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Association of Covid-19 Infection with Physical Activity and Food Intake; Mashhad PERSIAN Cohort Results

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ABSTRACT

Introduction: The emergence of the COVID-19 pandemic in December 2019 had a profound impact on global public health. This study investigates the effects of the coronavirus on dietary intake and physical activity among the Mashhad PERSIAN cohort population in Mashhad, Iran.

Method: This nested cohort study was done among the PERSIAN Cohort Study in Mashhad University of Medical Sciences population who confirmed COVID-19 infection through PCR testing. Participants were assessed for physical activity using the International Physical Activity Questionnaire (IPAQ) short form, as well as changes in appetite and food intake during the COVID-19 infection. All measurements were compared during the disease period to pre-infection.

Results: This study comprised 381 confirmed COVID-19 patients (average age of 42.51 ± 7.31 years) of which 154 (40.4%) were male. There was a significant reduction in the levels of vigorous and moderate physical activity, walking, and total sitting time (P<0.001 for all). Also, food intake was reduced during the COVID-19 infection compared to before the infection.

Conclusion: In summary, this study demonstrates a significant decrease in physical activity and food intake during COVID-19 infection.

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Introduction

In December 2019, an unknown-cause pneumonia outbreak occurred in Wuhan, Hubei Province, China, which alarmed the medical and scientific community. The causal culprit was ultimately identified as SARS-CoV-2, a new beta coronavirus that targets the lower respiratory system and causes bilateral pneumonia in humans (1). The World Health Organization (WHO) has given the name this pathology COVID-19, and it has infected and injured thousands of human beings worldwide. Many countries, including Spain, Italy, Brazil, Chile, and Colombia, have taken extraordinary measures. Quarantine, or the entire confinement of the populace in their houses, has been one of these containment strategies. This, however, has caused interruptions in most daily activities, including lifestyle aspects like nutrition and physical activity (2).

A healthy diet, according to the World Health Organization and the Spanish Academy of Nutrition and Dietetics (2020), can aid in disease prevention and treatment (3). The population's diet quality and their health have a strong relationship (4). It's worth mentioning that obtaining fresh food during quarantine periods may be challenging, and there may be shortages of certain food products. The Food and Agriculture Organization (FAO) acknowledges that the COVID-19 epidemic has disrupted global food supply systems, impacting both supply and

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demand. Furthermore, COVID-19 has increased social inequalities, with the poorest households bearing the brunt of the burden (2).

While quarantine and physical isolation have positive effects on preventing and reducing the transmission of the virus and protecting individuals' physical health, these measures can have long-lasting and widespread negative psychological impacts (7-5). Several studies have demonstrated various negative psychological effects of social isolation, including higher levels of anxiety, stress, fear, and even symptoms of depression that can persist beyond the isolation period (8-5). Positive social connections are important human requirements, and their deprivation may result in social cravings akin to food desires (9). As a result, physical isolation and quarantine may interfere with vital psychological requirements. They can make it challenging for people to try out and build interpersonal connections and relationships, as well as to self-regulate their activities (10).

Adequate physical activity leads to a reduction in the incidence of hospitalization related to COVID-19. Interestingly, engaging in at least 150 minutes per week of moderate-intensity aerobic activity, 75 minutes per week of vigorous-intensity aerobic activity, or an equivalent combination of moderate and vigorous activity, is associated with a 34.3% lower prevalence of COVID-19 and hospitalization due to COVID-19 (11).

This study aimed to investigate the relationship between COVID-19 infection with physical activity and dietary intake.

Materials and Methods

This study had a nested cohort design that was done among the Prospective Epidemiological Research Studies in Iran (PERSIAN) Cohort Study in Mashhad University of Medical Sciences) study population. The PERSIAN cohort study of Mashhad City is currently being implemented among Mashhad University of Medical Sciences employees. This population-based prospective organizational cohort study was conducted among participants aged 30 to 76 in Mashhad, Iran, as part of the "PERSIAN Cohort" research project (12). All Mashhad PERSIAN cohort population who confirmed COVID-19 infection through PCR testing was enrolled before the vaccination. Between 2 and 8 weeks after recovery, people were referred to the Mashhad PERSIAN cohort center and were evaluated for physical activity, anorexia, and reduced food intake during disease duration and compared with the collected data from before the disease.

