Original Research

Prevalence and co-occurrence of unhealthy lifestyle habits and behaviours among secondary school students in Tuscany, central Italy

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ABSTRACT

Objectives: Unhealthy habits acquired during adolescence may persist in adulthood and eventually increase the risk of chronic illnesses.

Study design: We reported on a survey conducted in 2013–2015 among secondary school students in Tuscany, central Italy.

Methods: We compared the prevalence of self-reported lifestyle characteristics and overweight/obesity between genders and age groups (14–16 vs 17–21 years). We partitioned each gender- and age-specific stratum into groups based on cigarette smoking and engagement in sport activities, and compared the prevalence of other unhealthy lifestyles across groups using Poisson regression.

Results: Overall, 2167 students (53.3% males, mean age 16.8 years) were included. Males were more frequently overweight/obese than females. Cigarette smoking increased with age and did not differ by gender. Males were more likely to engage in sport activities, drink alcoholic beverages and adopt other unhealthy lifestyle habits, whereas females reported a more frequent use of painkillers. Cigarette smoking was the single lifestyle characteristic most consistently associated with other unhealthy habits.

Conclusions: The prevalence and patterns of co-occurrence of unhealthy lifestyle habits varied by gender and age group among secondary school students in Italy. Our findings should be taken into account when planning public health initiatives aiming to combat obesity and tackle unhealthy lifestyles among secondary school students in Italy.

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Introduction

A considerable share of the total burden of disease (both morbidity and mortality) in industrialised countries is attributable to chronic illnesses such as cancer, heart and cerebrovascular diseases, diabetes and respiratory diseases.[1] These pathologies have a complex aetiology but have several recognised main risk factors that are potentially modifiable lifestyle characteristics. These include cigarette smoking, sedentary lifestyles, unhealthy diets and alcohol consumption. These can be acquired during adolescence on the basis of family values acquired during childhood,[2] persist in the transition to adulthood[3−5] and contribute to the development of chronic illnesses in later life.

The recognition of adolescence as a critical period for the acquisition of health-relevant attitudes and behaviours claims for the implementation of health promotion interventions focussing on teenagers, and aimed at routing them towards healthier lifestyles. Critically, effective health promotion interventions require detailed prior knowledge of the health status of the target population, and in particular, of the prevalence of the risk factor(s) towards which the intervention is addressed. With regard to this, it is important to recognise that unhealthy behaviours do not usually distribute independently among the adolescents; rather, they tend to occur together in definite population subgroups.[6] In particular, previous research has shown that cigarette smoking and sedentary behaviours are often associated with a wide range of other unhealthy lifestyle characteristics among adolescents.[7,8] Moreover, the acquisition and maintenance of healthy/unhealthy lifestyles during adolescence is largely influenced by the complex interaction of factors such as social norms; parental, media and peer pressure and the type of school attended, and their prevalence varies therefore with age and may largely differ by gender.[9,10] These distinctive patterns in the distribution of harmful behaviours among adolescents need to be taken into account when planning health promotion interventions in this population.

Here, we aimed to assess the prevalence of several potentially harmful lifestyle characteristics (including cigarette smoking, lack of physical activity, alcohol drinking and others) and of overweight/obesity, and to quantify their tendency to co-occur in the same population subgroups, taking advantage of a large sample of male and female high-school students from the metropolitan area of Pistoia (Tuscany, central Italy).

Methods

Study participants and data collection

We contacted the school principals of all the 18 upper secondary schools in the Province of Pistoia (Tuscany, central Italy) and illustrated the objectives of the study, its design and procedures. The permission to conduct the study was granted in eleven schools: six were high schools (providing theoretical education and focussing on humanities, science or art) and five were technical-vocational schools. The data collection process was completed between November 2013 and May 2015.

All students of each participating school were invited to complete an anonymous questionnaire that included questions on weight and height; smoking habits; practice of organised sports outside schools; consumption of alcohol beverages (wine, beer and hard liquor) with meals or when going out with friends; habitual use of painkillers; consumption of unhealthy, pre-packaged sweet or salty snacks (referred to as "snacks" henceforth for brevity); time spent watching TV, using the computer or playing video games; and the weekly frequency of meals consumed in pizzerias or fast food restaurants (i.e. the two most common types of away-from-home eating in this age group in Italy). Participating students were also invited to report their weight and height; individual body mass index (calculated as the ratio of weight to squared height) was then transformed into age- and gender-specific percentiles using growth charts for central−north Italian population.[11] Study participants were labelled as underweight if below the fifth percentile of the distribution; normal weight if between the fifth and the 84th percentile; overweight if between the 85th and the 95th percentile and obese if above the 95th percentile. As the percentage of students being obese was low (<2% of the study population), the latter two categories were merged into a single category for analytical purposes.

