Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Impact of Coronavirus disease-19 (COVID-19) lockdown on physical activity and energy expenditure among physiotherapy professionals and students using web-based open E-survey sent through WhatsApp, Facebook and Instagram messengers

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ABSTRACT

Background: Coronavirus disease - 19 (COVID-19) spread throughout the world and become pandemic. To stop and control the rapid infection of COVID-19 lockdown is the best option. Sudden lockdown implies change in entire lifestyle of the population. Social isolation affects individual's lives by greater reduction in their physical activity, which might increase the chance of infection by reducing immunity. To what extent, the physical activity is reduced during this lockdown period among physiotherapy professionals, and students who propagate physical activity is not known. Hence, we aimed to evaluate the impact of the COVID-19 lockdown on physical activity level and energy expenditure among physiotherapy professionals and students.

Material and methods: One hundred and forty three volunteered physiotherapy professionals and students participated in web-based open E-survey. The survey was carried out by sending the Google Forms link for International Physical activity questionnaire-short form (IPAQ-SF) through social networking sites using Google Forms to gather the amount of PA before and during COVID-19 lockdown period and analysed using Wilcoxon signed rank test.

Results: Among identified 261 potential survey participants, 143 responded, reaching a response rate of 54.8%. Total physical activity before and during COVID–19 lockdown period were 7809.7 (3849.7–11769.8) MET-min/week and 4135.7 (867.2–7404.1) MET-min/week; $p < 0.0001$. While energy expenditure before and during COVID–19 lockdown period were 8189.8 (4242.1–12137.6) kcal/wk and 4221.7 (1004.6–7438.8) kcal/wk; $p < 0.0001$.

Conclusion: A significant reduction in self-report physical activity and energy expenditure levels were observed among physiotherapy professionals and students during the COVID–19 lockdown period.

1. Introduction

Novel Coronavirus is a global epidemic, 2020 is the infectious year worldwide because of the outbreak of this viral respiratory disease. Most of the countries are affected with infectious diseases caused by a recently discovered coronavirus. COVID-19 (coronavirus disease 2019) originated from Wuhan (Hubei, China), and spread throughout the world with rapid infection and deaths.[1] COVID-19 was acquired from 3-bronchoalveolar lavage sample of a patient on December 30, 2019 in Wuhan Jingintan hospital.[2] Further this Virus was found and isolated in lung and intestinal tissues of the challenged animals.[3] Due to lack of immunity, the virus is more susceptible to the individuals.[4] This virus is spreading continuously in all over the world according to analysis published on March 22, 2020 by the COVID-19 study group. According

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to study by epidemiologist in U.S. reported that India could see 1.3 million cases in the mid of May if virus continue to spread at this rate.[5] Although human corona virus has been recognized for many years, COVID-19 was a new strain and its wide global spread among the public become panic. The Virus is transmitted by inhalation or contact with infected droplets and incubation period ranges from 2 to 14 day.[6] India, reported its first COVID-19 patient on January 31, 2020. At the end of January 2020, In China approximately 9720 diagnosed cases and 213 deaths reported while in the other 19 countries, 106 confirmed cases were found.[6] On January 30, 2020, World health organization (WHO) declared a public health emergency to outbreak the novel corona virus (2019-nCoV).[7] In the end of February 2020, the global risk level of COVID-19 reported very high, with reporting 83,652 confirmed cases and 2858 deaths globally while in India, 03 confirmed cases reported.[8] In the mid of March the number becomes double 153,517 confirmed cases with 5735 deaths while, in India it increases 107 confirmed cases and 02 deaths.[9] At the end of March, globally confirmed cases increases up to 750,890 with 36,405 deaths and in India 1071 confirmed cases and 29 deaths.[10] According to recent updates (16 April) of WHO, globally confirmed case increases up-to 1,991,562 with 130,885 deaths while in India it 12,380 confirmed case and 414 deaths.[11]

