Differences in quality of life, pulmonary function, and exercise behaviour in young overweight individuals with and without COVID-19

Diferencias en la calidad de vida, la función pulmonar y el comportamiento de ejercicio en jóvenes con sobrepeso con y sin antecedentes de COVID-19

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Abstract

Introduction: The consequences of COVID-19 on quality of life, pulmonary function, and exercise behaviour among young overweight adults remain unclear.
Objective: To investigate the effects of COVID-19 infection on quality of life, pulmonary function, and exercise behaviour in young overweight men and women.
Methodology: A total of 128 young overweight men and women were divided into two groups: those with a history of COVID-19 infection (COVID) and those without COVID-19 infection (NCOVID). Quality of life, pulmonary function, exercise behaviour, and the effects of COVID-19 infection were assessed. Data were analysed using a paired-samples t-test to compare differences between the two groups, with statistical significance set at $p < .05$.
Results: COVID women experienced mild to moderate pain or discomfort dimension in quality of life that was significantly higher than those in the NCOVID group. Quality of life was associated with height among men in the COVID group. Mobility, self-care, usual activities, and anxiety or depression dimensions in quality of life did not differ between the two groups. Exercise frequency was higher among young overweight men than women in both groups. Overweight men and women reported no symptoms; however, women reported cough and breathlessness more frequently than men after contracting COVID-19. There were no statistically significant differences in pulmonary function and exercise behaviour between the two groups.
Conclusions: This study indicated that overweight women in the COVID group experienced mild to moderate pain or discomfort in quality of life to a greater extent than the NCOVID group, with no differences in pulmonary function or exercise behaviour between the two groups.

Keywords

COVID-19; pulmonary function; overweight; exercise behaviour; quality of life.

Resumen

Introducción: Las consecuencias del COVID-19 en la función pulmonar, la calidad de vida y el comportamiento relacionado con el ejercicio entre adultos jóvenes con sobrepeso siguen siendo poco claras.
Objetivo: Investigar los efectos de la infección por COVID-19 sobre la calidad de vida, la función pulmonar y el comportamiento relacionado con el ejercicio físico en hombres y mujeres jóvenes con sobrepeso.
Metodología: Un total de 128 hombres y mujeres jóvenes con sobrepeso fueron divididos en dos grupos: aquellos con antecedentes confirmados de infección por COVID-19 (COVID) y aquellos sin antecedentes de infección (NCOVID). Se evaluaron la calidad de vida, la función pulmonar, el comportamiento relacionado con el ejercicio y los efectos residuales vinculados a la enfermedad. Para comparar las diferencias entre ambos grupos, se utilizó una prueba t para muestras pareadas, estableciendo el nivel de significación estadística en $p < .05$.
Resultados: Las mujeres que habían tenido COVID experimentaron un dolor o malestar de leve a moderado en la dimensión de calidad de vida que fue significativamente mayor que en el grupo NCOVID. La calidad de vida se asoció con la estatura entre los hombres del grupo con COVID. Las dimensiones de movilidad, cuidado personal, actividades habituales, y ansiedad o depresión en la calidad de vida no mostraron diferencias entre los dos grupos. La frecuencia de ejercicio fue mayor entre los hombres jóvenes con sobrepeso que entre las mujeres en ambos grupos. Tanto los hombres como las mujeres con sobrepeso no reportaron síntomas; sin embargo, las mujeres informaron tos y dificultad para respirar con mayor frecuencia que los hombres después de contraer COVID-19. No se encontraron diferencias estadísticamente significativas en la función pulmonar ni en el comportamiento relacionado con el ejercicio entre los dos grupos.
Conclusiones: Este estudio indicó que las mujeres con sobrepeso del grupo COVID experimentaron más dolor o malestar leve a moderado en su calidad de vida que el grupo NCOVID, sin diferencias en la función pulmonar ni en el comportamiento de ejercicio entre ambos grupos.

Palabras clave

COVID-19; función pulmonar; sobrepeso; comportamiento de ejercicio; calidad de vida.