The level of physical activity was assessed using the International Physical Activity Questionnaire (IPAQ) short form for one week (13). This questionnaire's reliability and validity in PERSIAN have been confirmed (14, 15). The frequency and duration of their exercise, their level of activity (vigorous, moderate, or strolling), and the amount of time they had spent sitting during the preceding seven days were also evaluated. Appetite levels and changes in food intake (evaluated through a 4-item dietary recall assessment (16)) were assessed during COVID-19 infection and compared to before the onset of COVID-19.

Statistical Analysis

All statistical analysis was done, using SPSS statistical software version 23. The normal distribution of the variables was evaluated by the Kolmogorov-Smirnov test. Qualitative and quantitative variables were described as frequency by percentage and mean ±standard deviation respectively. Quantitative variables were compared before and during corona infection by student paired t-test. The comparison of the qualitative variables in the two mentioned periods was made by the McNemar test. The significance level was considered less than 0.05.

The Mashhad University of Medical Sciences ethics committee approved the protocol of the study (IR.MUMS.MEDICAL.REC. 1400.631). Informed consent was completed by all participants before the study.

Results

The baseline characteristics of the study population are summarized in Table 1.

A total of 381 confirmed COVID-19 infected patients (mean age of 42.51±7.31 years) enrolled in to study. Among the participants, 154 individuals (40.4%) were male.

As indicated in Table 2, there was a significant reduction in the levels of vigorous and moderate physical activity, walking, and total sitting time compared to before the onset of COVID-19 ($P<0.001$ for all).

Table 3 shows the amount of oral food intake compared to before the onset of COVID-19. Most of our study participants reported a decreased

food intake during the period of disease. Specifically, 80% of them received only half or less than 50% of their usual food intake during COVID-19 infection. Only 2.9% of participants received 100% of their usual food intake.

Table 1. Characteristics and clinical outcomes of patients with COVID-19

Characteristic	Age, years	Gender, n (%)		Last Education, n (%)								Height (cm)
		Female	Male	Elementary	Middle school diploma	Diploma	Associate Degree	Bachelor	Master Degree	PHD	Illiterate	
N=381	42.51±7.31(30-76)	227(59.6%)	154(40.4%)	8(2.1%)	1(0.3%)	42(11%)	36(9.4%)	184(48.3%)	72(18.9%)	38(10%)	0(0%)	164.06±9.81(140-189.5)

Table 2. Association between COVID-19 infection and physical activity in the pre-and post-COVID-19 infection periods

	Before COVID-19 infection	After COVID-19 infection	P Value
Intense physical activity (min/day)	92.57±84.32	5.90±40.02	<0.001
Moderate physical activity(min/day)	135.89±107.05	18.24±53.35	<0.001
Walking physical activity (min/day)	36.23±18.50	4.08±13.56	<0.001
sitting (min/day)	406.40±141.64	311.21±168.18	<0.001

Paired t-test (The mean of physical activity in each level were compared before and after COVID-19 infection by paired t-test.)

Table 3. Association between COVID-19 infection and food intake during COVID-19 infection compared to before the onset of COVID-19.

	Number	Percent
No amount of food (%) 	92	24.1
25% of food (%) 	55	14.4
50% of food (%) 	157	41.2
75% of the food (%) 	66	17.3
100% or all food (%) 	11	2.9
Total	381	100

Discussion

Physical Activity

The results of this study showed a significant reduction in vigorous and moderate physical activity, as well as walking, and total sitting time during the period of COVID-19 infection compared to before the onset of COVID-19. The reported decrease in sitting time among individuals after contracting COVID-19 was attributed to spending more time lying down and resting during their illness.

Numerous studies have highlighted exercise as a protective factor against the disease (17). This protective factor has been associated with reduced mortality, improved lung function, and alleviation of disease symptoms (17). Our findings align with those of a conducted study by Antunes et al. (2020) which demonstrated that COVID-19 quarantine measures may lead to reduced physical activity levels in individuals (10). Conversely, the results of a cross-sectional study by Lesser et al. (2020) showed significant

changes in physical activity behavior between active and inactive participants since the implementation of COVID-19 restrictions. Among inactive individuals, 40.5% reported a reduction in physical activity levels, whereas only 22.4% of active individuals experienced decreased activity levels. Interestingly, 33% of those who were inactive got more active, while 40.3% of active people increased their physical activity even further (18).