Due to continuing spread of COVID-19, the Indian government announces lockdown to prevent individuals from exposure to infection of COVID-19. Due to lockdown, limiting outdoor activities and regular physical activity and exercises will affect the daily activities of most of the individuals.[5] Studies reported that staying home at the prolonged time might lead to sedentary behaviors, such as spending more time on sitting activities, playing games. Watching television, decreasing regular outdoor activity and exercises leads to an increased risk of chronic health conditions.[12] In the absence of protective vaccination social distancing or lockdown strategy was used by the government, implementing travel bans, closing crowded public places and school/colleges.[13]

The applicability of lockdown due to COVID-19 not only affects people's mental health but also affecting their physical health due to reduce activity in their daily routine. Previous studies reported that approximately 35% of individuals experiencing psychological stress. Among them, female shows higher (24.87 ± 15.03) psychological stress than male (21.41 ± 15.97).[14] Another study reported on the magnitude of mental health among healthcare workers who are treating COVID-19. They found that among 68.7% of health-workers, depression (50.4%), anxiety (44.6%), insomnia (34.0%) and distress (71.5%) were reported.[15] However, long-term physical inactivity may reduce the immune function of the individuals and can affect the normal physiological system of the body.[4,16,17] Meanwhile, individuals can be affected by multiple infections, drowsiness, lethargic, obesity and other psychological problems due to physical inactivity. Therefore, it is essential to understand the potential physical inactivity due to lockdown COVID-19 among physiotherapy professionals and students who propagate physical activity. We hypothesize that there will be no change in physical activity and energy expenditure among physiotherapy professionals and students during the lockdown period when compared to their before lockdown period as the null hypothesis, and there will be a significant change as the alternate hypothesis. The present study aimed to gather information regarding the impact of lockdown due to COVID 19 on physical activity and energy expenditure among physiotherapy professionals and students.

2. Methods

2.1. Ethical statement

The web-based open E-survey research was not submitted for the approval by the students' project committee and the institutional ethics committee (IEC) of Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation, Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala District, Haryana due to COVID-19 lockdown. But we ensured that the study was performed according to the principles laid by, declaration of Helsinki (Revised 2013), Council for International Organizations of Medical Sciences (CIOMS) guidelines, International ethical guidelines for health-related research involving humans (2016) and National guidelines for biomedical and health research involving human participants (2017). The purpose of the survey, introduction and about the length of the survey was added within the web-based open E-survey. A successful return of completed survey was considered as consent by the participant. No separate statement for consent was asked within the survey questionnaire.

2.2. Sample and design

A cross-sectional online survey was sent to physiotherapy professionals and students during COVID-19 lockdown period in the month of March 2020 and April 2020. Students who are pursuing Physiotherapy course (Undergraduate, Interns, Postgraduate and Doctorate in physiotherapy) were included in the study. Clinicians, academicians and researchers were also included in the study by a simple random sampling method. Physiotherapist students and professionals who are not willing to spare time for filling survey questionnaires, who do not have an account in social networking sites such as Facebook, WhatsApp, and Instagram and who do not have smartphone were excluded from the web-based open E-survey.

2.3. Survey development

A series of questionnaires were created for the survey, based on International Physical activity questionnaire-short form (IPAQ-SF) for young and middle-aged adults. The Survey contained three sections. The first section include a series of demographic questions, the second section of survey comprised of physical activity before the lockdown period, and the third section of survey comprised of physical activity during the lockdown period. Demographic related questions included in the survey were age, weight, gender, and subjective statements which includes, fear regarding COVID-19 and reduction of physical activity due to COVID-19 lockdown. Thus, the first draft of web-based open E-survey questionnaire was drafted.

2.4. Validation of questionnaires

The first draft of web-based open E-survey questionnaire was not subjected to content validation by a panel of experts as IPAQ-SF was an already validated tool. Thus the final web-based open E-survey has 18 questions; four questions were related to demographics, seven questions of IPAQ-SF for evaluating physical activity before the COVID-19 lockdown period and remaining seven questions of IPAQ-SF for evaluating physical activity during COVID-19 lockdown period.