Introduction

In 2019, an outbreak of pneumonia of unknown cause was first identified in Wuhan, the capital of Hubei province, China. The disease spread rapidly, resulting in significant morbidity and mortality. China and the World Health Organisation (WHO) subsequently identified the causative pathogen as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the agent of coronavirus disease 2019 (COVID-19), which was declared a global pandemic by the WHO in 2020 (Halpin et al., 2021; Xu et al., 2020). COVID-19 presents with a wide range of acute symptoms, including cough, fever, fatigue, muscle pain, loss of taste and smell perception, respiratory distress, and reduced lung function (Carvalho-Schneider et al., 2021; N. Chen et al., 2020). Fatigue, shortness of breath, muscle weakness, joint pain, cough, memory impairment, sleep disturbances, anosmia, loss of taste, and general exhaustion have been reported following COVID-19 infection (Carvalho-Schneider et al., 2021; Daher et al., 2020; Finney et al., 2021; Garrigues et al., 2020).

The severity of COVID-19 infection has been shown to vary significantly based on several individual factors, including pre-existing comorbidities, age, gender, smoking, overall health, immune system function, and body mass index (Wolff et al., 2021). Elevated body mass is particularly associated with a heightened risk of complications, more severe disease progression, and increased mortality related to COVID-19 (Singh et al., 2022). Obesity in the context of COVID-19 has been linked to greater levels of inflammatory and diabetic markers, alongside notable reductions in cardiovascular capacity, pulmonary function, diaphragmatic mobility, and physical inactivity (Raiman et al., 2023; Rubio Herrera & Breton Lesmes, 2021). Although many physically active individuals maintained exercise frequency and intensity during the pandemic (Chang et al., 2020), an overall increase in sedentary behaviour was observed in countries such as Thailand and the United States (Baker & Castelli, 2024; Topothai et al., 2023). Despite these findings, little is known about exercise behaviour specifically among young overweight men and women, particularly in relation to the long-term effects of COVID-19.

According to Finney et al. (2021), COVID-19 infection reduces quality of life. Several authors have reported difficulties in performing daily activities, anxiety or depression (Daher et al., 2020), pain or discomfort (Garrigues et al., 2020; Halpin et al., 2021), low social activity and emotional well-being scores (K.-Y. Chen et al., 2020), and lack of concentration (Casas-Apayco et al., 2025). Quality of life was associated with physical fitness, body composition, and pulmonary function following COVID-19 infection (van der Sar-van der Brugge et al., 2021; Zavala Crichton et al., 2025). Therefore, it is important to study the effects of COVID-19 infection on young overweight men and women. However, it is still unclear whether COVID-19 infection affects quality of life and is related to exercise behaviour in young overweight men and women.

COVID-19 has been shown to affect the respiratory system in multiple ways, with the lungs being the primary organs impacted by the infection (Torres-Castro et al., 2021). Previous studies have identified several pathological changes occurring in the lungs, including pulmonary haemorrhage, destruction of alveolar epithelial cells, protein leakage, plasma fibrin accumulation, and alveolar inflammation (Xu et al., 2020). The interaction of SARS-CoV-2 with the angiotensin-converting enzyme 2 receptor (ACE2) causes lung tissue damage (Cheng et al., 2020). Infections localised to the upper respiratory tract tend to be milder in severity compared to those affecting the lower respiratory tract (Nakagawara et al., 2022). Severe cases of COVID-19 may progress to acute respiratory distress syndrome (ARDS) or multiorgan failure, and are associated with elevated mortality rates (N. Chen et al., 2020). In adults with severe symptoms, gas diffusion capacity is significantly impaired during active infection and remains reduced even 12 months after recovery from COVID-19 infection (Finney et al., 2021; Wu et al., 2021).

Pulmonary function is commonly assessed using parameters such as forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and the FEV1/FVC ratio (Berg et al., 2025). It has been demonstrated that both FVC and FEV1 are reduced in adults during and after severe COVID-19 infection (Finney et al., 2021; Wu et al., 2021). Additionally, reductions in total lung capacity and residual volume have also been reported in the post-acute recovery phase (van den Borst et al., 2021). Similar to COVID-19, obesity has been independently associated with decreased lung function and increased airway resistance (Shah & Kaltsakas, 2023). This is primarily due to the mechanical effects of increased adiposity, particularly in the thoracic region, which can exert downward pressure on the chest wall and compress alveoli, leading to impaired ventilation and inefficient gas exchange (Dixon & Peters, 2018). However,

the specific consequences of COVID-19 on pulmonary function among young overweight individuals remain unclear and need to be investigated further.