Statistical analysis

The prevalence of overweight and unhealthy habits is likely to differ by gender and to change over time in the transition from adolescence to young adulthood. Therefore, all analyses were conducted separately in the four strata identified by gender (males vs females) and age group (14−16 vs 17−21 years at questionnaire completion), and we used Chi-squared tests to compare the distribution of lifestyle characteristics and body mass index across strata.

Cigarette smoking is the largest single lifestyle-related contributor to disease burden globally,[12] whereas physical activity (which is mostly done, in this age range, through participation in organised sports) is one of the most important health-promoting lifestyle habit because of its widespread effects on life expectancy and quality.[13] Here, we were interested in assessing how cigarette smoking and physical activity were associated with the prevalence of other health-relevant lifestyle habits among Italian adolescents. Therefore, we partitioned each gender-specific and age group−specific stratum into four groups defined on the basis of smoking habits (smoker vs non-smoker) and the practice of sport activities outside school (yes/no), and compared the prevalence of other unhealthy behaviours and characteristics across the groups using Poisson regression models with robust variance estimator (using physically active, non-smoking students as the reference category). These models yield risk ratios (RR) and corresponding 95% confidence intervals (CIs), and are recommended for the analysis of survey data when the outcomes of interest are not rare.[14,15]

All analyses were conducted using Stata, version 14 (StataCorp, College Station, TX). All statistical tests were two-

sided, and a P-value less than 0.05 was considered as statistically significant.

Results

Of 2587 students enrolled in the eleven upper secondary schools, 2234 (86.4%) completed the study questionnaire. Sixty-seven respondents failed to report their gender (n = 39), age (n = 19) or both (n = 9), and were excluded from subsequent analysis. Finally, the study sample included 2167 students, of which 1061 were from high schools (49.0%) and 1106 were from technical-vocational schools (51.0%) (Fig. 1).

Male students were more frequently overweight/obese than their female counterparts, both in the 14- to 16-year (15.0% vs 6.0%, P-value <0.001) and 17–21 years (10.3% vs 4.4%, P-value <0.001) age groups (Table 1). Male respondents were also more likely than females to engage in sport activities and less likely to use painkillers on a regular basis, regardless of age. No other lifestyle characteristic differed significantly by gender in the 14–16 years age group. Instead, males aged 17–21 years were more likely than females to drink alcoholic beverages (84.5% vs 78.0%, P-value 0.006), eat snacks (52.1% vs 44.7%, P-value 0.015), spend three or more hours/day using the computer or playing video games (27.0% vs 20.4%, P-value 0.011) and eat fast food weekly or more

frequently (11.0% vs 4.9%, P-value <0.001). There were no significant differences by gender in the prevalence of current smokers in either age group.

We reported in Table 2 the results of a more detailed analysis of consumption of alcoholic beverages by age group and gender. Alcohol drinking with meals was reported more frequently by males, in both age groups and for both wine and beer. With regard to social consumption of alcoholic beverages, intake of wine (limited to those aged 17–21 years) and beer was reported more frequently by males than females, whereas there were no gender differences in the proportion of students that declared drinking hard liquor when going out with friends. However, when restricting the analysis to students who used to drink hard liquor, males tended to consume greater quantities than females in both the age groups.