2.5. Administration of survey

The study was executed by sending the online link (https://forms.gle/cRsWuc1REDAVWRXu8) to Physiotherapy students and professionals through social networking sites such as Facebook, WhatsApp, and Instagram. 261 potential participants were identified and E-survey link was sent to them through the messaging services. Return of the completed questionnaire was considered as consent for participation in survey. The Survey was administered using the online survey portal, Google forms® (Online survey services). As people are mostly active on social networking sites and messengers when compared to frequent checking e-mails, social networking sites were used for circulating the survey questionnaire. The reminder survey link was sent to them, if response was not received within a period of two weeks. Internet Protocol (IP) address of the participant's computer or smartphone was used to identify potential duplicate entries from the same user. Web-

Table 1
Physical activity before and during lockdown period.

Physical activity	Before lockdown period (MET-min/week)[a]	During lockdown period (MET-min/week)[a]	Mean Percentage (%)	p-value[b]
Vigorous	2727.3 (1814.6–3639.9)	1165.2 (660.7–1669.7)	- 57.3	< 0.0001
Moderate	1994.3 (41.7–4030.3)	728.2 (427.4–1028.9)	- 63.5	< 0.0001
Walking	3088.2 (155.1–6331.5)	2242.3 (973.7–5458.2)	- 27.4	< 0.0001
Sitting	332.9 (201.6–464.3)	1255.3 (103.6–2614.1)	+377.1	< 0.0001
Total	8142.7 (4173.3–12112.1)	5390.9 (1862.4–8919.4)	- 33.8	< 0.0001
Total WoS	7809.7 (3849.7–11769.8)	4135.7 (867.2–7404.1)	- 48	< 0.0001

Note.
Abbreviation:WoS – Without sitting.
[a] Expressed in Mean (95% Confidence Interval).
[b] Wilcoxon Signed Rank test.

based open E-survey is cost-effective, eco-friendly, time-saving and practically feasible during the COVID-19 lockdown period.

2.6. Sample size estimation and recruitment

The required sample size for this cross-sectional study was estimated by using the formula for estimating proportion: $n = Z\alpha^2 P(1 - P)/d^2$, where $Z\alpha = 1.96$; $P = 90\%$ as the response rate of the online survey, and $d = 5\%$. Thus, the minimum number of participants required for this study was estimated to be 139. The incomplete submission of survey questionnaire was not possible due to the function in Google Forms which prevent submission of partially answered or filled questions, increasing the required sample size by 5% or 10% was not required. Hence, when the survey responses hit 139 and above, the web based open E-survey link has closed for accepting further responses and analysed.

2.7. Calculation of physical activity and energy spent

2.7.1. Estimating physical activity level

Based on IPAQ-SF, the physical activity was classified into four categories as, vigorous activity, moderate activity, walking and sitting. From the time spent (in minutes) for each of the above physical activity, utilized MET for the particular physical activity was estimated by multiplying MET with time spent. Similarly MET utilized for particular week was calculated by multiplying with the number of days in which the following physical activity performed. Thus, MET-min/wk was estimated. For estimating MET-min/week, the following MET values recommended by the American college of Sports Medicine (ACSM) were used, sitting – 1.5 METs; walking – 3.3 METs; moderate activity – 4.0 METs and vigorous activity – 8.0 METs.

2.7.2. Estimating energy expenditure

Energy expenditure during the physical activity was expressed in kilocalorie. One kilocalorie is the amount of energy required to increase the temperature of 1 kg of water by 1 °C. MET is converted into kcal/min in guidance with ACSM's formulae, 1 kcal/min = [(METs X 3.5 mL/kg/min X body weight in kg) ÷ 1000]. From this basic formulae, kcal/day or kcal/wk was calculated as adopted for MET-min/wk.

Thus, the amount of physical activity expressed in MET-min/wk and energy spent expressed in kcal/wk were compared before and during the lockdown period due to COVID-19.