Moreover, both quality of life and pulmonary function have been documented to decline following COVID-19 infection. Individuals with higher body weight appear to be at greater risk of acute respiratory failure and more extensive lung damage compared to those with normal weight. Despite these established associations, there is a notable gap in the literature regarding the potential links among COVID-19 history, pulmonary function, exercise behaviour, and quality of life, particularly in young overweight populations. Given this context, it is reasonable to hypothesise that quality of life, as it relates to both pulmonary function and exercise behaviour, may be significantly affected during the recovery period following COVID-19 infection.

Therefore, the primary objective of this study was to compare the quality of life, pulmonary function, and exercise behaviour between young overweight men and women with a history of COVID-19 infection and those who have never been infected. By investigating this relationship, the study aims to provide a deeper understanding of the long-term respiratory and behavioural outcomes associated with COVID-19 in this specific population group.

Method

Study design

This study involved young overweight men and women, with and without a previous history of COVID-19 infection. The quality of life, pulmonary function, exercise behaviour, and impact of COVID-19 infection among the participants were assessed. This research was approved by the Human Research Ethics Committee of Srinakharinwirot University. The Institutional Review Board (IRB) No SWUEC/E/G-140/2566. All participants provided written informed consent before their inclusion in the study.

Participants

A total of 128 young overweight men and women, both with and without a history of COVID-19 infection, participated in this research. Participants were divided into two groups included 64 participants with a history of COVID-19 infection (COVID) and 64 participants who had never been infected (NCOVID). Each group was further categorised into four subgroups, including COVID men, NCOVID men, COVID women, and NCOVID women. The inclusion criteria included men or women, aged between 18 and 25 years, and a body mass index (BMI) ≥ 25 kg/m^2. All participants had no underlying conditions such as hypertension, cardiovascular diseases, neuromuscular disorders, and no history of smoking. The participants in the COVID group had recovered from a mild to moderate COVID-19 infection. Participants were excluded if they did not meet the age requirement, had not fully recovered from COVID-19, and undergoing treatment for tuberculosis. Additional exclusion criteria included hemoptysis, hypertension, hypotension (< 90/60 mmHg), thoracic or abdominal surgery, chest pain, shoulder blade, tympanic membrane perforation, respiratory infections, pneumothorax, nausea, and vomiting.

Preliminary assessment

Body mass (Omron Healthcare, Japan), height, blood pressure, and resting heart rate (Omron Healthcare, Japan) were measured. Blood pressure and resting heart rate were measured after participants had been seated quietly for at least ten minutes. Body mass index (BMI) was calculated by dividing an individual's body mass in kilograms by the square of their height in meters. The Physical Activity Readiness Questionnaire (PAR-Q) was used to assess participants' readiness for physical activity (Venkataraman et al., 2024). Participants were required to refrain from engaging in strenuous exercise for at least 30 minutes and to avoid eating for at least two hours before the assessment.

Exercise behaviour and effects of COVID-19 assessment

Before undergoing the lung function test, participants completed questionnaires covering exercise behaviour, long-term effects of COVID-19 infection, and general health information (Sawekchan & Silalertdetkul, 2024). The exercise behaviour section included details on weekly exercise frequency, duration per session, and perceived intensity levels categorised as light, moderate, or vigorous. The general

health information included the number of times the participant had been infected with COVID-19, the number of vaccine doses received, and the time elapsed since the most recent COVID-19 infection. Participants were also asked to report any long-term effects of COVID-19, such as breathlessness, cough, sore throat, loss of taste, or absence of symptoms.

Pulmonary function assessment

Pulmonary function was assessed using a spirometer (NDD Medical Technologies, Switzerland). Pulmonary function included the following parameters (Berg et al., 2025): 1) Forced expiratory volume in 1 second (FEV1) is the maximum volume of air exhaled in the first second of a forceful, rapid exhalation. 2) Forced vital capacity (FVC) is the maximum volume of air exhaled during a forceful, rapid exhalation. 3) FEV1/FVC ratio is the percentage of the total exhaled air expelled in the first second. Before testing, the researcher explained the procedures for the pulmonary function assessment to the participants. Each participant performed the spirometry test at least three times, but no more than eight times, to ensure reliability. A rest period of at least one minute was provided between each test or until the participant recovered sufficiently to proceed. The best-recorded value from the assessments was used for analysis. To ensure consistency in test results, participants were instructed to avoid strenuous exercise for at least 30 minutes and to refrain from eating for at least two hours before the assessment. Participants wear loose clothing that does not restrict the neck, chest, or abdomen.

