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RESEARCH ARTICLE

Assessment of pain, physical activity, and overall health status in individuals who have had COVID-19

COVID-19 geçirmiş bireylerde ağrı, fiziksel aktivite ve genel sağlık durumunun değerlendirilmesi

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Abstract

Aim: COVID-19 is a viral disease that first emerged in Wuhan, a city in China's Hubei province, and has been declared a pandemic. The aim of this study is to evaluate pain, physical activity, and general health status in individuals who have had COVID-19.

Methods: The study was conducted on 58 men and 76 women who had recovered from COVID-19. The Physical Activity Questionnaire, McGill-Melzack Pain Questionnaire, and Nottingham Health Profile (NHP) Questionnaire were administered to assess the participants' pain, physical activity, and overall health status. The Anderson-Darling test was applied for normality analysis, the Two-Simple T test was applied to examine the relationship between normally distributed parameters, and the Mann-Whitney U test was applied for non-normally distributed parameters. To determine the relationship and degree between parameters, the Pearson Correlation test was applied to normally distributed parameters and the Spearman rho test was applied to non-normally distributed parameters.

Results: At the end of the study, it was found that after COVID-19, male individuals most frequently described "leaking" pain followed by "throbbing" pain, while female individuals described 'throbbing' pain followed by "leaking" pain. For protection, 72.41% of male individuals and 72.37% of female individuals were found to have received the Biontech vaccine. A significant difference was found between genders in terms of physical activity ($p<0.05$). When comparing the surveys according to physical activity status, a significant difference was found in McGill-Melzack scores between the very active-minimal active and very active-inactive groups ($p<0.05$). No significant difference was found between any groups for NHP 1 and NHP 2 scores ($p>0.05$).

Conclusion: The study evaluated pain, physical activity, and overall health status in individuals who had contracted COVID-19. We believe it will make significant contributions to clinical sciences in this regard.

Keywords: COVID-19, pain, physical activity, overall health status.

Özet

Amaç: COVID-19, Çin'in Hubei eyaletindeki Wuhan şehrinde ilk kez ortaya çıkan ve pandemi ilan edilen viral bir hastalıktır. Bu çalışmanın amacı, COVID-19 geçirmiş bireylerde ağrı, fiziksel aktivite ve genel sağlık durumunu değerlendirmektir.

Yöntemler: Çalışma, COVID-19'dan iyileşmiş 58 erkek ve 76 kadın üzerinde gerçekleştirilmiştir. Katılımcıların ağrı, fiziksel aktivite ve genel sağlık durumlarını değerlendirmek için Fiziksel Aktivite Anketi, McGill-Melzack Ağrı Anketi ve Nottingham Sağlık Profili (NHP) Anketi uygulanmıştır. Normallik analizi için Anderson-Darling testi, normal dağılan parametreler arasındaki ilişkiyi incelemek için Two-Simple T testi ve normal dağılmayanlar için Mann-Whitney U testi uygulanmıştır. Parametreler arasındaki ilişki ve derecesini belirlemek içinse normal dağılan parametrelere Pearson Correlation testi normal dağılmayan parametrelere Spearman rho test uygulanmıştır.

Bulgular: Çalışmanın sonunda, COVID-19'dan sonra erkeklerin en sık "sızlayan" ağrıyı, ardından "zonklayan" ağrıyı tarif ettikleri, kadınların ise 'zonklayan' ağrıyı, ardından "sızlayan" ağrıyı tarif ettikleri tespit edildi. Korunma amacıyla, erkeklerin %72,41'i ve kadınların %72,37'sinin Biontech aşısı olduğu tespit edildi. Fiziksel aktivite açısından cinsiyetler arasında önemli bir fark tespit edildi ($p<0,05$). Fiziksel aktivite durumuna göre anketler karşılaştırıldığında, çok aktif-minimal aktif ve çok aktif-inaktif gruplar arasında McGill-Melzack puanlarında önemli bir fark tespit edildi ($p<0,05$). NHP 1 ve NHP 2 puanları açısından gruplar arasında önemli bir fark tespit edilmedi ($p>0,05$).

Sonuç: Çalışma, COVID-19'a yakalanan bireylerde ağrı, fiziksel aktivite ve genel sağlık durumunu değerlendirmiştir. Bu konuda klinik bilimlere önemli katkılar sağlayacağına inanıyoruz.

Anahtar Kelimeler: COVID-19, ağrı, fiziksel aktivite, genel sağlık durumu.

