

# Lifestyle changes during the first and second waves of the COVID-19 pandemic in medical college students: are there gender-related differences?

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**Abstract.** *Background and aims:* The COVID-19 pandemic has seriously affected young people. The present study aims to explore the effects of COVID-19 on lifestyle in 500 undergraduate students both during the acute phase of the pandemic (so-called “first wave”) and during the second spread of infections (so-called “second wave”). Gender differences were also explored. *Methods and results:* During the first wave we found weight gain in 48.6% of subjects, a switch to an unhealthy diet (43%), and an increase in the amount of food introduced (35%). Interestingly, women showed higher intake of food in order to cope, while men privileged higher wine consumption as a coping mechanism. We observed a sharp reduction in physical activity, increased sedentary behaviours and deterioration in sleep quality. Stress correlates with eating to cope ( $r=0.86$ ;  $p<0.001$ ); drinking to cope ( $r=0.83$ ;  $p<0.001$ ). Contrary to expectations, the second wave led to a situation similar to the first. We have detected a further deterioration in quality of sleep (67% vs 77%;  $p<0.01$ ) and also a reduction in sleeping time (68.6% vs 77.7;  $p<0.01$ ). *Conclusions:* The long pandemic has led to unhealthy lifestyle changes in the student population of our municipality in Northern Italy. There are gender differences in lifestyle modifications developed during the pandemic that suggest a different response to stress. Moreover, the persistence of pandemic-related stress due to the “second wave” has severely affected the lifestyle habits of undergraduate student. ([www.actabiomedica.it](http://www.actabiomedica.it))

**Key words:** gender, lifestyle; COVID-19; young; pre-graduate students; risk factors; anxiety

## Introduction

Since February 2020, the world has been facing a pandemic caused by the virus SARS-CoV-2. Coronavirus disease 2019 (COVID-19) is causing a high number of deaths. In Europe, Italy was the first country to enforce nationwide lockdown and national quarantine. The first Lockdown came into force on 23 February and involved Northern Italy (1). On 9 March the lockdown measures were extended to the whole of Italy (1,2) and were lifted on May 3 (2).

The spread of infection in Italy between March 2020 and May 2020 was defined as the “first wave”. During the summer, Italy experienced a reduction in the clinical impact of COVID-19 and some restrictions were removed and / or relaxed.

On October 13, 2020, the second spread of infection induced a so-called “second wave” of illness that had a major impact on the health system leading to other restrictions, such as the closure of secondary schools and universities (3).

Students suffered from these additional restrictions that limited social life and access to University facilities. Some papers suggest that the “second wave” and related restrictions had a stronger psychological impact on young people since they were suffering from social life restrictions and school closures (4-6).

Quarantine and isolation are two measures that can prevent, or at least minimize, the impact of infectious disease outbreaks (7).

Several studies reported that stress, anxiety and depression also involved young and specifically students (8-10). The main consequence of quarantine in undergraduate students was a change in lifestyle habits: nutrition, physical activity, sedentary behavior, and quality of sleep (11-14).

Overall, the Pandemic has resulted in a series of restrictions that have continued over a long period of time. Little is known about the effects of such prolonged restrictions, because this is the first such long-lasting pandemic in recent times (4,5,15).

The aim of the present study was to explore the effects of COVID-19 on lifestyle in a population of undergraduate medical school students from the North of Italy both during the acute phase of the pandemic (so-called the “first wave”) and in the mid-term, after the summer release (so-called “second wave”), and to explore whether there are differences between men and women in lifestyle changes in response to COVID-19 pandemic and analysed association between COVID-19 induced stress and changes in lifestyle

## Materials and methods

### Participants

Participants completed an anonymous web-based survey on Google platform relative to the period March 24 -May 3, 2020 after agreeing to give the electronic informed consent required of each participant. Invitations to participate in the survey were sent by email, using google email groups, to all 1081 students of the degree program in dentistry, nursing and dental hygiene. Indeed, it was stressed that the participant could refuse participation in the protocol whenever he/she wished. This study was approved by our Internal Review Board. The survey took 20 minutes to complete. A total of 500 participants (46.2%), recruited from within the University of Modena and Reggio Emilia (pre-graduate students from the School of Medicine), with an average age of  $22.84 \pm 2.68$  (range 19–24 years), completed the survey. None of the participants reported symptoms of COVID-19.