Quality of life assessment

Quality of life was assessed using the EQ-5D-5L questionnaire (Devlin et al., 2022), which evaluates five dimensions composed of mobility (walking ability), self-care, usual activities (e.g., work, study, household tasks, family activities, or leisure activities), pain or discomfort, and anxiety or depression. Each dimension includes five response levels, ranging from no problems to extreme problems. Participants self-rated their health status, and utility scores were calculated using a standardised utility value table. The utility score ranges from -1 to 1, where 1 represents the best possible health state, 0 represents the worst possible health state or death, and negative values indicate a state perceived as worse than death.

Statistical analysis

Statistical analyses were performed using SPSS software (Version 24.0). Data were presented as means and standard deviations. Descriptive statistics for exercise behaviour, time since COVID-19 infection, and long-term effects of COVID-19 were reported as frequencies and percentages. Quality of life scores were reported as total scores, as described above (Devlin et al., 2022). Differences in FVC, FEV1, FEV1/FVC ratio, quality of life, exercise behaviour, and long-term effects of COVID-19 infection between the two groups were analysed using a paired samples t-test. An independent samples t-test was conducted to compare these variables between men and women. Pearson's product-moment correlation was used to examine the relationships between quality of life and exercise behaviour, anthropometry, blood pressure, and resting heart rate. Additionally, the associations between FEV1, FVC, and FEV1/FVC ratio with BMI, blood pressure, resting heart rate, height, and quality of life scores were further analysed. A p-value less than .05 was considered statistically significant. Sample size was calculated using G*Power version 3.1.9.4 with an anticipated effect size of 0.5, an alpha level of 0.05, and a statistical power of 0.8. A sample size of 128 participants was sufficient to achieve a statistical power of at least 95%.

Results

General characteristics of participants

There were no statistically significant differences between the COVID and NCOVID groups in terms of age ($p = .44$), body mass ($p = .89$), height ($p = .76$), BMI ($p = .81$), systolic blood pressure ($p = .82$), diastolic blood pressure ($p = .58$), resting heart rate ($p = .82$), and number of vaccine doses received ($p = .44$). In COVID group, significant differences between men and women were observed in age ($p = .02$), body mass ($p < .01$), height ($p < .01$), systolic blood pressure ($p = .01$), and resting heart rate ($p = .01$). In NCOVID group, men had significantly higher body mass ($p < .01$), height, ($p < .01$), and systolic blood pressure ($p = .04$) compared to women. The data are presented in Table 1.

Table 1. Body mass, height, body mass index (BMI), blood pressure, resting heart rate, number of COVID-19 infections, number of vaccine doses received, and time since COVID-19 infection in the COVID-19-infected (COVID) and non-COVID-19-infected (NCOVID) groups (N = 128).

	Men		Women	
	COVID N = 30	NCOVID N = 30	COVID N = 34	NCOVID N = 34
Age (year)	19.9 ± 1.3	20.3 ± 1.6	20.7 ± 1.4#	20.0 ± 1.5
Body mass (kg)	94.3 ± 14.7	92.3 ± 11.6	76.1 ± 10.6#	77.2 ± 10.6#
Height (cm)	175.3 ± 5.4	174.3 ± 5.5	160.8 ± 5.4#	162.5 ± 5.1#
Body mass index (kg/m^2)	30.7 ± 4.6	30.3 ± 3.6	29.4 ± 3.4	29.3 ± 3.6
Systolic blood pressure (mmHg)	124.9 ± 12.4	122.3 ± 11.6	112.2 ± 12.4#	115.5 ± 13.9#
Diastolic blood pressure (mmHg)	66.9 ± 12.2	65.8 ± 10.5	68.0 ± 9.4	67.1 ± 9.9
Heart rate (beats/minute)	77.9 ± 9.7	79.3 ± 12.5	84.3 ± 10.1#	83.8 ± 8.5
Number of COVID-19 infected	1.6 ± 0.8	-	1.4 ± 0.7	-
Number of vaccine doses received	2.8 ± 0.8	2.6 ± 0.8	2.8 ± 0.7	2.7 ± 0.7
Time since COVID-19 infection (months)	9.0 ± 3.5	-	8.3 ± 3.9	-
1-3	4 (13%)	-	5 (15%)	-
4-6	3 (10%)	-	4 (12%)	-
7-12	23 (77%)	-	25 (73%)	-

Data are presented as mean ± standard deviation (SD) and as numbers (percentages). *A statistically significant difference between the two groups (p < .05). #A statistically significant difference between men and women (p < .05).