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INTRODUCTION

COVID-19 first emerged in January 2020 in the city of Wuhan, Hubei province, China, and gradually spread globally from there. It was declared a pandemic by the World Health Organization (WHO) on March 11, 2020, and this process continued until the first half of 2023 (1,2). At the same time, the report published by the WHO states that a total of 778.900.250 cases have occurred to date. In addition to the cases, 7.103.247 deaths have also been reported by the WHO (3). Another published report states that 32% of the total population has received at least one dose of the vaccine, while 67% has been fully vaccinated. A total of 13.64 billion doses of the vaccine have been administered (3). Although it has many known symptoms, the most common symptoms are cough, fever, and shortness of breath. A range of symptoms affecting the gastrointestinal and cardiovascular systems can also be seen in these patients (4). It has been reported that individuals who have had COVID-19 subsequently experience increased pain, loss of physical activity, anxiety, sleep disturbances, fear of illness, and depression. It is thought that this increase in these factors affects the individual's psychological, genetic, socioeconomic, biological, and psychosocial structure (5). In addition, a decrease in physical activity has been reported among a certain portion of the population during the mandatory isolation period (6,7).

Physical activity can be defined as the expenditure of energy above the basal level, resulting in body movements through skeletal muscle contraction. In other words, all activities that increase energy consumption can be referred to as physical activity (8-10). Parameters such as frequency, content, duration, type, and intensity have been defined as the five domains of physical activity (10). The intensity of these physical activities is expressed in terms of Metabolic Equivalent of Task (MET). This unit corresponds to the oxygen consumption (ml/kg/min) required per kilogram of body weight. It is divided into groups as light (<3 MET), moderate (3-6 MET), vigorous (6-8 MET), and very vigorous (>8 MET) (10). The validity and reliability of the scale used in this measurement were established by Craig et al (11) Its validity and reliability in Turkish have been demonstrated by Savci et al (12).

The McGill-Melzack Pain Questionnaire, used to assess pain status, is a measure consisting of four distinct sections that determine the location of pain, the characteristics of pain, the relationship of pain to time, and the intensity of pain. The validity and reliability of this scale, introduced by Melzack and Targerson in 1971, has been established in Turkish by Kuğuoğlu, Eti Aslan, and Olgun (13,14). Another questionnaire used to assess health status is the Nottingham Health Profile, developed by Kind et al (15). The validity and reliability of the Turkish version, which has a total of 6 sub-parameters including social isolation, sleep, pain, physical activity, emotional reactions, and energy level, have been established by Küçükdeveci et al (16).

METHODS

Our study was conducted on students enrolled at Karabük University who had a history of COVID-19. A power analysis was performed using the G*Power program with 95% confidence (1-α), 80% test power (1-β), and an effect size of d=0.5. The maximum sample size was found to be 27. A total of 134 individuals, including 58 men and 76 women aged 18-65, were included in the study. The individuals' Covid-19 history was checked through their individual e-Nabız systems. The International Physical Activity Questionnaire, McGill-Melzack Pain Questionnaire, and Nottingham Health Profile Questionnaire were administered to the individuals. The data obtained from the questionnaires were recorded in Excel.

The criterion of having had COVID-19 within the last 6 months to 1 year was also considered for individuals included in the study.

Our study was approved by the Karabük University Non-Interventional Clinical Research Ethics Committee with decision number 2022/1111. The study was conducted in accordance with the Helsinki Declaration.

The descriptive statistics of the data include the median, minimum, maximum, mean, and standard deviation values. The normality of the data distribution was tested using the Anderson-Darling test; the Two-Simple T test was used for pairwise comparisons of normally distributed parameters, and the Mann-Whitney U test was used for pairwise comparisons of non-normally distributed parameters. The relationship and degree of relationship between parameters were determined using

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the Pearson Correlation test for normally distributed data and the Spearman rho test for non-normally distributed data. IBM SPSS Statistics 27 and Minitab Statistical Software 22 applications were used for all statistical analyses performed.

RESULTS

The study examined 134 individuals, including 58 male and 76 female participants, and it was observed that the parameters of age, height, and weight did not follow a normal distribution. For parameters that followed a normal distribution, the mean and standard deviation were provided; for parameters that did not follow a normal distribution, the minimum, maximum, and median values were provided (Table 1).

