

Impact of the COVID-19 pandemic on physical activity among university students in Pavia, Northern Italy

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Abstract. *Aim:* To evaluate the University of Pavia students about physical activity (PA) changes before, during and after the COVID-19 pandemic. *Methods:* The International Physical Activity Questionnaires (IPAQ) survey was employed to evaluate the PA in three periods: the pre-pandemic period, during national stay-at-home order (March 9th - May 4th 2020), current PA. Exercise intensity for each period was defined using the Metabolic Equivalent of Task (Met) as unit of measurement. The questionnaire was administered online to university students from June 9th to July 4th 2021, structured in four sections, also collecting demographic data. *Results:* 55,6% of the study population reported a significant decrease in PA during lockdown. The number of active/very active subjects dropped from 72.2% in pre-pandemic period to 29.6% during containment measures. 50% reported a substantial increase in moving out of the lockdown. Stay-at-home order was associated with an increase in sedentary lifestyle (68.5%), which sharply decreased moving out from lockdown (two-third of study population). Average time in minutes spent sitting was 612 before pandemic, 844 during the pandemic and 670 after social restrictions. *Conclusions:* Lockdown had a negative impact on PA among the university students leading to an increase in sedentary behaviours. Following the gradual relaxation of the restrictive measures, situation has improved, without however returning to pre-pandemic level. It is of fundamental importance to study new strategies to promote healthy lifestyles while coping with the on-going pandemic. (www.actabiomedica.it)

Key words: Sedentary Behavior, Exercise, COVID-19

Background

WHO defines physical activity as any bodily movement produced by skeletal muscles that requires energy expenditure. Physical activity refers to all movement including during leisure time, for transport to get to and from places, or as part of a person's work (1). Moderate physical activity of any kind, on a

regular basis, is an important protective factor against metabolic as well as cardiovascular diseases and reduces mortality by 20%-35% (2). Active lifestyles need to be encouraged through information campaigns, educating people on the multiple benefits of a regular physical activity. The Italian National Institute of Health recommends several actions to promote sport, including increasing the amount of time devoted to

physical activity (both in and out of school), organising sporting events in social settings, involving citizens, encouraging physical activities in the workplace as well as promoting the development of urban environments motivating people to take up physical activity (3). Physical exercise leads also to a reduction in public health costs. A study showed that in most countries, the highest health expenditure is determined by cardiovascular diseases, which account for between 12% and 16.5% of total health expenditure. For the remaining non-communicable chronic diseases, expenditure varies from 0.7% to 7.4% (4). According to an estimate, physical inactivity cost international health systems \$53.8 billion worldwide in 2013 (3).

The WHO has established guidelines recommending at least 60 minutes of moderate to vigorous activity per day for children and adolescents; for adults (18 to 64 years) it recommends 150 minutes of moderate intensity or 75 minutes of vigorous activity per week; for the elderly (65 years and older) it recommends physical activity at least three times a week. Physical activity is also classified according to the type of activity (aerobic, strength, flexibility, balance), intensity, which can be moderate (when requires three to six times the amount of oxygen consumed while sitting at rest) or vigorous (when requires more than six times the amount of oxygen consumed while sitting at rest), duration and frequency.

On the basis of the WHO guidelines, three profiles can be defined: a person is defined as physically active when he or she adheres to the physical activity guidelines and performs heavy work that requires considerable physical exertion; a person is partially active if he or she does some physical activity in leisure time without reaching the levels recommended by the guidelines; a sedentary person does not do heavy work and does not perform any physical activity in leisure time. Physical inactivity and sedentary behaviour are important health risk factors. Lack of physical exercise increases the risk of chronic non-communicable diseases such as coronary heart disease, type 2 diabetes mellitus, breast and colon cancer and, consequently, reduces life expectancy. This represents a huge public health problem. Physical inactivity is the fourth most common risk factor for death worldwide and WHO estimates that 1.9 million deaths occur each year due

to insufficient physical activity. To counter this trend, the WHO has implemented a global plan for physical activity from 2018 to 2030 to increase the number of active people and the health threshold worldwide: “*Global action plan on physical activity 2018–2030: more active people for healthier world*” (5). These are policies to support physical activity for a healthier world and aim to reduce physical inactivity by 10% by 2025 and 15% by 2030. Active living is influenced by the socio-cultural context and countless individual variables. The strategies in this plan include several policy and actions. The objectives are: “creating active societies”, to promote knowledge and greater awareness of the multiple benefits of consistently practised physical activity; “create active environments”, to create and maintain places that enable people to access safe spaces in their cities and communities in which they can exercise regularly; “create active people”, to design and deliver age- and lifestyle- friendly programmes and opportunities to encourage healthy living in multiple settings; “create active systems”, to orient governments to promote physical activity and health as much as secure the investments needed to strengthen the work of managing and coordinating physical activity promotion. In 2020, due to the advent of the COVID-19 pandemic, containment measures have undoubtedly caused changes in people’s lifestyle (6), affecting many aspects: mental health was impacted (7) as well as dietary habits, alcohol consumption, gambling (8) and smoking (9). There was a strong impact also on physical activity due to lockdown restrictions that led to the closure of gyms, swimming pools and all sports venues.