Between December 6, 2020 and December 16, 2020 the same questionnaire (#2) was sent to the students of the same cohorts. Not all students answered the second submission of the questionnaire, 310 students out of the initial 500 (62%), completed the second round of the questionnaire concerning the prolonged effects of the restrictions caused by the “second wave” of the disease. (Table 1) Informed consent specified that the aim of the second administration

**Table 1.** Baseline characteristics of student population.

a. answer to questionnaire #1

	<b>Total population</b>	<b>Females</b>	<b>Males</b>
Nr of subjects (%)	500	297 (59.4)	203 (40.6)
Mean age	$22.25 \pm 2.87$ (range 19–24 yrs)	$21.96 \pm 2.81$	$22.55 \pm 2.93$
Mean BMI	$21.6 \pm 3.4$	$19.87 \pm 3.98$	$23.34 \pm 2.99$
High level of physical activities (nr of subjects and (%))	103 (20.6)	28 (9.4)	75 (37)

answer to questionnaire #2

	<b>Total population</b>	<b>Females</b>	<b>Males</b>
Nr of subjects (%)	310	193 (62.2)	117 (37.8)
Mean age	$21.67 \pm 2.9$ (range 19–24 yrs)	$21.35 \pm 2.5$	$22.84 \pm 2.71$
Mean BMI	$21.2 \pm 2.9$	$19.9 \pm 2.98$	$24.12 \pm 3.02$
High level of physical activities (nr of subjects and (%))	97 (31)	27 (13.9)	70 (59.8)

of questionnaire was to gather information on the effects of the second wave developed after summer 2020. Comparison have been made between summer time (before second wave) and December 2020 (during second wave of COVID-19 disease in Italy).

#### *First questionnaire*

A 40-question multiple-choice questionnaire was prepared. After providing informed consent, patients completed the questionnaire.

The questionnaire consisted of four sections covering demographic information, changes in diet, physical activity and sleep during quarantine, and ways of coping with lockdown. We also asked participants about self-perception of stress, fear, stigma and anxiety.

#### *Nutrition habits*

Questions explored frequency of drinking/eating habits before and during quarantine. Diet was researched by comparing it with nutritional habits before quarantine. We specifically investigated changes in habits regarding quantity and quality of food. We ask about increased/reduced and no change in the number of meals and snacks. A snack was considered as every eating opportunity between main meals and we specifically investigated chocolate bars, commercial snacks, chips, almonds and dried fruit. We evaluated changes (increased/reduced and no change) in different categories of food: pasta, pizza, vegetables, fruit, meat, cheese, fat- and sugar-rich food and beverages. A list of some fat- and sugar-rich foods has been included in the notes. Changes in drinking frequency were also explored with specific questions related to coffee, tea, wine, and beer.

#### *Physical activity and sedentary behaviour*

We asked about frequency of exercise before and during quarantine (occasionally, 1-2 times a week, 4-3 times a week, more than 5 times a week). We also explored type of exercises (swim, bicycle, run, or team sports) performed before and during lockdown. Exercise during lockdown referred to physical activity at home (indoor exercise bike, treadmill, resistance

training) or jogging/running around one's house, given that it was not possible either to participate in organized sports or perform other outdoor activities. In Italy, indoor activities were closed from February 2020 to May 2020 and again from September 2020 to April 2021. We also investigated if students use apps and websites to exercise at home. We were not able to collect information regarding intensity of exercise. We included questions on screen time and sofa time (increased/reduced and no change) as parameters of sedentary behaviour.