Table 1. Descriptive statistics for the parameters

Parameters	Sex	Mean (Std. Dev.)
Height (cm)	Male	178.60±6.11
	Female	164.57±5.68
Nottingham Health Profile (NHP) 1	Male	140.92±117.90
	Female	163.84±124.31
Parameters	**Sex**	**Median (Min–Max)**
Age	Male	20 (18-30)
	Female	19 (18-25)
Weight (kg)	Male	76 (58-111)
	Female	58 (41-86)
Vaccine Dose	Male	2 (0-4)
	Female	2 (0-4)
McGill Melzack Score	Male	33 (0-82)
	Female	37 (0-95)
Nottingham Health Profile (NHP) 2	Male	0 (0-6)
	Female	0.5 (0-7)

The results of the Nottingham Health Profile 1 test were compared by gender, and the Two Sample T test yielded a p-value of 0.278. No significant difference was found between the two genders in terms of the NHP 1 value. The results of the Nottingham Health Profile 2 test were compared by gender, and the Mann Whitney U test yielded a p-value of 0.476. No significant difference was found between the two genders in terms of the NHP 2 value. McGill Melzack test results were compared by gender, and the Mann Whitney U test yielded a p-value of 0.392. No significant difference was found between the two genders in terms of the McGill Melzack value.

Individual vaccine preferences are shown in the table below (Table 2). According to current data, the most preferred vaccine among both men and women was Biontech (72.41% among men, 72.37% among women). Furthermore, 72.39% of all vaccines administered were Biontech. Sinovac was the second most preferred vaccine with 11.94%. This was followed by the Biontech/Sinovac combination (3.73%), Pfizer (1.49%), and the Astrazeneca/Biontech and Biontech/Pfizer combinations (0.75%). 8.96% of individuals did not get vaccinated, and the majority of these individuals were women.

The physical activity levels of individuals are presented in the table below (Table 3). According to the data obtained, 22.39% of individuals were very active, 47.01% were minimally active, and 30.60% were inactive. While the vast majority of individuals in both genders were minimally active (39.66% of men and 52.63% of women), the smallest number of individuals in the male gender were in the inactive group (24.14%), and the smallest number of individuals in the female gender were in the very active group (11.84%).

The chi-square test was applied to the results of the physical activity questionnaire. This test revealed a significant difference ($p<0.05$) between men and women in terms of physical activity levels.

Table 2. Individuals' vaccine preferences

Sex	Not Vaccinated	Biontech	Sinovac	Pfizer	Astrazeneca/ Biontech	Biontech/ Sinovac	Biontech/ Pfizer
Male	1 (%1.72)	42 (%72.41)	7 (%12.07)	1 (%1.72)	1 (%1.72)	5 (%8.62)	1 (%1.72)
Female	11 (%14.47)	55 (%72.37)	9 (%11.84)	1 (%1.32)	0	0	0
Total	12 (%8.96)	97 (%72.39)	16 (%11.94)	2 (%1.49)	1 (%0.75)	5 (%3.73)	1 (%0.75)

Table 3. Individuals' physical activity levels

Sex	Inactive	Minimal Active	Very Active
Male	14 (%24.14)	23 (%39.66)	21 (%36.21)
Female	27 (%35.53)	40 (%52.63)	9 (%11.84)
Total	41 (%30.60)	63 (%47.01)	30 (%22.39)

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Table 4. Expressions used by individuals to describe their pain