Exercise frequency, duration, and intensity:

Table 2. Exercise frequency, duration, and intensity in the COVID-19-infected (COVID) and non-COVID-19-infected (NCOVID) groups (N = 128). Data are presented as numbers (percentages) and as mean ± standard deviation (SD). *A statistically significant difference between the two groups (p < .05). #A statistically significant difference between men and women (p < .05).

	Men		Women	
	COVID N = 30	NCOVID N = 30	COVID N = 34	NCOVID N = 34
Exercise frequency (time/week)	3.2 ± 1.5	3.4 ± 1.5	1.9 ± 1.2#	2.3 ± 1.6#
No exercise	1 (3%)	1 (3%)	7 (21%)	8 (24%)
1-3	16 (53%)	14 (47%)	24 (70%)	18 (53%)
More than 3	13 (44%)	15 (50%)	3 (9%)	8 (24%)
Exercise duration (minutes/day)	62.5 ± 31.8	62.1 ± 33.2	48.1 ± 28.1	42.1 ± 30.2#
Exercise intensity				
No exercise	1 (3%)	1 (3%)	7 (21%)	8 (24%)
Light	4 (13%)	6 (20%)	7 (21%)	9 (26%)
Moderate	19 (64%)	19 (64%)	20 (58%)	17 (50%)
Vigorous	6 (20%)	4 (13%)	0 (0%)	0 (0%)

*A statistically significant difference between the two groups (p < .05). #A statistically significant difference between men and women (p < .05).

There were no statistically significant differences in exercise frequency between the COVID and NCOVID groups for either men (p = .54) or women (p = .09). Among women in both groups, the majority of participants reported exercise frequency between one and three times per week. Among men, those in the NCOVID group engaged in exercise more than three times per week, whereas those in the COVID group typically exercised between one and three times per week. These findings suggest some variation in exercise frequency between the COVID and NCOVID groups, particularly among men. Overall, exercise frequency was significantly higher among men compared to women in both the COVID (p < .001) and NCOVID (p = .01) groups. Similarly, exercise duration in men more than in women across both groups; this difference reached statistical significance in the NCOVID group (p = .01) and approached significance in the COVID group (p = .059). However, there were no statistically significant differences in exercise duration between the COVID and NCOVID groups for either men (p = .54) or women (p = .92). In terms of exercise intensity, the majority of participants in both the COVID and NCOVID groups engaged in moderate-intensity physical activity. The data are presented in Table 2.

Long-term effects of COVID-19 infection

Most male and female participants reported no persistent symptoms following COVID-19 infection. However, among those who had previously been infected, both men and women experienced breathlessness and cough. Notably, female participants reported these symptoms more frequently than their male counterparts. The data are revealed in Table 3.

Table 3. Long-term effects of COVID-19 infection in the COVID-19-infected (COVID) and non-COVID-19-infected (NCOVID) groups (N = 128).

	Men		Women	
	COVID N = 30	NCOVID N = 30	COVID N = 34	NCOVID N = 34
Breathlessness	3 (10%)	0	8 (24%)	0
Cough	5 (17%)	0	11 (32%)	0
Sore throat	0	0	1 (3%)	0
Loss of taste	0	0	1 (3%)	0
No symptom	22 (73%)	30 (100%)	13 (38%)	34 (100%)

Data are presented as numbers (percentages).

Pulmonary function

There were no statistically significant differences in pulmonary function between the COVID and NCOVID groups. Specifically, there were no significant differences in FEV1 (p = .66), FVC (p = .91), and FEV1/FVC ratio (p = .41) between the COVID and NCOVID groups. Among young overweight men, FEV1 (p = .41), FVC (p = .68), and FEV1/FVC ratio (p = .47) did not differ significantly between the COVID and NCOVID groups. Similarly, there were no statistically significant differences between the COVID and NCOVID groups in FEV1 (p = .84), FVC (p = .64), and FEV1/FVC ratio (p = .62) in young overweight women. The data are presented in Table 4.