This study aims to investigate how the COVID-era changed the level of physical activity practised in a student population during and after the lockdown, compared to the pre-pandemic period.

Methods

The present cross-sectional study was conducted using the IPAQ questionnaire (International Daily Physical Activity Questionnaires), a validated instrument that measures the type and amount of physical activity a subject normally performs (10).

The questionnaire is split into four sections:

one section deals with intense activities (e.g. lifting weights, heavy work in the garden, aerobic activities such as running or cycling at high speed); one section investigates moderate activities (e.g. carrying light weights, cycling at a regular speed, activity in the gym, working in the garden, prolonged physical work at home); one section assesses walking; the last section investigates the degree of sedentariness. Interpreting the data involves calculating the Metabolic Equivalent of Task (Met): a unit of measurement that estimates the amount of energy the body uses during an activity compared to when it is at rest. Met is calculated according to the type of physical activity carried out. We can therefore identify three different formulas: Met for intensive activities formula (minutes * days * 8 Met), Met for moderate activities formula (minutes * days * 4 Met) and Met for activities involving walking formula (minutes * days * [3 Met if moderate/3,3 Met if vigorous/2,5 Met if slow]).

Total Met is then calculated by adding up the Met of intense activity, moderate activity and walking. If the total is less than 700 Met then the subject is inactive, if the total is between 700 and 2519 Met the subject is sufficiently active, if the total is more than 2520 Met the subject is considered active or very active.

In the present study, IPAQ questionnaire was used to assess the degree of physical activity performed by University of Pavia students in three periods: in the period prior to the COVID-19 pandemic, during the first Italian lockdown (March 9th 2020 - May 4th 2020) and at the time of the study (June 2021). Each participant was asked to consent to the processing of their data, in accordance with privacy legislation.

The questionnaire was structured in four sections. The first section was aimed at collecting demographic data: gender, age group, smoking/non-smoking status, area of study, university course, size of the town where the subject lives, work activities in addition to university attendance.

Each of the next three sections shows the IPAQ questionnaire with reference to each of the three periods under analysis.

For each student, the total number of Met scores in the three different phases was then calculated and it was analysed how these varied according to the time period.

The study population included students of the University of Pavia, aged 18 to 34, who completed the online questionnaire in a totally anonymous form in accordance with EU-GDPR 679/2016, from June 9th to July 4th 2021. Data were collected through a questionnaire drafted in the shape of a Google Form and shared through social networks (Facebook and WhatsApp closed groups). Only completely filled-in questionnaires were included in the study.

Results

Seventy-seven questionnaires were compiled, of which 54 were completely filled in. The study population consisted of 42.6% males and 57.4% females. Most of the questionnaires were completed by the age group 18-22 (57.4%) followed by the age group 22-26 (42.6%). One fourth of study subjects were current smokers.

A further distinction was then made on the basis of the university course: more than half of the respondents attended the university course in Exercise and Sport sciences (55.6%), while 44.4% declared themselves enrolled in other degree courses: Medicine (20.4%), Engineering (11.1%), Mathematics (3.7%), Economics (3.7%), Philosophy, Literature and Psychology (1,9%), Communication Sciences (1,9%), Politics Sciences (1,9%). With regard to the size of the town in which they declared to live in, 42.6% of the population answered small town (less than 10,000 inhabitants), 20.4% answered urban centre (between 10,000 and 50,000 inhabitants), 24.1% answered medium-sized city (between 50,000 and 250,000 inhabitants) and only 13% answered large town (more than 250,000 inhabitants), as shown in Table 1.

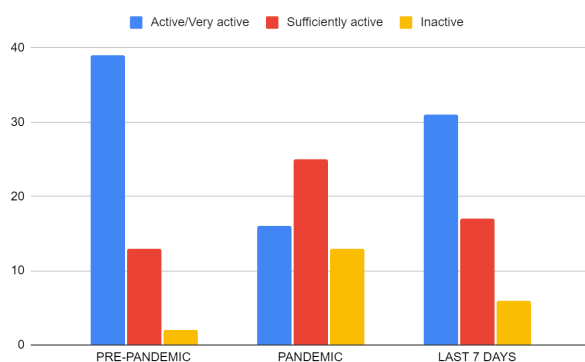
Table 1 reports Met variation over the study periods. In the pre-pandemic period, 72.2% were active/very active, with only 24.1% sufficiently active and 3.7% inactive. Looking at the period during the pandemic, there was a decrease in the number of active/very active subjects, down to 29.6%, with an increase in the number of sufficiently active subjects, 46.3%, and inactive subjects, 24.1%. During the last 7 days, there was an increase in active/very active subjects, 57.4%, with sufficiently active subjects dropping to 31.5% and inactive subjects dropping to 11.1%. Strati-