Sex	Male	Female	Total
Painful	2 (%1.89)	1 (%0.65)	3 (%1.16)
Heavy	7 (%6.60)	9 (%5.88)	16 (%6.18)
Suppressor	0	1 (%0.65)	1 (%0.39)
Boring	0	1 (%0.65)	1 (%0.39)
Terrible	3 (%2.83)	0	3 (% 1.16)
Exhausting	0	1 (%0.65)	1 (%0.39)
Like hitting	1 (%0.94)	0	1 (% 0.39)
Like a pinch	2 (%1.89)	1 (%0.65)	3 (%1.16)
Burner	1 (%0.94)	1 (%0.65)	2 (%0.77)
Unbearable	0	2 (%1.31)	2 (%0.77)
Drilling	0	1 (%0.65)	1 (%0.39)
Piercing	0	1 (%0.65)	1 (%0.39)
Prickly	3 (%2.83)	1 (%0.65)	4 (%1.54)
Beater	0	4 (%2.61)	4 (%1.54)
Penetrating	5 (%4.72)	1 (%0.65)	6 (%2.32)
Like a needle prick	5 (%4.72)	3 (%1.96)	8 (%3.09)
Like torture	0	5 (%3.27)	5 (%1.93)
As if it were being cut	0	1 (%0.65)	1 (%0.39)
Sharp	2 (%1.89)	1 (%0.65)	3 (%1.16)
Frightening	1 (%0.94)	1 (%0.65)	2 (%0.77)
Terrible	0	3 (%1.96)	3 (%1.16)
Like cramps	6 (%5.66)	11 (%7.19)	17 (%6.56)
Like lead	1 (%0.94)	1 (%0.65)	2 (%0.77)
Fluttering	6 (%5.66)	4 (%2.61)	10 (%3.86)
Hot	1 (%0.94)	0	1 (%0.39)
Troubled	1 (% 0.94)	0	1 (%0.39)
Compressor	0	1 (%0.65)	1 (%0.39)
Leaking	19 (%17.92)	21 (%13.73)	40 (%15.44)
Annoying	1 (%0.94)	3 (%1.96)	4 (%1.54)
Like a flash of lightning	1 (%0.94)	4 (%2.61)	5 (%1.93)
Like lightning	0	2 (%1.31)	2 (%0.77)
Like a needle piercing	4 (%3.77)	0	4 (%1.54)
Trembling	1 (%0.94)	0	1 (%0.39)
Drowsy	1 (%0.94)	0	1 (%0.39)
Chilling	0	1 (%0.65)	1 (%0.39)
Hitting	3 (%2.83)	3 (%1.96)	6 (%2.32)
Burning	1 (%0.94)	0	1 (%0.39)
Spreading	1 (%0.94)	1 (%0.65)	2 (%0.77)
Predator	0	1 (%0.65)	1 (%0.39)
Intense	0	8 (%5.23)	8 (%3.09)
None	8 (%7.55)	12 (%7.84)	20 (%7.72)
Exhausting	2 (%1.89)	10 (%6.54)	12 (%4.63)
Throbbing	17 (%16.04)	31 (%20.26)	48 (%18.53)
Total	106	153	259

The expressions individuals used to describe their pain are listed in the table below (Table 4). The most commonly used expression among men was “leaking” at 17.92%, while among women it was ‘throbbing’ at 20.26%. Looking at the total for both groups, the most commonly used expression was “throbbing” at 18.53%.

The localization of individuals’ pain areas is shown in the table below (Table 5). According to this, the areas where men experience the most pain are, in order, the head (25.23%), back and lower extremities (11.71%), thorax and upper extremities (10.81%), abdomen (8.11%), neck and lower back (7.21%), while 7.21% of individuals did not specify any specific area. Similarly, looking at the areas where women experience the most pain, in order, they are head (19.75%), back and lower extremities (15.29%), waist (12.10%), upper extremities (8.92%), thorax (7.64%), abdomen (6.37%), and neck (5.73%), while 8.92% of individuals did not specify any specific area.

Table 5. Localization of pain areas

	Male	Female	Total
Upper Extremity	12 (%10.81)	14 (%8.92)	26 (%9.70)
Lower Extremity	13 (%11.71)	24 (%15.29)	37 (%13.81)
Head	28 (%25.23)	31 (%19.75)	59 (%22.01)
Neck	8 (%7.21)	9 (%5.73)	17 (%6.34)
Thorax	12 (%10.81)	12 (%7.64)	24 (%8.96)
Abdomen	9 (%8.11)	10 (%6.37)	19 (%7.09)
Lower Back	13 (%11.71)	24 (%15.29)	37 (%13.81)
Waist	8 (%7.21)	19 (%12.10)	27 (%10.07)
None	8 (%7.21)	14 (%8.92)	22 (%8.21)
Total	111	157	268

The symptoms experienced by individuals during the course of their illness are listed in the table below (Table 6). During this period, the most common symptom in men was fatigue at 23.50%, while fatigue was also the most common symptom in women at 23.19%. Fatigue was also the most common symptom among all reported symptoms at 23.32%.