2.8. Data analysis

Response rate (RR) of the survey was calculated using the formulae, RR = [(No. of survey participants responded ÷ total no. of potential survey participants contacted) × 100]. The Gaussian distribution of the collected online survey data were analysed using Kolmogorov–Smirnov test. As Gaussian distribution of the collected data were not verified, the central tendency and dispersion of continuous variables which included, age and weight were expressed in mean with 95% confidence interval (CI) and mean [standard error of the mean (SEM)] in Error Bar. Categorical data were reported in frequencies as percentages and sample size (n). Wilcoxon signed rank test was used to compare levels of physical activity before and during the pandemic. For all the analyses, the level of significance was set at 0.05 to minimize Type 1 error. The above statistical analysis was performed using the statistical software, IBM SPSS Statistics for Windows 10, version 20 (IBM Corp., Armonk, N.Y., USA).

3. Result

By contacting 261 potential participants, total 143 survey responses were recorded. Hence, the response rate (RR) was found to be 54.8%. The mean with 95% CI of age and weight of the survey participants were 23.9 (23–24.8) years and 60.9 (58.9–62.9) kg respectively. Physical activity expressed in (MET-min/week) before and during the lockdown period is tabulated in Table 1 as mean (95% CI) and as mean (SEM) in Error Bar (including sitting activity in Fig. 1 and without sitting activity in Fig. 2). While energy expenditure (kcal/wk) before and during the lockdown period is tabulated in Table 2 and as mean (SEM) in Error Bar (including sitting activity in Fig. 3 and without sitting activity in Fig. 4). There exists statistical significance ($p < 0.0001$) before and during lockdown period in physical activity and energy expenditure.

4. Discussion

The web-based open E-survey was designed with reference to previous online survey studies.[18,19] This research paper describes a sample of physiotherapy students and physiotherapy professionals to report the impact of COVID19 on their physical activity and energy expenditure before and during the lockdown period. Web-based open E-surveys are easy to implement, and less time-consuming method used for gathering information.[20] Simple random sampling was performed in the study, and a reminder related to the survey was sent to the various groups of physiotherapy students and professionals through WhatsApp, Facebook and Instagram messenger. The survey took about 10 min to complete. A total of 143 physiotherapy students and professionals' participated in the study through a link sent on WhatsApp, Facebook, and Instagram. This method was adopted to obtain a maximum response within shorter timeframe. IPAQ-SF[21] was modified and used for this online survey to gather the information. IPAQ-SF divided into four categories; vigorous physical activity, moderate physical activity, walking, and sitting.[21] The study proved alternate hypothesis as there is significant difference ($p < 0.0001$) in physical activity and energy expenditure among physiotherapy professionals and students during the lockdown period when compared to their before lockdown period.

The study findings revealed that physiotherapy students and professionals performed more vigorous physical activity before the