Table 1 - Different level of physical activity: Met variation and gender stratification

	Pre-pandemic		Pandemic		Last 7 days	
Inactive	2 (3,7%)		13 (24,1%)		6 (11,1%)	
	M	F	M	F	M	F
	1 (4,4%)	1 (3,2%)	4 (14,4%)	9 (29%)	2 (8,7%)	4 (13%)
Sufficiently active	13 (24,1%)		25 (46,3%)		17 (31,5%)	
	M	F	M	F	M	F
	3 (13%)	10 (32,3%)	8 (34,8%)	17 (54%)	5 (21,7%)	12 (38,6%)
Active/Very active	39 (72,2%)		16 (29,6%)		31 (57,4%)	
	M	F	M	F	M	F
	19 (82,6%)	20 (64,5%)	11 (47,8%)	5 (16%)	16 (69,6%)	15 (48,4%)

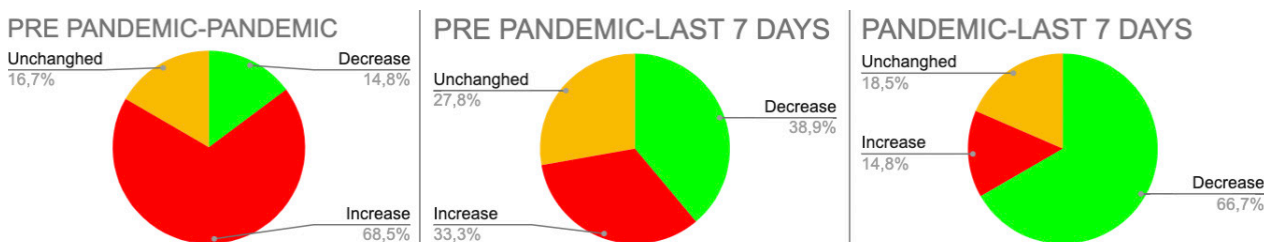
fication based on Met value has been also represented in Figure 1.

The study showed a different level of physical activity between genders. It should be noted that in the pre-pandemic period 82.6% of males were active/very active compared with 64.5% of females. The latter have a higher percentage of sufficiently active subjects, 32.3%, compared to 13% of males. On the other hand, 4.4% of males and 3.2% of females did not engage in enough physical activity and were therefore inactive.

**Figure 1.** Different level of physical activity: Met variation

During the lockdown there is a reduction in physical activity in both genders but males remain more active than females: 47.8% of males were active/very active compared to 16% of females. The majority of females, 54%, remained sufficiently active during the pandemic as opposed to 34.8% of males. Females represent the highest percentage of inactive persons during the lockdown, about 29%, while males represent 14,4%. Referring to the last 7 days before the completion of the questionnaire, it emerges that 69,6% of males have an active/very active lifestyle as well as 48,4% of females. Females were more sufficiently active than males (38.6% vs. 21.7%). As during the pandemic, females are more inactive than males in last 7 days, about 13% of them compared to 8.7% of males.

The questionnaire included questions about the time, in minutes, spent sitting during a working day. The study showed that in the pre-pandemic period the average number of minutes spent sitting was 612, during the pandemic it was 844 minutes and in the last seven days it was 670. We evaluated how this sedentary behaviour changed in the following three transition periods: pre-pandemic/ pandemic period, pandemic/last 7 days, pre-pandemic/last 7 days, as shown in Figure 2.

**Figure 2.** Changes in sedentariness during transitions

As can be seen, the lockdown caused an increase in time spent sitting, compared to before the pandemic, for 68.5% of the study population; only 14.8% of the subjects reported a reduction in sedentariness; instead, for 16.7%, the pandemic did not bring about any change. Figure 2 shows that the end of the lockdown and certain restrictions resulted in a reduction in time spent sitting for 66.7% of the subjects; 18.5% stated that time spent sitting remained unchanged; for 14.8% it even increased. The study also assessed how the advent of the pandemic had modified sedentary behaviour compared to the previous period. From Figure 2 it emerges that 38.9% of the subjects in the study had reduced the time spent sitting in the last seven days compared with the pre-pandemic period; 33.3% declared an increase; finally 27.8% of the sample stated that there had been no significant change.