The group of non-smoking, physically active students (which was used as the reference group in the regression models) represented the largest group in each gender-specific and age group–specific stratum. In detail, it accounted for 67.5% and 52.6% of male and female students, respectively, aged 14–16 years, and of 52.1% and 39.0% of male and female students, respectively, aged 17–21 years. Conversely, the group of smokers, physically inactive students accounted for the smallest proportion of students in all strata, ranging between 1.8% among males aged 14–16 years and 13.1% among females aged 17–21 years. Students from technical-vocational
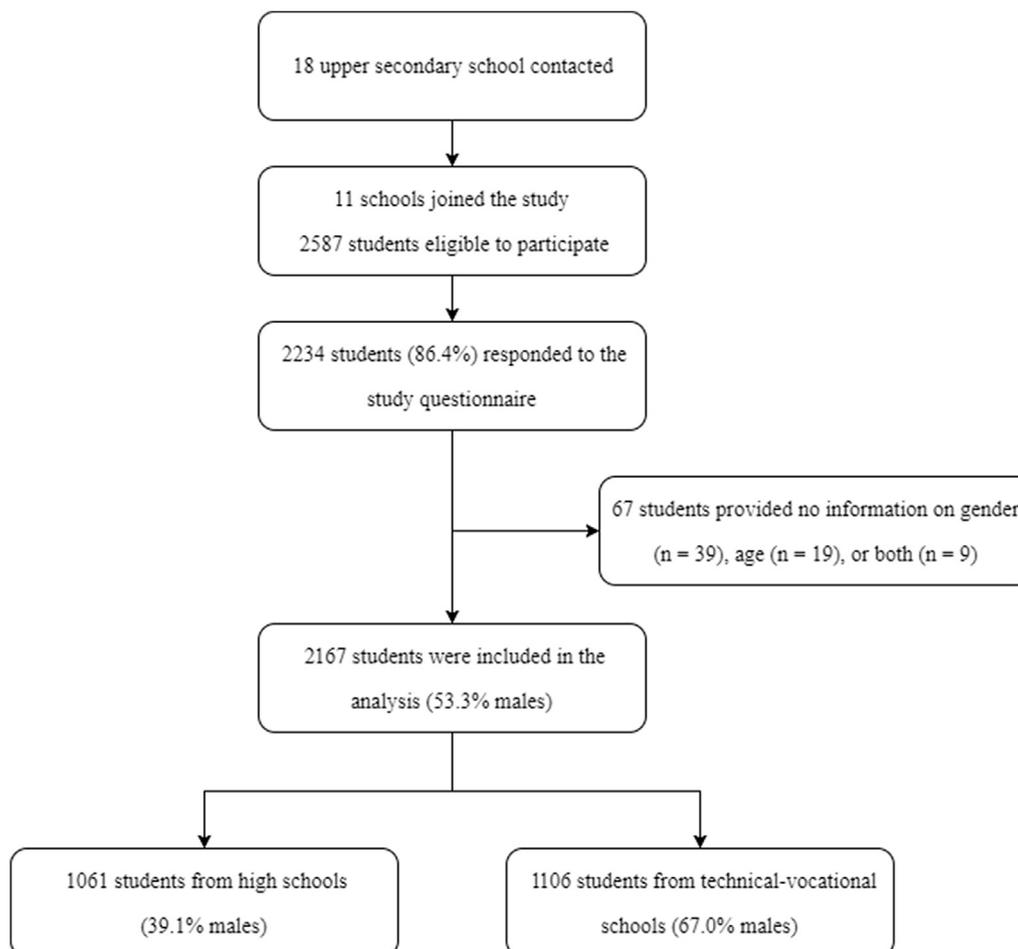

Fig. 1 — A flowchart illustrating the inclusion of participants into the study.

Table 1 – Main characteristics of study participants based on their age and gender. Numbers do not always sum up because of missing values.

Characteristic	Aged 14–16 years					Aged 17–21 years				
	Males (n = 628)		Females (n = 418)		P-value	Males (n = 528)		Females (n = 593)		P-value
	n	%	n	%		n	%	n	%	
Body mass index										
Underweight	18	3.0%	24	6.3%		30	6.0%	46	8.3%	
Normal weight	487	82.0%	335	87.7%		422	83.7%	481	87.3%	
Overweight/obese	89	15.0%	23	6.0%	<0.001	52	10.3%	24	4.4%	<0.001
Do you smoke?										
No	502	80.1%	322	77.4%		342	65.3%	386	65.5%	
Yes	125	19.9%	94	22.6%	0.302	182	34.7%	203	34.5%	0.925
Do you play any sports in your free time?										
No	88	14.1%	136	32.6%		96	18.4%	231	39.3%	
Yes	537	85.9%	281	67.4%	<0.001	426	81.6%	357	60.7%	<0.001
Do you drink alcoholic beverages (with meals or when you go out with friends)?										
No	229	38.9%	165	43.0%		78	15.5%	125	22.0%	
Yes	359	61.1%	219	57.0%	0.212	425	84.5%	442	78.0%	0.006
Do you use painkillers?										
No	234	37.6%	79	18.9%		219	42.0%	84	14.2%	
Yes	388	62.4%	338	81.1%	<0.001	303	58.0%	507	85.8%	<0.001
Do you eat snacks?										
No	294	48.9%	212	53.5%		240	47.9%	318	55.3%	
Yes	307	51.1%	184	46.5%	0.154	261	52.1%	257	44.7%	0.015
How much time do you spend watching TV?										
≤2 h/day	447	72.0%	308	74.4%		379	73.3%	453	77.7%	
≥3 h/day	174	28.0%	106	25.6%	0.391	138	26.7%	130	22.3%	0.090
How much time do you spend using the computer or playing video games?										
≤2 h/day	440	71.0%	289	70.0%		371	73.0%	460	79.6%	
≥3 h/day	180	29.0%	124	30.0%	0.732	137	27.0%	118	20.4%	0.011
How often do you eat pizza (at a restaurant)?										
Never or less than weekly	401	65.2%	271	67.1%		320	63.2%	362	62.2%	
Weekly or more	214	34.8%	133	32.9%	0.536	186	36.8%	220	37.8%	0.723
How often do you eat fast food?										
Never or less than weekly	482	92.2%	297	94.0%		405	89.0%	505	95.1%	
Weekly or more	41	7.8%	19	6.0%	0.320	50	11.0%	26	4.9%	<0.001

schools were more likely to be smokers (boys and girls) and physically inactive (only girls) than those attending high schools, regardless of age.