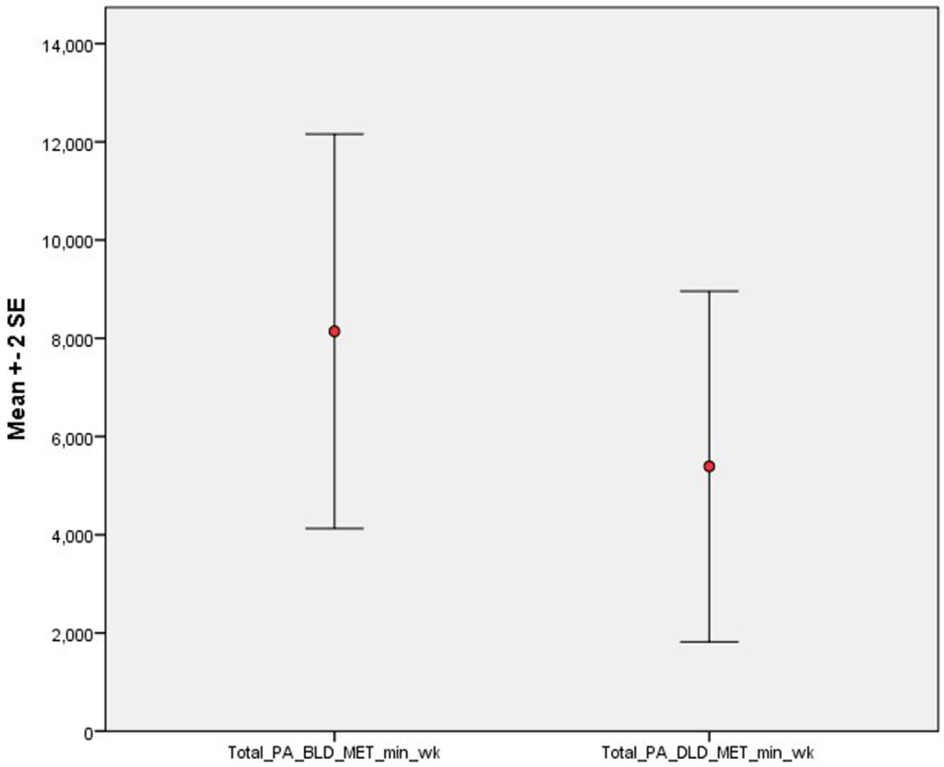

Fig. 1. Physical activity (MET-min/week) before and during lockdown period expressed in mean and standard error of the mean.

lockdown period (2727.3 MET-min/wk) and vigorous activity decreased (−57.3%), as compared to the lockdown period (1165.2 MET-min/wk). Moderate physical activity is also decreased (−63.5%) in the lockdown period (728.2 MET-min/wk), as compared to the before lockdown period (1994.3 MET-min/wk). Walking was also affected (−27.4%) during the lockdown period (2242.3 MET-min/wk), as compared to the walking before the lockdown period (3088.2 MET-min/wk). The sitting activity was also affected and increased (+377.1%) during lockdown period (1255.3 MET-min/wk) as compared to the sitting activity before lockdown period (332.9 MET-min/

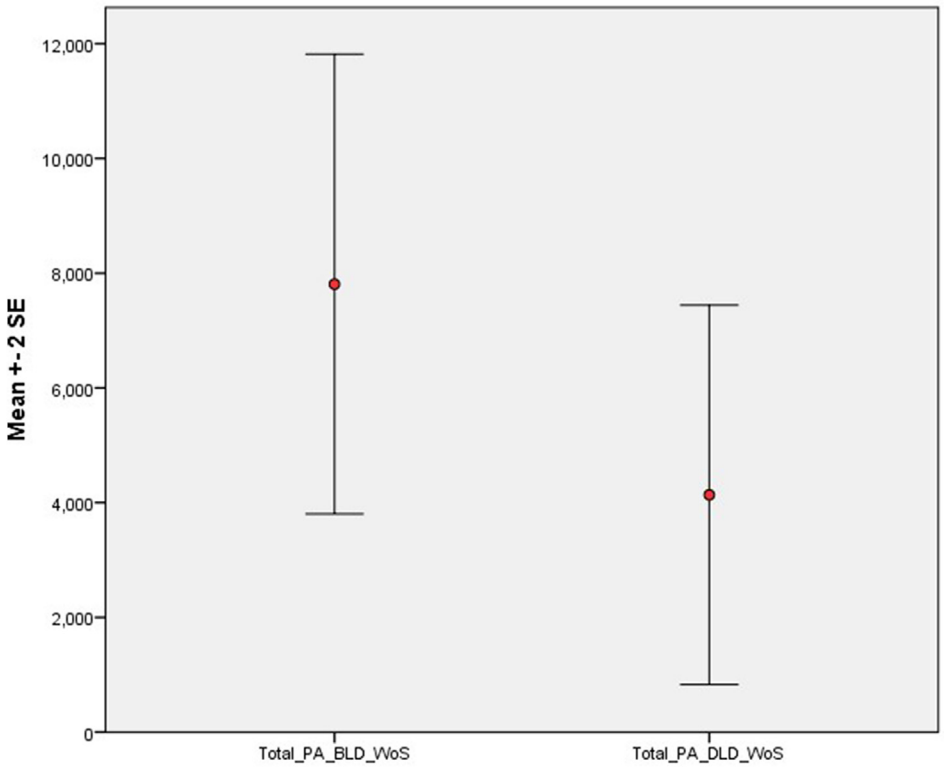

Fig. 2. Physical activity (MET-min/week) before and during lockdown period (without sitting activity) expressed in mean and standard error of the mean.

Table 2
Energy spent before and during lockdown period.