#### *Sleep*

We investigated the number of hours sleeping and changes in the actual time of going to sleep. Sleep was evaluated as subjective perception of sleeping well or changes in quality of sleep or sleeping badly.

#### *Second questionnaire*

We investigated the effects of the "second wave"-induced restriction on diet, physical activity, sleep disorders and hygiene habits by administering the same questionnaire to the same study group of subjects. Specifically, we asked if the further restrictions had impacted on the psychological condition resulting in an improvement or a worsening of lifestyle habits.

In addition, we add 2 specific questions asking if the further restrictions introduced by the government to counter the second wave, had impacted on the individual's psychological condition resulting in an improvement or a worsening regarding lifestyle habits.

(Question 1: Which of the following emotions do you feel when thinking about COVID-19 second wave? Question 2: In your opinion the second wave of restrictions induced by COVID-19 influenced your lifestyle habits?)

#### *Statistical analysis*

Descriptive analyses were performed for all variables. The Shapiro-Wilk test was used to test normal distribution of continuous variables. We revised the analytical plan used in the preregistration because of the differences in age and gender between cohorts

(see Table 1). To determine differences between groups of questions (before and after quarantine) and cohorts (data obtained from the first and the second questionnaire) we used T-test, chi-square test and, when appropriate, Fisher's exact test. We explored correlations between stress and variables related to the habits of life developed during the quarantine by using Pearson correlation test. Categorical moderators were dummy-coded (i.e. Sex: 0 = Men, 1 = Women)

SPSS (v25) was used and a two-tailed  $p$ -value  $< 0.05$  was considered significant. Missing values were excluded.

### *Ethical consideration*

No personal or private data was collected and similarly, the data collection procedure followed the provisions of the Declaration of Helsinki on human subjects (16). This study was approved by Internal Review Board on February 12, 2020. The ethical characteristics of the study were set out in the presentation of the questionnaire. Indeed, it was stressed that the participant could refuse participation in the protocol whenever he/she wished. Those interested in participating were given an electronic informed consent form, which recalled the voluntary nature of participation, the confidentiality and the anonymous nature of the information

## **Results**

A total of 500 students completed the first questionnaire; 297 (59.4%) women and 203 men (40.6%). The characteristics of the population are shown in Table 1.

As expected, the students self-reported that they suffered from increased stress and emotional distress that led to an increase in weight in 48.% of subjects, to unhealthy diet (43%), and to an increase in the amount of food introduced into their diet (35%). Comparing women and men, we found that women had a greater worsening of eating habits. Compared to men, women introduced foods richer in sugar (48% versus 40% for men;  $p < 0.05$ ) and adopted more "eating to cope" (68% versus 43.8%;  $p < 0.001$ ). In contrast, men reported

greater "drinking wine to cope" (70.5 versus 47.5% in the women's group;  $p < 0.001$ ). Regarding soft drinks, women were more likely to drink tea and showed a greater increase in tea consumption than men (14.1% versus 9.3% in men;  $p < 0.01$ ) (Table 2).

The great majority of students halted all physical activity, including outdoor walks. A small number of students continued to exercise at home. The increase in physical activity was greater in males than females (20.7% vs 2.7%;  $p < 0.001$ ) (Table 2) Sleeping time was reduced (68.6%) and sleep quality worsened (67%) in the total population, with no difference detected between women and men.

Screen time and sofa time were increased in all populations without differences between women and men.

Then we correlated self-perception of increase in stress due to COVID-19 with all the variables related to eating, drinking, physical activity and sleep during the quarantine. To do this analysis Categorical moderators were dummy-coded (i.e. Sex: 0 = Men, 1 = Women; increase in sugar rich food: 0=yes; 1= no etc). Table 3 presents correlations among these variables.

There were strong positive associations between COVID-19 stress perception and gaining weight, changes in diet and physical activity and changes in drinking patterns.