We reported in Table 3 the RR and 95% CI of selected lifestyle characteristics among male and female students aged 14–16 years based on smoking habits and practice of sport activities (reference group: non-smoking, physically active students of the same gender and age group).

Few differences were observed between the groups regarding lifestyle habits other than alcohol drinking. Among males, those who were physically inactive were more likely to spend ≥3 h/day on a computer, whereas smokers were more likely to use painkillers than non-smokers. In addition, male students who did not smoke and practised no sport were less likely to eat fast food weekly or more, while those who smoked and were physically active were also more likely to eat snacks and drink coffee. The differences between the groups were even more modest among females, with smokers who declared drinking more coffee, and those physically inactive who were more likely to spend ≥3 h/day on a computer (if non-smokers) or watching TV (if smokers).

Concerning alcohol drinking habits, male students aged 14–16 years who were non-smokers and physically inactive were less likely to consume alcohol when going out with friends, whereas non-smoking, physically inactive female students aged 14–16 years were more likely to drink alcoholic beverages with meals. Finally, smokers (male and female, whether physically active or not) were more likely to drink alcoholic beverages than non-smokers, especially when going out with friends.

In Table 4, we reported the comparison between groups for students aged 17–21 years. Concerning lifestyle habits other than alcohol drinking, the largest differences emerged for smokers, physically active males, who were more likely to spend ≥3 h/day on a computer, eat snacks, drink coffee and eat pizza and fast food weekly or more, than their counterparts with healthier lifestyles (i.e. males aged 17–21 years who did not smoke and were physically active). Fewer differences were observed between groups among females: those who smoke and were physically inactive were less likely to drink coffee and eat pizza weekly or more, whereas spending ≥3 h/day on a computer was more frequent in the group of smokers, physically inactive female students. Finally, the consumption of alcohol beverages was less frequent among non-smoking, physically inactive females, and more frequent (both with meals and when going out with friends) among male and female smokers, whether physically active or not.

Table 2 – Intake of different alcoholic beverages with meals and when going out with friends, based on study participants' age and gender.

Questionnaire item	Aged 14–16 years					Aged 17–21 years				
	Males (n = 628)		Females (n = 418)		P-value	Males (n = 528)		Females (n = 593)		P-value
	n	%	n	%		n	%	n	%	
Alcohol drinking with meals										
Do you drink wine with meals?										
No	578	92.0%	402	96.2%		460	87.1%	553	93.3%	
Yes	50	8.0%	16	3.8%	0.007	68	12.9%	40	6.7%	0.001
Do you drink beer with meals?										
No	572	91.1%	404	96.7%		467	88.4%	565	95.3%	
Yes	56	8.9%	14	3.3%	<0.001	61	11.6%	28	4.7%	<0.001
Alcohol drinking when going out with friends										
Do you drink wine when you go out with friends?										
No	364	78.1%	275	79.9%		221	55.8%	304	65.9%	
Yes	102	21.9%	69	20.1%	0.528	175	44.2%	157	34.1%	0.002
How much wine do you typically drink when you go out with friends?[a]										
1–3 glasses	92	90.2%	62	89.9%		148	84.6%	140	89.2%	
≥4 glasses	10	9.8%	7	10.1%	0.942	27	15.4%	17	10.8%	0.217
Do you drink beer when you go out with friends?										
No	294	54.6%	228	63.5%		142	31.7%	253	52.0%	
Yes	244	45.4%	131	36.5%	0.008	306	68.3%	234	48.0%	<0.001
How much beer do you typically drink when you go out with friends?[a]										
1–3 cans	225	92.2%	119	90.8%		251	82.0%	214	91.5%	
≥4 cans	19	7.8%	12	9.2%	0.645	55	18.0%	20	8.5%	0.002
Do you drink hard liquor when you go out with friends?										
No	326	60.5%	229	61.4%		152	33.3%	187	34.8%	
Yes	213	39.5%	144	38.6%	0.782	304	66.7%	350	65.2%	0.622
How much hard liquor do you typically drink when you go out with friends?[a]										
1–3 drinks	163	76.5%	125	86.8%		234	77.0%	302	86.3%	
≥4 drinks	50	23.5%	19	13.2%	0.016	70	23.0%	48	13.7%	0.002

[a] Calculated among drinkers.