In 2020, Grazia Maugeri and colleagues conducted a cross-sectional study on physical activity during the COVID-19 pandemic. They found that individuals with low physical activity levels before the pandemic increased their activity during the quarantine, while highly active and moderately active participants reduced their exercise. Overall, physical activity significantly decreased across different age groups. The study's results align with our findings, emphasizing the decrease in physical activity levels among highly active and moderately active individuals during the pandemic. The imposed quarantine restrictions compelled many people, especially those who were typically more active; to reduce their regular physical activity levels (19). Furthermore, in a systematic review, a majority of studies reported a decrease in time spent in all physical activity subgroups, including light, moderate, vigorous, and walking (if specified), during the relevant quarantine period. Additionally, an increase in sedentary behaviors was observed across various populations, including children and patients with different medical conditions (20).

While publications on the influence of the COVID-19 pandemic on physical activity have been published, no research concentrating on the COVID-19 infection impacts on physical activity has been reported.

The present study showed a significant decrease in food intake during COVID-19 infection compared to before infection. There was no similar study to compare food intake during COVID-19 infection with before infection. Dietary patterns and the amount of food intake during COVID-19 widespread among healthy individuals have been investigated in previous research.

Regarding the association of COVID-19 infection on food intake and nutrition, there were a total of 1,383 studies, out of which 6 articles were similar to our study (2, 21-25).

Dietary pattern research revealed that the COVID-19 dietary pattern consumed more energy and had lower dietary quality than pre-COVID-19 dietary patterns. In terms of food composition, the COVID-19 food basket contained fewer beverages (particularly alcohol and coffee), a slight increase in the availability of eggs and red meat, and a significant increase in plant-based foods (particularly processed vegetables, fruits, nuts, and pasta/rice) when compared to food baskets in 2019. However, intake of plant-based food products remained below the dietary standards' suggested levels, while consumption of red meat remained high. The COVID-19 diet's daily energy intake was 2,509 kilocalories, a 6% increase over 2019 and 27% more than the recommended level (21).

Another study found that 43.5% of those polled reported eating more during the quarantine, and 51.8% acknowledged eating extra snacks between meals. The highest frequency of daily meals during the quarantine was reported as three meals (30.3%) and four meals (39.3%), while for snacks, it was one snack (28.1%) and two snacks (36.1%). Comparatively, individuals with higher BMI reported increased food and snack consumption. Finally, individuals who were more obese had the highest frequency of consuming more snacks during the quarantine (25).

In general, based on the results of the conducted studies, a significant reduction in the consumption of rice, meat, chicken, fresh vegetables, fresh fruits, soy products, and dairy products were observed. The frequency of food intake also differed between genders, with women consuming more rice, fresh vegetables, and fresh fruits but less meat, chicken, soy products, and dairy compared to men. There was a notable increase in the consumption of wheat products, other main dishes, and preserved vegetables (23).

In another study, the number of meals consumed during the day increased significantly during the quarantine, with 11.2% of respondents consuming five or more meals. The percentage of individuals eating snacks between meals increased by 5.1% during the quarantine. Overall, two-thirds of the respondents reported changes in body weight, with 45.86% of participants gaining weight during the quarantine, primarily due to increased body fat mass. Finally, individuals who were overweight,

obese, and older (aged 36 to 45 years and over 45 years) tended to gain weight, while those underweight were more inclined to lose weight (22).

Conclusion

In this study, a significant decrease in physical activity and daily food intake during COVID-19 infection was observed.

Declarations

Funding

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Conflict of Interest

The authors declare no conflict of interest.

Strengths

This study is the first longitudinal study to investigate the relationship between COVID-19 infection and food intake and physical activity. The study was conducted within a university cohort, and the sample size was acceptable. We were able to exclude individuals who had received vaccination before follow-up. There are no reports on the impact of COVID-19 infection on physical activity, and all published studies have only examined the effects of the COVID-19 pandemic on physical activity. Our study is the first to report the impact of COVID-19 on physical activity.

Limitations

The design of this study was observational, so causality cannot be determined. Assessing individuals' physical activity using a pedometer instead of a physical activity questionnaire could have provided a better assessment of changes in physical activity. Assessing food intake using a 24-hour recall during COVID-19 infection could have provided a better assessment of changes in food intake.

Suggestions

In future studies, it is recommended to measure the evaluated indices multiple times and conduct regular follow-ups of study participants. This longitudinal approach will provide a more comprehensive understanding of the changes and trends in the studied indices over time. Furthermore, it is important to include a control group in addition to the outcome group to allow for comparison and better interpretation of the results. Investigating these indices in the long term will provide valuable insights into the long-term effects and implications.

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