Energy	Before lockdown period (kcal/wk)[a]	During lockdown period (kcal/wk)[a]	Mean Percentage (%)	p-value[b]
Vigorous	2861.8 (1962.9–3760.8)	1264.7 (672.3–1857.1)	- 55.8	< 0.0001
Moderate	2110.9 (39.2–4182.7)	722.9 (432.1–1013.9)	- 65.8	< 0.0001
Walking	3217.1 (4.9–6429.3)	2234.1 (916.7–5384.8)	- 30.5	< 0.0001
Sitting	358.5 (210.7–506.3)	1408.3 (144.5–2961.1)	+ 392.8	< 0.0001
Total	8548.4 (4590.9–12505.7)	5630.0 (2071.3–9188.8)	- 34.1	< 0.0001
Total WoS	8189.8 (4242.1–12137.6)	4221.7 (1004.6–7438.8)	- 0.49	< 0.0001

Note.
Abbreviation: WoS – Without sitting
[a] Expressed in Mean (95% Confidence Interval).
[b] - Wilcoxon Signed Rank test.

wk). Without considering sitting component, the physical activity was decreased (−48%) during the lockdown period (413 MET-min/wk) as compared to the before lockdown period (780 MET-min/wk). Overall, physical activity was higher before the lockdown period (8142.7 MET-min/wk) and decreased (−33.8%), compared to the physical activity during lockdown period (5390.9 MET-min/wk), with significance difference ($p < 0.0001$). Statistically significant differences were noted in individual component of physical activity (Vigorous, moderate, walking, and sitting) before and during lockdown period ($p < 0.0001$). Total physical activity before and during COVID–19 lockdown period were 7809.7 (3849.7–11769.8) MET-min/week and 4135.7 (867.2–7404.1) MET-min/week; $p < 0.0001$, (48% reduction) as shown in Table 1.

Energy expenditure is also decreased before and during the lockdown period. Energy expenditure during the lockdown period was (1264.7 kcal/wk), which is almost decreased (−55.8%) as compared to the energy expenditure following vigorous activity before the lockdown period (2861.8 kcal/wk). Energy expenditure followed by moderate physical activity was also decreased (−65.8%) during the lockdown period (722.9 kcal/wk) as compared to the before lockdown period (2110.9 kcal/wk). Energy expenditure during walking was decreased (−30.5%) during the lockdown period (2234.1 kcal/wk) as compared to the before lockdown period (3217.1 kcal/wk). Energy expenditure during sitting was increased (+392.8%) during the lockdown period (1408.3 kcal/wk) as compared to the before lockdown period (358.5 kcal/wk). Overall energy expenditure was decreased (−34.1%) during the lockdown period (5630.0 kcal/wk) as compared to the before lockdown period (8548.4 kcal/wk), shown in Table 2. Statistically significant difference was noted in the individual components of physical activity (Vigorous, Moderate, Walking, and sitting) before and during lockdown period ($p < 0.0001$). Energy expenditure during COVID–19 lockdown period were 8189.8 (4242.1–12137.6) kcal/wk and 4221.7 (1004.6–7438.8) kcal/wk; $p < 0.0001$ were observed without sitting component. There were approximately 49% reduction of energy expenditure, as shown in Table 2.

A previous study was conducted to estimate physical activity levels in college-going students.[18] They included students of different professions, including physiotherapy students too. They found comparable results with our study that students from other professions (engineering, management, etc.) doing more vigorous activity as compared to the students of other professions. The mean of vigorous physical activity of physiotherapy students in their study was 237 MET-min/wk.