Discussion

We surveyed over 2100 male and female upper secondary school students from central Italy (aged 14–21 years) and studied the prevalence of overweight/obesity and of a range of unhealthy lifestyle habits (including smoking, sedentary behaviours and consumption of alcoholic beverages), paying particular attention to differences in distribution by gender and age group and patterns of co-occurrence. Our findings are generally in good agreement with those from other surveys carried out in Italy in previous years, such as the Health Behaviour in School-aged Children (HBSC), conducted in 2009–2010, [16–18] and the 2015 report of the European School Survey Project on Alcohol and Other Drugs, which focused on 15- and 16-year-old adolescents,[10] despite some differences that were partly due to the diversity in terms of the questionnaires that were used and of the demographic characteristics of the adolescents who were surveyed.

We found that the proportion of students being overweight or obese decreased with age and was higher among male than female students, whereas the prevalence of underweight slightly increased with age and was higher among female students. These features were in fair agreement with the HBSC survey, although the prevalence of underweight and overweight was slightly lower and higher than in our study, respectively.[16] The prevalence of cigarette smoking increased with age during early adolescence in the HBSC survey.[19] Here, we confirmed this finding and showed that the trend of increasing prevalence persisted among older ages (i.e. among students aged 17–21 years, who were not included in the HBSC survey) and was also evident for alcohol drinking and physical inactivity. As already mentioned, health-compromising habits and behaviours that are acquired early in life are very often maintained in older ages.[3–5] Therefore, adolescents represent an ideal target for the implementation of public health initiatives whose ultimate goal is the reduction of high-burden chronic diseases of adulthood and older ages.

Male and female students differed in terms of the prevalence of some, but not all, unhealthy lifestyle habits, and these differences were only partially affected by the students' age. Namely, the prevalence of cigarette smoking did not differ by gender, and male students practised sport activities more frequently than female students, regardless of age. Some interaction with age was observed in the comparison of alcohol drinking patterns between genders; although drinking alcoholic beverages with meals was more frequent among males than females of any age, the gap between genders in alcohol drinking when going out with friends was especially evident among students aged 17–21 years. Age- and gender-related differences in alcohol drinking have been reported previously in Italy;[20,21] however, data from other European countries and

Table 3 – Relative risk (RR) and 95% confidence intervals (CIs) of unhealthy lifestyle characteristics among male and female high-school students aged 14–16 years based on smoking habits (yes/no) and practice of sport activities outside school (yes/no). Poisson regression models with robust error variance adjusted by school type; reference group: non-smoking, physically active students of the same gender and age group.