As would be expected, there were also strong associations between eating to cope and drinking wine to cope and weight gain. The self-perception of stress correlates with increase in weight ( $r=0.9$ ;  $p < 0.001$ ), increase in drinking wine to cope ( $r=0.83$ ;  $p < 0.001$ ), increase in eating to cope ( $r=0.86$ ;  $p < 0.001$ ). Students reported an increase in wine consumption, especially during meals. (Table 3) With regard to non-alcoholic beverages, we recorded an increase in the consumption of tea and coffee. An inverse correlation was found between an increase in coffee consumption and increase in weight ( $r=-0.7$ ,  $p < 0.01$ ).

Then we compared data obtained from the questionnaire administered in March 2020 during the "first wave" (March 2020-May 2020) with data obtained during the "second wave" (October 2020-December 2020).

Answer to the additional 2 questions underline that the second wave induced fear and anxiety (56% of

**Table 2.** Comparison between women and men during quarantine induced by the “first wave” of COVID 19.

<b>Changes in weight Nr of subjects (%)</b>	<b>Females 297 (59.4)</b>	<b>Males 203 (40.6)</b>	<b>P</b>
Increase	156 (52.6)	87 (42.9)	0.05
Reduction	68 (22.8)	32 (15.8)	0.01
No change	73 (24.6)	84 (41.3)	0.01
<b>Changes in physical activity</b>			
Increase	8 (2.7)	42 (20.7)	0.001
Reduction	210 (70.7)	94 (46.3)	0.001
No change	79 (26.6)	67 (33)	n.s.
<b>Changes in tea drinking</b>			
Increase	42 (14.1)	19 (9.3)	0.01
Reduction	98 (33)	40 (19.7)	0.01
No change	157 (52.9)	144 (71)	0.01
<b>Changes in coffee drinking</b>			
Increase	65 (22)	78 (38.5)	0.01
Reduction	21 (7)	69 (34)	0.001
No change	211 (71)	56 (27.5)	0.001
<b>Eating for cope</b>			
Yes	202 (68)	89 (43.8)	0.001
No	95 (32)	114 (56.2)	0.001
<b>Drinking wine for cope</b>			
Yes	141 (47.5)	143 (70.5)	0.001
No	156 (52.5)	60 (29.5)	0.001
<b>Sugar and fat-rich food</b>			
Increase	143 (48.1)	81 (40)	0.05
Reduction	20 (2.8)	24 (11.8)	0.01
No change	134 (45.2)	98 (48.2)	n.s.
<b>Sleeping time</b>			
Reduced	205 (69)	138 (67.9)	n.s.
NO change	92 (31)	65 (32,1)	n.s.
<b>Quality of sleep</b>			
Worsened	201 (67.6)	134 (66)	n.s.
No change	96 (32.4)	69 (34)	n.s.

students), no specific emotion (18% of the students). No differences have been reported between women and men. Answer to Question 2: “In your opinion the second wave of restrictions induced by COVID-19 influenced your lifestyle habits?” was “yes” in 67% and “no” in 33%.

The comparative analysis showed no differences in nutritional habits and physical activity between cohorts (Table 4).

Interestingly we found a change in coffee consumption and, specifically, an increase in coffee consumption from 1st wave to 2nd wave. (Table 4) Moreover, when comparing the “first wave” and the “second wave” we observed that a high number of subjects revealed a worsening of sleep quality (67% vs 77%;  $p < 0.01$ ) and a reduction in sleeping time (68.6% vs 77.7;  $p < 0.01$ ). Differences in behaviour among sex persist during the second wave as shown in Table 5.

## Discussion

Our study shows that the Italian lockdowns had a significant impact on both the lifestyle and wellbeing of medical students and that the “second wave” of spread of COVID-19 delayed the return to healthy lifestyle. Furthermore, there are gender differences in how college students have been affected by the lockdown and have changed their lifestyle, including diet, eating habits, physical activity and sleep quality. This finding supports the hypothesis that women and men have responded differently to the stress induced by the spread of COVID-19 and government-induced social quarantine measures.