Discussion

The study found that the pandemic led to a decrease in physical activity among students and an increase in sedentariness during the lockdown period. Interestingly, the intensity of physical activity among the respondents has increased in the recent period following the relaxation of pandemic restrictions, and the distribution in the different intensity categories is again very similar to the pre-pandemic period. However, the percentage of students reporting intense physical activity when completing the questionnaire remains lower than pre-pandemic. These results can be attributed to several reasons: primarily, during the first lockdown, the restrictions in place did not allow people to leave their homes even for a walk: most subjects therefore found themselves working and studying from remote, increasing the time spent sitting and decreasing the amount of time and intensity of their daily physical activity. Another reason that may have contributed to this outcome may have been the impossibility of attending sports centres and facilities such as gyms and swimming pools: people therefore found themselves having to exercise at home, often without having adequate equipment and space available for physical activity at home. All this may have contributed to students' demotivation

since they could have been subjected to the psychological distress arising from the situation, affecting their level of daily physical activity. These findings are confirmed by studies that have already been carried out: an international online survey was launched in April 2019, which included the use of the IPAQ to assess the level of physical activity. From the study conducted by Ammar et al. (11) a reduction in physical activity during lockdown occurred: the number of minutes per day spent on physical exercise decreased by 33.5%, the number of minutes per day spent walking decreased by 34% and the number of hours per day spent sitting increased by 33.5%.

Similarly to our study, a survey (12) of Italian university students was carried out and again showed a decline in physical activity in almost half of the sample examined.

In our study, physical activity during the last seven days was also assessed and showed an increase compared to the lockdown period, although not reaching the levels reported in the pre-pandemic period. This could be attributable to the restrictions still in place at the time the questionnaire was completed, such as the reduced capacity of sports centres, gyms and swimming pools. In contrast, a minority of subjects reported an increased level of physical activity during the pandemic, thus using the restrictive measures as an opportunity to improve their lifestyle. These probably include individuals who had a sedentary job, led a busy life and did not have time to exercise; during the lockdown, they found themselves with more time to spend in physical activity. Some people took advantage of the situation to dedicate a space in their home to exercise, e.g. by turning their garage into a small gym.

With regard to the time spent sitting down, there was a marked increase in the number of minutes during the lockdown compared to prior to it, dictated by the fact that many subjects found themselves in distance learning, unable to leave the house, and thus spending most of their time in front of the television or otherwise sitting on the bed or sofa.

Fortunately, this trend was reversed in the days preceding the completion of the questionnaire for 66.7% of the subjects: this result is to be considered positive in consideration of the negative health effects of a sedentary lifestyle.

Another important factor evaluated is the different level of physical activity between genders: males seem to be more likely active/very active than females. This finding is confirmed by a study (13) conducted on a global level stating that females are more inactive, 33.9%, than males, 27.9%, and that males are more likely to participate in vigorous physical activity than females. In fact, the average total minutes of moderate to vigorous physical activity in males is 35.5 minutes per day compared to 32 minutes for females.

Our study has some significant limitations that must be taken into consideration: first of all, the limited number of answers to the questionnaire (seventy-seven), taking into account that only a part of them was considered valid for the study (fifty-four) by completely filling the questionnaire. Moreover, since the questionnaire was only addressed to students of the University of Pavia, the data collected concern a specific group and are therefore not representative of the general population. Another limitation seems to be the method of diffusion of the questionnaire, exclusively through social networks. Furthermore, the survey was structured to ensure anonymity of participants, without the possibility of tracing back them since no ID or matriculation number was requested.

Among the strengths of the study there is the use of a validated questionnaire, the IPAQ, already used, for example, in a survey by Castañeda-Babarro et al. (14) whose aim was to evaluate how self-reported physical activity and time spent sitting changed during the lockdown in the Spanish population: vigorous physical activity and time spent walking decreased by 16.8% and 58.2% respectively, while time in minutes spent sitting increased by 23.8%.

A further strength of our survey is that the questionnaire was designed in a digital form, which is easy to share and can be filled in from any device, completely anonymously.

Conclusions

Lockdown, social distancing and restrictions still in place are essential measures to counter and reduce the spread of COVID-19 (15). According to the study, there was a sharp drop in the amount of physical activ-

ity practised by University of Pavia students during the lockdown and it is not known how this might affect people's general health and wellbeing in the long run. An increase in physical activity accompanied by a reduction in sedentariness is nevertheless evident at the time of the survey. Although the results of the questionnaire seem not only interesting but also absolutely in line with the COVID-19 pandemic trend, it would be desirable from our point of view to continue the survey with larger and more heterogeneous samples. We know that inactivity and sedentariness are important health risk factors, increasing the risk of developing chronic non-communicable diseases and mental health distress (16). It is therefore of fundamental importance to study new strategies to educate the population, encouraging people to practice physical activity and a healthy lifestyle. In this sense, both institutions, through programmes and information campaigns, and Exercise and Sport Sciences professionals, in their daily practice, can make a great contribution.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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