| Characteristic | Males, 14–16 years (n = 624) | | | | | | Females, 14–16 years (n = 520) | | | | | |
| | Non-smokers, inactive (12.3%) | | Smokers, active (17.8%) | | Smokers, inactive (1.8%) | | Non-smokers, inactive (11.5%) | | Smokers, active (27.8%) | | Smokers, inactive (6.4%) | |
	RR (95%CI)	p	RR (95%CI)	p	RR (95%CI)	p	RR (95%CI)	p	RR (95%CI)	p	RR (95%CI)	p
Being overweight/obese	**1.67 (1.01–2.76)**	**0.044**	0.95 (0.55–1.65)	0.863	1.32 (0.37–4.66)	0.664	1.63 (0.80–3.29)	0.177	0.85 (0.45–1.60)	0.617	1.15 (0.44–2.99)	0.780
≥3 h/day watching TV	1.07 (0.98–1.17)	0.107	1.07 (1.00–1.15)	0.060	1.16 (0.95–1.43)	0.144	1.02 (0.93–1.12)	0.691	1.06 (0.99–1.14)	0.115	**1.16 (1.03–1.32)**	**0.018**
≥3 h/day on computer	**1.11 (1.02–1.21)**	**0.020**	0.99 (0.92–1.06)	0.737	**1.29 (1.08–1.53)**	**0.004**	**1.15 (1.04–1.26)**	**0.005**	0.99 (0.92–1.06)	0.701	1.02 (0.90–1.15)	0.744
Eat snacks	0.96 (0.88–1.05)	0.371	**1.12 (1.05–1.19)**	**<0.001**	1.12 (0.92–1.35)	0.262	1.04 (0.95–1.14)	0.371	1.01 (0.95–1.08)	0.693	0.93 (0.82–1.06)	0.282
Drink coffee	1.10 (0.56–2.16)	0.776	**2.05 (1.30–3.24)**	**0.002**	1.72 (0.48–6.20)	0.406	1.22 (0.74–2.00)	0.435	**1.82 (1.32–2.51)**	**<0.001**	**1.84 (1.11–3.07)**	**0.019**
Use painkillers	1.03 (0.96–1.11)	0.381	**1.15 (1.10–1.21)**	**<0.001**	**1.16 (1.01–1.32)**	**0.030**	0.93 (0.84–1.02)	0.125	1.05 (0.98–1.11)	0.154	1.09 (0.99–1.20)	0.078
Eating pizza weekly or more	0.95 (0.87–1.04)	0.246	1.01 (0.94–1.09)	0.762	0.89 (0.72–1.09)	0.252	0.95 (0.86–1.05)	0.331	**1.12 (1.05–1.20)**	**0.001**	1.03 (0.91–1.17)	0.629
Eating fast food weekly or more	**0.95 (0.91–0.99)**	**0.013**	1.02 (0.96–1.09)	0.434	1.11 (0.90–1.36)	0.317	0.96 (0.89–1.04)	0.316	0.99 (0.93–1.05)	0.660	1.09 (0.96–1.23)	0.194
Drinking habits												
Any alcoholic drinking	**0.88 (0.81–0.96)**	**0.004**	**1.20 (1.15–1.26)**	**<0.001**	**1.21 (1.09–1.34)**	**<0.001**	0.99 (0.93–1.06)	0.805	**1.11 (1.07–1.14)**	**<0.001**	**1.11 (1.06–1.15)**	**0.000**
With meals	0.49 (0.20–1.18)	0.112	1.20 (0.74–1.95)	0.463	2.08 (0.79–5.46)	0.137	**1.71 (1.04–2.82)**	**0.035**	1.48 (0.99–2.20)	0.055	1.55 (0.85–2.85)	0.154
wine	0.67 (0.24–1.84)	0.434	1.16 (0.57–2.36)	0.681	**3.52 (1.26–9.81)**	**0.016**	**1.98 (1.12–3.52)**	**0.019**	1.10 (0.64–1.88)	0.729	1.21 (0.50–2.89)	0.675
beer	0.46 (0.14–1.46)	0.186	1.52 (0.86–2.67)	0.150	2.12 (0.59–7.58)	0.250	**2.17 (1.03–4.56)**	**0.041**	**2.30 (1.30–4.06)**	**0.004**	**2.69 (1.22–5.90)**	**0.014**
When going out with friends	**0.69 (0.50–0.94)**	**0.018**	**1.60 (1.43–1.80)**	**<0.001**	**1.63 (1.30–2.04)**	**<0.001**	0.97 (0.82–1.15)	0.707	**1.26 (1.17–1.36)**	**<0.001**	**1.28 (1.16–1.40)**	**<0.001**
wine	0.77 (0.43–1.37)	0.370	1.51 (0.98–2.32)	0.060	1.36 (0.41–4.50)	0.614	1.16 (0.79–1.71)	0.459	**1.75 (1.37–2.23)**	**<0.001**	**1.65 (1.13–2.40)**	**<0.001**
beer	0.74 (0.50–1.10)	0.139	**2.00 (1.69–2.37)**	**<0.001**	**1.78 (1.08–2.93)**	**0.023**	1.05 (0.82–1.33)	0.716	**1.46 (1.28–1.66)**	**<0.001**	**1.29 (1.02–1.63)**	**0.031**
hard liquor	**0.54 (0.32–0.93)**	**0.026**	**2.39 (1.98–2.89)**	**<0.001**	**2.56 (1.81–3.61)**	**<0.001**	0.87 (0.65–1.16)	0.345	**1.52 (1.33–1.72)**	**<0.001**	**1.48 (1.22–1.79)**	**<0.001**

Statistically significant results are in bold.
CI, confidence interval; RR, risk ratio.

Table 4 — Relative risk (RR) and 95% confidence intervals (CI) of unhealthy lifestyle characteristics among male and female high-school students aged 17—21 years according to smoking habits (yes/no) and practice of sport activities outside school (yes/no). Poisson regression models with robust error variance adjusted by school type; reference group: non-smoking, physically active students of the same gender and age group.