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Table 6.	Symptoms exhibited by individuals		
	Male	Female	Total
No symptoms	1 (%0.50)	1 (%0.36)	2 (%0.42)
Fire	35 (%17.50)	47 (%17.03)	82 (%17.23)
Cough	33 (%16.50)	44 (%15.94)	77 (%16.18)
Shortness of breath	14 (%7.00)	25 (%9.06)	39 (%8.19)
Vomiting	3 (%1.50)	5 (%1.81)	8 (%1.68)
Pain	35 (%17.50)	45 (%16.30)	80 (%16.81)
Lethargy	47 (%23.50)	64 (%23.19)	111 (%23.32)
Weight loss	9 (%4.50)	11 (%3.99)	20 (%4.20)
Loss of balance	6 (%3.00)	18 (%6.52)	24 (%5.04)
Loss of taste	7 (%3.50)	8 (%2.90)	15 (%3.15)
Loss of smell	10 (%5.00)	8 (%2.90)	18 (%3.78)
Total	200	276	476

The survey scores according to individuals' physical activity levels are shown in the table below (Table 7). Accordingly, the McGill Melzack score for the very active group was 47.23±22.62, while the score for the minimally active group was 36.26±20.63 and the score for the inactive group was 28.92±16.00. The Nottingham Health Profile 1 score was 154.02±126.36 in the highly active group, 130.65 (0-429.73) in the minimally active group, and 173.70±130.94 in the inactive group. The Nottingham Health Profile 2 score was 0 (0-7) in the highly active group, 0 (0-6) in the minimally active group, and 1 (0-7) in the inactive group.

Table 7.	Descriptive statistics for physical activity scoring	
Parameters	Group	Mean (Std. Dev.)
McGill Melzack Score	Inactive	28.92±16.00
	Minimal Active	36.26±20.63
	Very Active	47.23±22.62
Nottingham Health Profile 1	Inactive	173.70±130.94
	Very Active	154.02±126.36
Parameters	**Group**	**Median (Min-Max)**
Nottingham Health Profile 1	Minimal Active	130.65 (0-429.73)
Nottingham Health Profile 2	Inactive	1 (0-7)
	Minimal Active	0 (0-6)
	Very Active	0 (0-7)

The ANOVA test was used in the evaluation of McGill-Melzack scores. The evaluation revealed a significant difference ($p<0.005$) between the highly active – minimally active and highly active – inactive groups. The Kruskal-Wallis test was used to evaluate the NHP 1 and NHP 2 scores. The tests revealed no significant difference between the groups in terms of NHP 1 scores ($p=0.543$) or NHP 2 scores ($p=0.240$).

In the correlation analysis between groups, a weak correlation (0.338) was observed between NHP 2 and the McGill Melzack score, a weak correlation (0.477) between NHP 1 and the McGill Melzack score, and a moderate correlation (0.605) between NHP 1 and NHP 2.

DISCUSSION

The study found no significant difference between genders in the NHP 1, NHP 2, and McGill-Melzack questionnaires ($p>0.05$). The preferred vaccine was "Biontech" in both genders (72.41% in men, 72.37% in women, 72.39% overall). A significant difference was found between genders in terms of physical activity ($p<0.05$). Regarding the expressions chosen to describe pain, the most frequently mentioned expression among men was "throbbing," followed by "aching," while among women, the most frequently mentioned expression was "throbbing," followed by "aching." The most commonly used expression in both genders was throbbing, followed by aching. When localizing pain areas, the most frequently mentioned painful area in both genders was the "head region." In terms of symptoms reported, "fatigue" was mentioned in both genders. When comparing the questionnaires according to physical activity status, a significant difference was found in the McGill-Melzack scores between the very active-minimal active and very active-inactive groups ($p<0.05$). No significant difference was found between any groups for NHP 1 and NHP 2 scores ($p>0.05$). In the intergroup correlation assessment, a weak correlation was observed between NHP 2 and McGill Melzack scores, and a moderate correlation between NHP 1 and NHP 2 scores. The fact that Covid-19 also affects the musculoskeletal system and its components can be cited as one of the main reasons why individuals experience increased pain as their level of physical activity increases.

A study conducted by Lazarus et al. in 2022 examined vaccine hesitancy and support by country. According to this study, globally, 20.9% of individuals expressed hesitancy or opposition to vaccines, while 79.1% expressed support. Looking at the percentage of

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individuals expressing supportive attitudes by country, from highest to lowest, we see 98.3% in India, 96.6% in China, 92.5% in Singapore, 89.9% in Spain, 89.6% in Peru, 89.2% in South Korea, Ecuador 88.6%, Brazil 87.2%, Canada 87%, Italy 84.6%, France 81.7%, United Kingdom 80.4%, United States 80.2%, Sweden 79.2%, 78.1% in Germany, 73.6% in Mexico, 72% in Turkey, 71.9% in Nigeria, 68.8% in Kenya, 64.1% in Poland, 60.8% in Russia, 58% in Ghana, and 47.9% in South Africa (17).