To our knowledge, this is the only manuscript comparing gender differences on lifestyle changes induced by the “first wave” and “second wave” of COVID-19 prevalence in students. The results obtained demonstrate that this selected and intellectually aware population of medical students was significantly affected by the impact of Covid-19 lockdowns. The pandemic was a new and unpredictable situation for everyone (17). Our findings suggest that a medical student is not better protected from stress simply by attending courses dealing with health care, indeed, stress appears to be high, as they face an unknown situation (4,5,8).

Lifestyle is a complex set of habits that includes diet, physical activity, exercise, a sedentary lifestyle, and other harmful habits (e.g. smoking, alcohol, sugar-rich and caffeine-rich drinks) (17,18). We found that the response to the COVID-19 stress were different in women and men, especially as regards the diet and



**Table 4.** Comparison between “first wave” and “second wave”.

Nr of subjects (%)	First wave 500	Second wave 310	p
<b>Changes in weight</b>			
Increase	243 (48.6)	152 (49)	n.s.
Reduction	100 (20)	59 (19.0)	n.s.
No change	157 (31.4)	99(31.9)	n.s.
<b>Changes in physical activity</b>			
Increase	50 (10)	52(16.7)	Trend to 0.05
Reduction	304 (60.8)	167(53.8)	n.s.
No change	146 (29.2)	91 (29.3)	n.s.
<b>Changes in tea drinking</b>			
Increase	61 (12.2)	43 (13.8)	n.s.
Reduction	138 (27.6)	91 (29.3)	n.s.
No change	301 (60.2)	176 (56.7)	n.s.
<b>Changes in coffee drinking</b>			
Increase	143 (28.6)	142(45)	0.01
Reduction	90 (18)	66 (21.2)	n.s.
No change	267 (53.4)	102 (32.9)	0.01
<b>Eating for cope</b>			
Yes	291 (58.2)	186 (60)	n.s.
No	209 (41.8)	124(40)	n.s.
<b>Drinking wine for cope</b>			
Yes	284 (56.8)	173(55.8)	n.s.
No	216 (43.2)	137(44.2)	n.s.
<b>Sugar and fat-rich food</b>			
Increase	224 (44.8)	123 (39.6)	Trend to 0.05
Reduction	44 (8.8)	34 (10.9)	n.s.
No change	232 (46.4)	153 (49.3)	n.s.
<b>Sleeping time</b>			
Reduced	343 (68.6)	241(77.7)	0.01
No change	157 (31.4)	69 (22.2)	0.01
<b>Quality of sleep</b>			
Worsened	335 (67)	239 (77)	0.01
No change	165 (33)	71(23)	0.01

physical activity. The great majority of students change their lifestyle switching to unhealthy habits: poor quality of food, reduced physical activity, increase screen time.

**Table 5.** Comparison between men and women of lifestyle changes during the second wave.

Changes in weight Nr of subjects (%)	Females 193 (62.2)	Males 117 (37.8)	p
Increase	99 (51.3)	53 (45.2)	0.005
Reduction	21(10.9)	38 (32.5)	0.01
No change	73 (37.8)	26 (22.2)	0.01
<b>Changes in physical activity</b>			
Increase	21 (11)	31 (26.5)	0.001
Reduction	114 (59)	53 (45.3)	0.01
No change	58 (30)	33 (28.2)	n.s.
<b>Changes in tea drinking</b>			
Increase	39 (20.2)	4 (3.4)	0.001
Reduction	47 (24.3)	44 (37.6)	0.05
No change	107 (55.4)	69 (58.9)	n.s.
<b>Changes in coffee drinking</b>			
Increase	81 (42.1)	61 (52.2)	0.001
Reduction	37 (19)	29 (24.8)	0.001
No change	75 (38.9)	27 (23)	0.001
<b>Eating for cope</b>			
Yes	132 (68.3)	54 (46.1)	0.001
No	61 (31.7)	63 (53.9)	0.001
<b>Drinking for cope</b>			
Yes	95 (49.2)	78 (66.6)	0.001
No	98 (50.8)	39 (33.3)	0.001
<b>Sugar and fat-rich food</b>			
Increase	88 (45.6)	35(29.9)	0.001
Reduction	16 (8.2)	18(15.4)	0.001
No change	89 (46.2)	64 (54.7)	n.s.
<b>Sleeping time</b>			
Reduced	147 (76.2)	94 (80.3)	n.s.
No change	46 (23.8)	23 (19.7)	n.s.
<b>Quality of sleep</b>			
Worsened	154 (79.8)	85 (72.6)	n.s.
No change	39 (20.2)	32 (27.3)	n.s.