Table 4. Predicted forced expiratory volume in one second (FEV1), forced vital capacity (FVC), and FEV1/FVC ratio in the COVID-19-infected (COVID) and non-COVID-19-infected (NCOVID) groups (N = 128).

Pulmonary function	Men		Women		Total	
	COVID N = 30	NCOVID N = 30	COVID N = 34	NCOVID N = 34	COVID N = 64	NCOVID N = 64
FEV1 (%)	100.1 ± 9.1	98.3 ± 7.7	99.4 ± 11.9	99.8 ± 10.1	100.1 ± 10.7	99.3 ± 8.8
FVC (%)	100.7 ± 8.8	99.8 ± 9.3	101.7 ± 11.8	102.9 ± 9.3	101.8 ± 10.4	102.0 ± 9.0
FEV1/FVC ratio (%)	95.9 ± 6.0	94.9 ± 4.9	96.9 ± 4.9	96.4 ± 4.0	96.4 ± 5.5	95.7 ± 4.4

Data are presented as mean ± standard deviation (SD). *A statistically significant difference between the two groups (p < .05). #A statistically significant difference between men and women (p < .05).

Quality of life

Table 5. Quality of life scores in the COVID-19-infected (COVID) and non-COVID-19-infected (NCOVID) groups.

Quality of life	Men		Women	
	COVID N = 30	NCOVID N = 30	COVID N= 34	NCOVID N= 34
Mobility				
I have no problems walking about	0 (30)	0 (30)	0 (33)	0 (33)
I have slight problems walking about	0 (30)	0 (30)	.056 (1)	0 (0)
I have moderate problems walking about	0 (30)	0 (30)	0 (33)	.114 (1)
Total score in mobility	.000	.000	.0560	.1140
Self-care				
I have no problems washing or dressing myself	0 (30)	0 (30)	0 (30)	0 (30)
Total score in self-care	.000	.000	.000	.000
Usual activities				
I have no problems doing my usual activities	0 (23)	0 (23)	0 (32)	0 (32)
I have slight problems doing my usual activities	0.043 (1)	.043 (1)	0 (32)	.043 (2)
I have moderate problems doing my usual activities	0 (23)	0 (23)	.075 (2)	0 (32)
Total score in usual activities	.0430	.0430	.0044	.0025
Pain or discomfort				
I have no pain or discomfort	0 (18)	0 (23)	0 (20)	0 (27)
I have slight pain or discomfort	.04 (10)	.04 (6)	.04 (9)	.04 (6)
I have moderate pain or discomfort	.068 (2)	.068 (1)	.068 (5)	.068 (1)
Total score in pain or discomfort	.0179	.0103	.206	.0091*
Anxiety or depression				
I am not anxious or depressed	0 (23)	0 (24)	0 (27)	0 (31)
I am slightly anxious or depressed	.032 (5)	.032 (4)	.032 (6)	.032 (2)
I am moderately anxious or depressed	.097 (7)	.097 (2)	.097 (1)	.097 (1)
Total score in anxiety or depression	.0118	.0107	.0085	.0047
Utility score	.968	.976	.965	.980

Data are presented as mean scores (number of participants). *A statistically significant difference between the two groups (p < .05).

Among young overweight women, the pain or discomfort dimension in quality of life was significantly different between the COVID and NCOVID groups (p = .04), with the COVID group reporting greater

impairment. However, no significant differences were observed in mobility, self-care, usual activities, and anxiety or depression dimensions between the COVID and NCOVID group, either young overweight men or women. Additionally, there were no statistically significant differences in utility scores between COVID and NCOVID men (p = .77) or between COVID and NCOVID women (p = .48). The data are revealed in Table 5.

The relationship between parameters

There was a correlation between quality of life and height among men in the COVID group, and a tendency toward a correlation with body mass in the NCOVID group. Among young overweight adults, the utility score showed a tendency to correlate with both exercise duration and frequency in the COVID group. In contrast, the utility score tends to correlate with exercise duration in the NCOVID group. Pulmonary function, including FEV1 and FVC, was not significantly correlated with BMI, blood pressure, heart rate, height, and quality of life scores in either the COVID or NCOVID groups. However, among women in NCOVID group, FEV1/FVC ratio was moderately associated with systolic blood pressure (p = .001) and diastolic blood pressure (p = .01). In the COVID group, body mass demonstrated a non-significant negative correlation with the FEV1/FVC ratio in COVID among women (r = -.25, p = .15). These data are presented in Tables 6 and 7.

