version of the FTQ questionnaire, which is largely employed and validated in adolescents. In adolescents who were “light” cigarette smokers, increasing pack/year values were positively associated with powerful indicators of dependence such as smoking the first cigarette shortly after awakening, difficulty of refraining from smoking, or smoking when sick. The total FTQ score indicated a low to intermediate level of dependence in the total sample of smoking students (Fig. 3), but the level of dependence was similar between “light” and HN smokers for similar pack/year values. Furthermore, the intercept and slope of the relationship between number of cigarettes/day and FTQ score were similar in “light” and HN smokers. Because our study was cross-sectional, it does not help clarify whether “light” cigarettes are causing less dependence.

Alternatively, there may be some control on smoking intake by those adolescents who smoke “light” cigarettes to reduce harm. In addition, any effect secondary to the nicotine content of cigarettes might require a longer smoking history to become evident in young subjects. However, the latter hypothesis is not supported by the results of Ling and coworkers, who found that adult smokers of ultra-low tar cigarettes were unexpectedly unlikely to quit. Dependence in our “light” smokers was also suggested by frequent ineffective trials to quit, similar to previously published data. Longitudinal studies on large numbers of adolescents are necessary to conclusively study a possible effect of “light” smoking on the development of dependence.

Our data are not representative of the entire student population, since students came from only one school and low to medium-income families. The study of smoking and other health-related behaviours among high school students is well suited for multilevel analyses, because students can be seen as individuals (first level), members of the social context defined by the specific class to which they belong (second level) and members of the social context of the specific school (third level). One limitation of our study is that we did not analyze the data according to class distribution of the students, which could have provided information on second-level clustering of smoking habits.

Over 70% of smoking female students reported “light” cigarette smoking, similar to adult data. It is likely that the factors influencing the choice of “light” or HN smoking are complex and acting at multiple levels. Tobacco smoking and the inclination to quit not only depend on nicotine dependence but also social and psychosocial factors as well as habits. The different distribution of “light” and HN smoking according to gender could reflect such influences which were not addressed in our study.

The prevalence of smoking was based on self-reported data, but young subjects are known to under-estimate their attitude to smoke. Objective measurements of nicotine exposure (i.e., cotinine levels in blood or CO measurements in exhaled breath) could not be obtained in our study. On the other hand, both these measurements are known to correlate with answers to the modified FTQ.

We also investigated the impact of “light” vs. HN cigarette smoking on respiratory symptoms, as no study took into account both smoking status and nicotine content of cigarettes in adolescents.

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<thead>
<tr>
<th>Table 2</th>
<th>Respiratory symptoms in students.</th>
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<tbody>
<tr>
<td></td>
<td>Non-smoking students (%)</td>
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<tr>
<td>Previous diagnosis of bronchitis</td>
<td>44/275 (16.0)</td>
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<tr>
<td>Previous diagnosis of asthma</td>
<td>22/276 (8.0)</td>
</tr>
<tr>
<td>Previous diagnosis of allergy</td>
<td>80/280 (28.6)</td>
</tr>
<tr>
<td>Episodes of breathlessness</td>
<td>23/280 (8.2)</td>
</tr>
<tr>
<td>Cough with phlegm</td>
<td>56/275 (20.4)</td>
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Data reported as absolute number of positive out of total responses, (percentage in parentheses). Asterisks indicate significant difference between smoker and non-smoker students. No significant difference was found when comparing “light” and HN cigarette smokers.
Regular smoking in adolescents was associated with increased risk for current and late onset cough, and persistent and late onset wheeze. Among Hong Kong students, prevalence of throat and nose problems, cough with phlegm and wheezing was higher in smokers than in non-smokers. While our data are in line with these observations, smoking “light” cigarettes did not confer any advantage, as no difference was found between “light” and HN cigarette smokers. Breathlessness was positively associated with pack/year, confirming that smoking at young age might be already associated with a physical disability and reduced quality of life. Promotion of physical activity has been used during interventions to quit smoking in adults, with poor results. However, because smoking affects athletic performance, exercise may be an important issue to reinforce the motivation to quit in adolescents. Pronk et al. recently indicated the need to improve exercise and diet in US adolescents.

In summary, most high school smoking students, and females in particular, prefer “light” cigarettes. However, nicotine dependence and prevalence of respiratory symptoms showed no difference between “light” and HN cigarette smokers. Greater efforts should be made to correctly inform adolescents about the misperception of risk and the development of dependence associated with “light” smoking, and its negative impact on respiratory health.

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References