#### *Changes in food and dietary habits*

During quarantine, female students were more likely to change their nutritional habits with an increase in “comfort food” and in “food craving” leading to an increase in weight and obesity. They reported an

increase of sugar-rich food both during meals and as snacks. It is well known that the relationship between stress and eating behaviours reveals that some subjects cope with stress by eating and drinking in an attempt to feel better (“stress-related eating”) (19-22). In our population, women were more likely to develop these changes in nutritional habits compared with men. These results are similar to those reported by Weingarten HP and co-workers (19). They investigated food craving in college undergraduates and found that 97% of women and 68% of men reported experiencing food cravings. Chocolate was the most frequently reported food being craved for, especially among women (19).

Moreover, our data support the hypothesis that women and men act differently to cope with stress (21,23,24). We have reported an increase in wine consumption in young males during quarantine and we hypothesize that this increase was an identifiable response as “drinking to cope”. “Drinking for cope” is the stress response characterized by an increase in alcohol consumption to counteract the effects of stress. However, in the face of a generalized increase in the frequency of alcohol consumption, the students reported a reduction in the consumption of beer during occasional “happy hours”. The consumption of beer and “happy hour” beverages has dropped considerably in our population due to the lockdown, these being habits connected with socialising with friends, which has been restricted in many municipalities in Italy (4).

An increase in the consumption of tea and coffee during the quarantine has been reported and corresponds to what is reported by the food sales tables. The increase in the sale of beverages through large-scale distribution is attributable to the closure of bars and cafeterias, which led to an increase in home consumption (25,26). In previous studies caffeine has been identified as a positive predictor of mental distress as caffeinated beverages are commonly consumed worldwide (27-29). Caffeine acts on adenosine A1 and A2A receptors found in regions of the brain that process threat, fear and anxiety (29-31). In addition, caffeine increases glucocorticoid levels, which by stimulating the HPA axis increase the risk of mental distress (28-30).

Drinking coffee is a very common habit in Italy, notably consumed at the end of a meal and is included in the Mediterranean Pyramid (26,30-32). Furthermore,

by comparing the behavior in the 2 waves, coffee consumption was the only dietary parameters that changes significantly. Coffee consumption increased in males during the two waves of COVID-19, which may have contributed through physiological mechanisms to maintaining a high level of stress and increase and increased further in the second wave. this data is extremely interesting and difficult to explain. Further studies should be carried out to evaluate the influence of stress on the consumption of caffeinated beverages.

#### *Changes in physical activity*

Perceived stress and coping influenced nutritional habits as well as physical activity (33). Furthermore, COVID-19 home confinement resulted in a reduction in the frequency and intensity of physical activity in the population (14,34,35).

Some manuscript recently underlines the negative effects of confinement on physical activity, people in general reduced the length (days and hours) and intensity of physical activity, mainly during the first week of confinement (changes in routines), although it may increase afterward (adaptation of routines) (14, 35-38).