A systematic review conducted by Sallam et al., examining studies conducted between February 2020 and December 2020, included data on the extent to which citizens of many countries supported the vaccine. The researchers found that Kuwait had the lowest level of support at 23.6%, while Ecuador had the highest level of support at 97% (18).

The numerous health effects of COVID-19 have been established by many studies in the literature. Some studies observing individuals who have had this disease have identified symptoms of long-term Covid, including fatigue, shortness of breath, coughing, vague chest pain, palpitations or dizziness, neurocognitive difficulties, abdominal and muscle pain, and hoarseness (19-22).

Another study conducted during the same period indicated that patients developed respiratory failure during the pandemic and required mechanical ventilation. However, mechanical ventilation can also cause diaphragm muscle atrophy and contraction disorders, which can lead to rapid weakening of the respiratory muscles (23). At the same time, failure to provide the necessary ventilation will reduce performance in many activities and may lead to the development of symptoms associated with inactivity (23).

In a study conducted by Şahin et al., 34 of 83 individuals who reported having pain before Covid, 127 of 170 individuals who reported having pain during Covid, and 62 of 113 individuals who reported having pain after Covid stated that they experienced "headache" (24). According to the results examined in a review study conducted by Weng et al., researchers observed that 1.7% to 33.9% of participants complained of "headache" (25). In another study conducted by Yakut et al., researchers indicated that the area where participants felt the most pain was the "lower back" (26). Many differences are observed in the localization of pain. Studies in the literature indicate that pain is present in many areas.

In a study conducted by Yakut et al., McGill Melzack scores were compared between men and women, and the researchers stated that there was no significant difference between them (26).

To the best of our knowledge, no studies examining the relationship between NHP 1 and NHP 2 and Covid-19 have been found in the literature.

Limitations

The time elapsed since individuals contracted COVID-19 has not been classified or statistically analyzed. Comparisons between vaccine groups could not be made because the number of individuals receiving different vaccines was low. These circumstances can be considered limitations of the study.

CONCLUSION

This cross-sectional study among university students with a history of COVID-19 showed that, despite being a relatively young population, a substantial proportion reported pain, reduced physical activity, and various persistent symptoms after the infection. Most participants were either minimally active or inactive, and there was a significant difference between men and women in physical activity levels, with women predominantly clustered in the minimally active group. However, there were no significant gender differences in overall health status and pain scores as measured by the Nottingham Health Profile (NHP 1 and NHP 2) and the McGill-Melzack Pain Questionnaire.

Fatigue emerged as the most common symptom during the course of COVID-19 in both sexes, and headache was the most frequently reported pain localization, supporting the view that COVID-19 has important and lasting systemic and musculoskeletal effects. The pain experienced by individuals was most often described with qualitative expressions such as throbbing and aching, indicating that post-COVID pain is not limited to a single pattern but involves a wide spectrum of sensory experiences. Vaccine preference was clearly

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dominated by the Biontech vaccine in both genders, and the proportion of unvaccinated individuals was relatively low, suggesting a generally favorable attitude toward vaccination in this cohort.

A key finding of this study is the significant relationship between physical activity level and pain intensity. McGill-Melzack scores were highest in the very active group and lowest in the inactive group, indicating that individuals who remained or became highly active after COVID-19 reported more intense pain. While NHP 1 and NHP 2 scores did not differ significantly between physical activity groups, weak positive correlations between pain scores and NHP subscales suggest that increasing pain is accompanied by a gradual deterioration in perceived health status. These results support the notion that COVID-19 may induce or exacerbate musculoskeletal complaints, and that higher physical loads on a vulnerable system might contribute to increased pain perception.

Taken together, the findings indicate that COVID-19 can lead to persistent pain, changes in physical activity patterns, and subtle impairments in health perception even in young adults. Monitoring pain and functional status, encouraging appropriately dosed and supervised physical activity, and integrating pain management strategies into post-COVID follow-up may be important for this population. Future studies with larger samples, longitudinal designs, objective measurements of physical activity, and a clearer classification of time since infection are needed to better clarify causality, underlying mechanisms, and optimal rehabilitation strategies in individuals recovering from COVID-19.

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