Characteristic	Males, 17—21 years (n = 416)						Females, 17—21 years (n = 584)					
	Non-smokers, inactive (24.9%)		Smokers, active (14.8%)		Smokers, inactive (7.7%)		Non-smokers, inactive (25.8%)		Smokers, active (20.6%)		Smokers, inactive (13.1%)	
	RR (95%CI)	p	RR (95%CI)	p	RR (95%CI)	p	RR (95%CI)	p	RR (95%CI)	p	RR (95%CI)	p
Being overweight/obese	0.98 (0.40—2.41)	0.965	0.49 (1.11—2.18)	0.347	—	—	1.20 (0.38—3.77)	0.755	1.85 (0.62—5.50)	0.266	1.57 (0.46—5.43)	0.473
≥3 h/day watching TV	1.06 (0.98—1.15)	0.155	1.09 (0.98—1.20)	0.099	1.06 (0.92—1.21)	0.423	0.97 (0.90—1.04)	0.335	0.98 (0.91—1.06)	0.682	1.00 (0.92—1.10)	0.922
≥3 h/day on computer	1.01 (0.93—1.09)	0.826	**1.14 (1.04—1.26)**	**0.008**	1.14 (1.00—1.30)	0.053	1.05 (0.98—1.12)	0.207	1.02 (0.95—1.09)	0.613	**1.17 (1.06—1.28)**	**0.001**
Eat snacks	**1.11 (1.03—1.21)**	**0.008**	**1.11 (1.09—1.22)**	**0.034**	1.10 (0.97—1.24)	0.152	0.99 (0.92—1.06)	0.711	0.96 (0.88—1.03)	0.266	1.06 (0.97—1.16)	0.186
Drink coffee	1.47 (0.80—2.7)	0.211	**2.23 (1.23—4.05)**	**0.008**	2.10 (0.92—4.80)	0.078	**0.42 (0.27—0.65)**	**<0.001**	1.23 (0.93—1.63)	0.147	1.26 (0.91—1.75)	0.168
Use painkillers	0.98 (0.93—1.04)	0.486	1.03 (0.97—1.09)	0.348	1.04 (0.97—1.12)	0.258	1.02 (0.98—1.06)	0.371	1.01 (0.97—1.06)	0.501	1.02 (0.97—1.07)	0.437
Eating pizza weekly or more	0.99 (0.91—1.08)	0.844	**1.15 (1.05—1.27)**	**0.040**	1.09 (0.95—1.24)	0.204	**0.90 (0.83—0.96)**	**0.003**	0.99 (0.91—1.07)	0.758	0.99 (0.90—1.08)	0.805
Eating fast food weekly or more	0.99 (0.94—1.05)	0.816	**1.13 (1.03—1.23)**	**0.007**	1.01 (0.93—1.11)	0.770	0.97 (0.93—1.01)	0.101	0.98 (0.93—1.03)	0.369	0.99 (0.94—1.07)	0.989
Drinking habits												
Any alcohol drinking	1.01 (0.93—1.1)	0.728	**1.31 (1.23—1.39)**	**0.000**	**1.23 (1.11—1.35)**	**0.000**	**0.92 (0.87—0.97)**	**0.005**	**1.09 (1.04—1.13)**	**<0.001**	**1.09 (1.04—1.14)**	**0.001**
With meals	0.81 (0.26—2.46)	0.706	2.38 (1.00—5.66)	0.050	1.95 (0.59—6.47)	0.277	0.79 (0.35—1.78)	0.564	1.82 (0.93—3.56)	0.080	**3.33 (1.77—6.26)**	**<0.001**
wine	0.65 (0.13—0.32)	0.595	**3.15 (1.10—9.05)**	**0.033**	1.17 (0.15—8.98)	0.880	0.80 (0.31—2.12)	0.661	1.51 (0.65—3.52)	0.335	**3.28 (1.54—6.98)**	**0.002**
beer	1.20 (0.29—4.88)	0.803	2.73 (0.75—9.90)	0.126	2.45 (0.52—11.6)	0.259	0.52 (0.11—2.40)	0.401	**2.92 (1.06—8.04)**	**0.038**	**5.68 (2.19—14.7)**	**<0.001**
When going out with friends	1.08 (0.83—1.41)	0.572	**2.08 (1.75—2.47)**	**<0.001**	**1.74 (1.34—2.27)**	**<0.001**	**0.82 (0.70—0.95)**	**0.009**	**1.22 (1.11—1.34)**	**<0.001**	**1.22 (1.10—1.35)**	**<0.001**
wine	1.34 (0.79—2.26)	0.278	**1.86 (1.07—3.23)**	**0.027**	1.47 (0.72—2.99)	0.289	0.83 (0.55—1.27)	0.394	**2.04 (1.47—2.83)**	**<0.001**	**2.09 (1.47—2.96)**	**<0.001**
beer	1.40 (0.95—2.07)	0.092	**2.98 (2.19—4.06)**	**<0.001**	**2.54 (1.71—3.78)**	**<0.001**	0.80 (0.59—1.10)	0.170	**1.85 (1.48—2.31)**	**<0.001**	**1.72 (1.35—2.22)**	**<0.001**
hard liquor	0.88 (0.58—1.35)	0.557	**2.78 (2.14—3.60)**	**<0.001**	**2.45 (1.73—3.48)**	**<0.001**	**0.66 (0.53—0.82)**	**<0.001**	**1.27 (1.12—1.45)**	**<0.001**	**1.22 (1.04—1.43)**	**0.014**

Statistically significant results are in bold.
CI, confidence interval; RR, risk ratio.

the USA show substantial diversity,[10,22] which is not surprising given the complex effect of social and cultural contexts (including family and peer influences) on alcohol drinking in this age group.[9] Comparatively fewer differences between genders emerged for the other health-relevant lifestyle habits that were investigated; female students declared a more frequent use of painkillers (which is most likely explainable by the need to relieve period cramps), whereas male students aged 17—21 years were more likely to eat snacks and fast food and spent more time watching TV or using the computer/playing video games than female students of the same age.