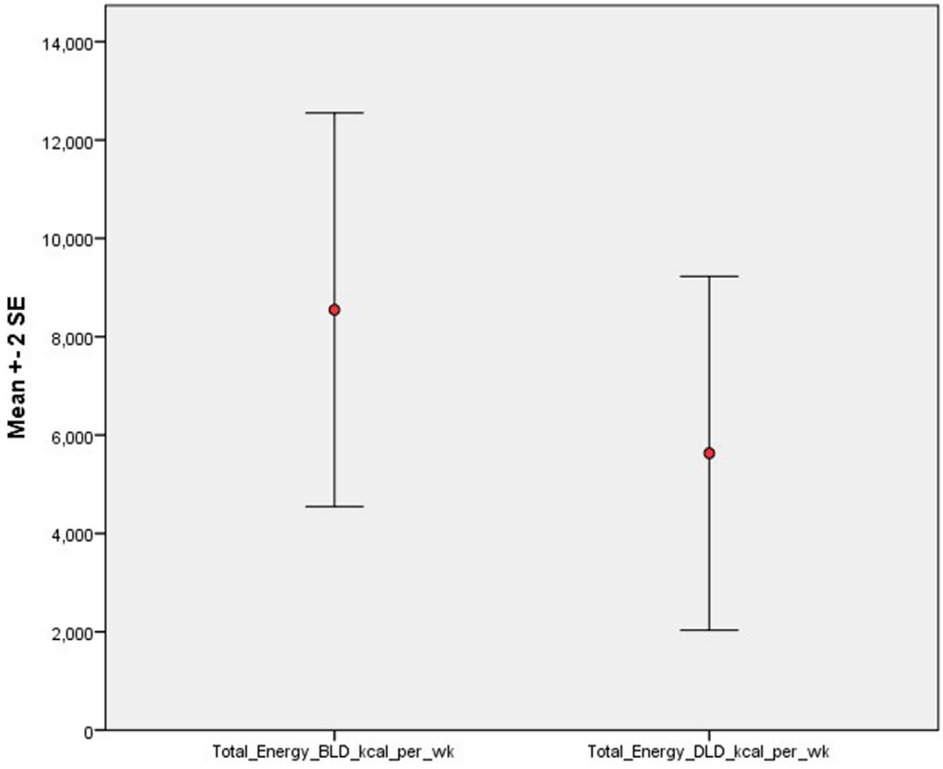

Fig. 3. Energy expenditure (kcal/week) before and during lockdown period expressed in mean and standard error of the mean.

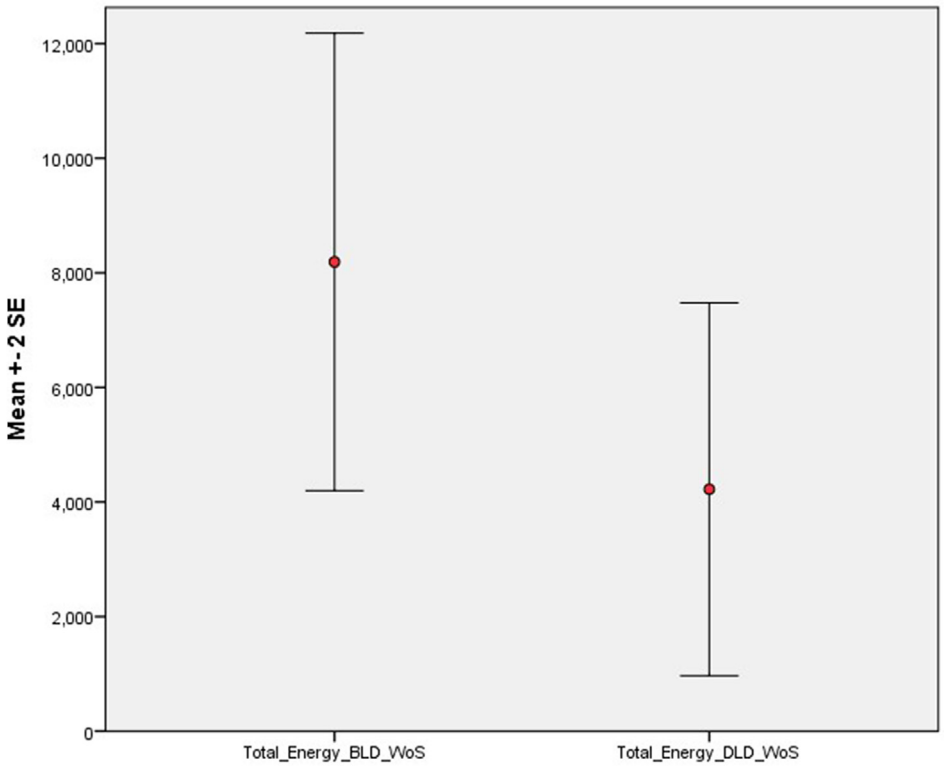

Fig. 4. Energy expenditure (kcal/week) before and during lockdown period (without sitting activity) expressed in mean and standard error of the mean.