We reported a reduction in physical activity during the first lockdown wave that persisted during the second wave as well. Our data refer to students who have been forced to lockdown in Municipalities in the North of Italy with high mortality impact from COVID-19. Students used distance learning for all lessons and tests. These results are similar to those reported by Esteves and colleagues who pointed out that, during the period of social distancing, most students reported not engaging in physical activities, maintaining involvement in study-related activities, and keeping in contact with friends via the Internet or telephone (4). Similarly, Wilson et al reported a significant decline in physical activity and mental health among college students during the COVID-19 circumstances, and any physical activity engaged in did not appear to protect against deterioration in mental health (6). The lockdown and restrictions imposed by governments reduced access to sport facilities and gyms, leading to a reduction in physical activity and an increase in sitting time in the population (13,14,22,39). In addition, stress and depression are often associated with

an increase in sitting time and an increase in the time spent watching television. This phenomenon has also been registered in our groups of students. Distance learning may have contributed to the increase in sitting time in students (22,40).

During quarantine at home, the population tends to adopt a sedentary routine, which could lead to psychosocial distress in the form of depression and anxiety (22,39).

Regular physical exercise can reduce symptoms of anxiety and amplify positive emotions such as happiness and wellbeing (41,42). Regular physical activity reduces inflammation and oxidative stress and prevents development of non-communicable disease (43).

#### *Changes in sleep habits*

Pandemic affected the quantity and quality of sleep (44,45). Huang and Zhao found that public's levels of anxiety-related symptoms increased when Covid-19 pandemic occurred (44). They found that healthcare workers had a higher risk for poor sleep quality (44). One possible reason is that the working time and labour intensity of healthcare workers increased in the face of severe epidemic causing them not to have enough time to rest, and to be prone to chronic stress and psychological distress (44-46).

We observed a decline in quality of sleep both during the lockdown in March 2020 and during the second wave of disease. Sleep disorders during the COVID-19 pandemic lockdown have been previously reported (10,14,45,47). Marelli and coworkers described poor quality of sleep and poor sleep hygiene during the COVID-19 lockdown in a study group that comprised pre-graduate students (14). They suggested that the COVID-19 outbreak acts as a traumatic event and can produce psychological distress and anxiety symptoms, which negatively impact sleep quality (14).

#### *Stress and pandemic*

The persistence of the pandemic appears to have exacerbated stress and stress-related lifestyles in students. The second questionnaire, focusing on lifestyle changes during the "second wave", demonstrated the persistence of unhealthy lifestyle habits. The "second

wave" of disease was perceived as much more serious than the "first wave" despite there being increased knowledge of the disease that led to effective therapies and vaccine development. Students perceived an increase in fear, emotional distress and stigma, which resulted in further deterioration of lifestyle. The continuation of distance learning has further contributed to increased depression and low mood in students (4,48).

Despite efforts to share reliable information on correct nutrition and physical activity, the psychological orientation of young people, particularly towards their health and food consumption, appears not to have changed in the second wave period.

**Limitation of the study.** First of all, questionnaires were self-administered and described a subjective evaluation. No validated tools were used to assess stress and depression. Secondly, we used a web-based survey that makes selection bias possible, even though the questionnaires were sent to the same cohort of students. Then, we selected a restricted cohort of medical students. For this reason, it is not possible to extend our findings to the general population. Nevertheless, this very select population of medical students provides important information on how young people have perceived the lockdown and the effects that the lockdown has had on their lives. Our case series included a far higher number of women than men but this reflects the sex distribution of medical school students in the classes examined.

Thirdly, we have limited data related to the second administration of the questionnaire because not all the students answered, which can be partly attributed to the short period of administration of the questionnaire. Given the number of students in the cohort it is very likely that the same student has answered both the first and the second questionnaire but being anonymous we are not able to quantify the overlap.

#### **Conclusions**

The long-lasting pandemic has led to stress and anxiety and unhealthy lifestyle changes in young students. This stress has been affecting the student population for an extremely long period of time and will lead to long-term adverse health effects.

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