The patterns of co-occurrence of health-relevant lifestyle habits were complex as they varied by gender and age group. Overall, cigarette smoking emerged as the lifestyle characteristic most consistently associated with other unhealthy habits. In particular, compared with non-smoking, physically active students of the same gender-specific and age group—specific stratum (which was the reference category in our analysis), smokers (whether practising sport activities or not) were consistently more likely to consume alcoholic beverages. The association of cigarette smoking with the other lifestyle habits was weaker, with most differences being observed among physically active males aged 17—21 years, and nearly no association emerged among females of the same age. In contrast, the lack of participation in sport activities outside school did not appear to be linked with other unhealthy lifestyle habits among non-smokers, and tended indeed to be associated with an overall lower consumption of alcoholic beverages (with the only exception of alcohol drinking with meals among girls aged 14—16 years).

Our findings on the pattern of co-occurrence of health-relevant lifestyle habits have public health implications. In our study, cigarette smoking emerged as the best single predictor of the co-occurrence of other unhealthy habits, and in particular alcohol drinking, within each stratum (i.e. once the main demographic predictors [gender and age] were controlled for). A range of health promotion techniques (such as mass media campaigns, social marketing, peer education and motivational interviewing) have proved effective for smoking cessation.[23] However, smoking cessation does not necessarily lead to the adoption of healthier lifestyle habits and, in particular, to parallel changes in alcohol use.[24,25] It is also worth noting that the effectiveness of smoking cessation interventions may depend on smokers' gender, age and socio-economic status.[26,27] In particular, social stigmatisation of smokers as a public health tool may have counter-productive effects among the most socially disadvantaged individuals, including an exacerbation of low self-esteem and self-efficacy which can lead to the failure of attempts to cease smoking or to implement similar attempts to improve one's lifestyle.[26,28,29] The recently proposed multiple health behaviour change paradigm for health promotion interventions may be more suitable to address several unhealthy lifestyle habits at the same time; however, their effectiveness among the youth is unclear.[30,31] A better understanding of psychological and social mechanisms leading to the adoption and maintenance of health-relevant lifestyle habits among the adolescents is warranted.

The main strengths of our study are its large sample size and the participation of male and female upper secondary school students aged from 14 to 21 years, that is, distributed over an age range that was wider than that in previous investigations in the same area.[16—18] The questionnaire included questions on several health-relevant lifestyle habits and behaviours, and, in particular, it discriminated between different types of alcoholic beverages (wine, beer, liquor) and between their consumption with meals (i.e. mainly with parents) and for recreational use (i.e. when going out with friends). This allowed us to study with great detail the complex patterns of co-occurrence of smoking, alcohol drinking and other health-relevant lifestyles. Our study has several limitations as well. The cross-sectional design with no follow-up of study participants prevented studying how the prevalence of the different lifestyle habits evolved in the transition from adolescence to early adulthood. However, given the narrow age range and the fact that all questionnaires were completed over a short period of time (18 months), cohort effects are likely to be moderate, and statements regarding trend of prevalence with age appear to be justified. Height and weight were self-reported, which is common in surveys conducted in schools but may raise concerns on the accuracy of those measures. For female students, the questionnaire did not distinguish between the use of painkillers to relieve menstrual cramps or for other reasons, which prevented comparison with males and made it difficult to detect and quantify any abuse of those drugs. Finally, the study was limited to a single province in central Italy, and whether our findings can be extrapolated to other areas in Italy or to other countries can be questioned. Unhealthy habits among the adolescents are determined by a complex set of cultural and socio-economic influences, peer pressure, parental guidance and other factors, that are variously interconnected with one another and whose relative importance is likely to vary geographically and over time. Previous investigations have shown, however, that cross-cultural similarities (in addition to differences) may exist in lifestyle habits of the adolescents from different countries.[32—35] Therefore, we believe that making our findings available to an international audience is important, for instance to provide background information that may prove helpful for researchers and health policy makers in different countries.

In conclusion, we showed that the proportion of secondary school students being overweight or obese is high, especially males in the younger age groups; that the prevalence of cigarette smoking, alcohol drinking and sedentary behaviours increases with age and differ to some extent between genders; and that cigarette smoking is a good predictor of co-occurrence of multiple unhealthy lifestyle habits and especially alcohol drinking. Our findings may be helpful for public health professionals planning interventions that aim to combat obesity and tackle unhealthy lifestyles among adolescents.

Author statements

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