The mean of moderate physical activity was 109 MET-min/wk. The mean of sitting component was 38 MET-min/wk, and mean of walking component was 50.6 MET-min/wk for physiotherapy students. The total mean physical activity of physiotherapy students in their study is 435 MET-min/wk. Physical activity level was decreased in physiotherapy students as compared to the students of other profession.[18]

Physical activity is composed of individual, task and environmental factors. Social isolation due to lockdown is believed to affect health behaviours through their impact on social support for behaviour choices.[22] The results of our study show that approximately 50% of physical activity was reduced in the individuals, so we assume that there might be chance of reduced the immunity level as decrease in physical activity can lead to decrease in immunity. This findings can be supported by study that shows individuals who are stayed at home or lonely are found to be less active.[23] Social isolation was significantly associated with physical activity so individuals who are in social isolation are less physically active and also more likely to report multiple health risk behaviours.[24] Various studies has been suggested that physical activity has positive as well as negative impact on immune system. Regular physical activity can reduces the days of sickness and also reduces the risk of upper respiratory tract infection.[25] Exercise is thought to boost the immune system and thus reduces the risk of infection in long term. Moderate endurance exercises enhances number of immunological indices such as T-cell count and immunoglobulin level.[26] Decrease in physical activity can affect the physiological systems of the body. It might affect the physiological process of cardiovascular function, insulin sensitivity, cholesterol level, obesity and hypertension.[27–31] The physical activity is accompanied by environmental and competitive stress that leads to adverse changes in several immunological indices and can increase the risk of upper respiratory tract infection.[26] Susceptibility to infections can be due to rapid mutations of virus and this could reduce the immunity. Physical activity might enhance the immune functions and thus reduce the risk of infection.[26] A study found that, 5 min of regular stair running can cause an immediate increase in the number of natural killer cells.[32] Catecholamine mediated decrease of cell margination may contribute to the increased count of natural killer cells.[33] Physical activity improves insulin resistance, decreases hyper-insulinaemia and reduces the risk for diabetes and cancers.[34,35] Researchers suggested that recurrence risk of cancers in woman might be reduced by engaging more than 4.5 MET hours/week of recreational physical activity included approximately 2–3 h per week of brisk walking.[36] Sedentary lifestyle in younger age can lead to chronic disease in adulthood.[37] Changes in immune response due to exercise affected by exercise duration, intensity, sex and age.[38] Regular moderate exercise can enhance immune response. Studies reported that exercise training affects the immunity by natural cytotoxicity and T lymphocyte proliferation reducing stress induced antibody formation,[39] and increase counts of T-cells, B-cells and immunoglobulins.[4,40] So by participating in regular physical activity would be beneficial for preventing from the chance of infection and lowering the risk of immunity.[4]

The web-based open E-survey method of study was adopted because nowadays people are mostly using social network sites and messenger. The strengths of this study were that the method of survey was cost-effective, minimally time consuming, easily accessible to participants, and eco-friendly. The small sample size, unequal distribution of physiotherapy students and professionals were limitations of our study. Future studies should target larger sample size, medical professionals, and individuals of other profession, pediatric and geriatric populations. Future studies should also include other outcome measures for measuring physical activity and energy expenditure of the target population. The study highlights physical activity and energy expenditure levels among physiotherapy students and professionals before and during the lockdown period.

5. Conclusion

About 48% of physical activity and 49% energy expenditure were decreased in physiotherapy professionals and students during the lockdown period when compared to their before the lockdown period.

The feasibility of this online survey in documenting physical activity and energy expenditure levels before and during the lockdown period among physiotherapy professionals and students has been verified.

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Declaration of competing interest

None.

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