Table 6. The relationship between quality of life scores and exercise duration (DUR), exercise frequency (FRE), body mass, height (H), systolic blood pressure (SBP), and resting heart rate (HR) in the COVID-19-infected (COVID) and non-COVID-19-infected (NCOVID) groups (N = 128).

	DUR		FRE		BM		H		SBP		HR	
	r	p	r	p	r	p	r	p	r	p	r	p
COVID women	-.21	.22	-.23	.19	-.01	.98	-.04	.85	.01	.94	.12	.49
NCOVID women	.28	.12	.04	.55	-.06	.75	.12	.46	.14	.42	-.13	.47
COVID men	.02	.93	-.04	.84	-.10	.59	-.37*	.04	-.25	.19	-.08	.67
NCOVID men	.12	.53	.26	.16	-.27	.15	.03	.89	.10	.59	.05	.80

*A statistically significant correlation at p < .05.

Table 7. The relationship between forced expiratory volume in one second (FEV1), forced vital capacity (FVC), and FEV1/FVC ratio with body mass index (BMI), blood pressure (BP), resting heart rate (HR), height (H), and quality of life scores (QL) in the COVID-19-infected (COVID) and non-COVID-19-infected (NCOVID) groups (N = 128).

	BMI		SBP		DBP		HR		H		QL	
	r	p	r	p	r	p	r	p	r	p	r	p
COVID												
FEV1	.04	.74	.09	.51	.12	.34	-.01	.92	.08	.51	-.06	.64
FVC	.04	.78	.04	.75	.15	.22	.02	.86	.02	.87	-.06	.66
FEV1/FVC ratio	-.11	.37	-.15	.25	-.08	.52	-.09	.47	-.14	.27	-.06	.62
NCOVID												
FEV1	-.10	.43	.06	.62	.03	.79	-.06	.63	-.02	.85	.14	.26
FVC	-.16	.21	-.07	.61	-.10	.43	.07	.61	-.13	.30	.15	.24
FEV1/FVC ratio	-.02	.89	.12	.34	.12	.31	-.15	.25	-.10	.41	.01	.93
COVID men												
FEV1	.03	.88	.05	.80	.07	.69	.16	.41	-.08	.69	-.02	.94
FVC	.09	.62	.04	.85	.17	.37	.19	.30	-.03	.86	.07	.70
FEV1/FVC ratio	-.04	.84	.04	.86	-.19	.31	.11	.55	-.07	.72	-.09	.62
NCOVID men												
FEV1	-.09	.65	.16	.40	-.09	.63	-.14	.46	.09	.65	.06	-.09
FVC	-.15	.42	.16	.41	-.18	.35	.06	.77	-.07	.71	.001	-.15
FEV1/FVC ratio	-.14	.45	-.24	.20	-.15	.44	-.16	.41	.12	.51	-.003	-.14
COVID women												
FEV1	.05	.79	.10	.58	.17	.33	-.11	.56	.21	.24	.08	.65
FVC	.003	.98	.09	.61	.15	.40	-.11	.55	.18	.31	.11	.55
FEV1/FVC ratio	-.19	.28	-.28	.11	.06	.74	-.15	.41	-.15	-.40	.04	.82
NCOVID women												
FEV1	-.09	.60	.05	.77	.11	.52	-.03	.85	.05	.79	.25	.16
FVC	-.13	.47	-.16	.37	-.05	.77	.003	.99	.04	.83	.25	.16
FEV1/FVC ratio	.16	.36	.54*	.001	.42*	.01	-.24	.17	-.08	.66	.01	.94

*A statistically significant correlation at p < .05.

Discussion

The main finding of this study indicated that young overweight women in the COVID group experienced mild to moderate pain or discomfort dimension in quality of life more frequently than those in the NCOVID group. Quality of life is associated with height, and a tendency towards body mass and exercise behaviour, with these associations varying between the COVID and NCOVID groups. Despite these differences, no significant variations in pulmonary function were observed between the two groups. Additionally, exercise frequency was higher among young overweight men compared to women in both the COVID and NCOVID groups, while exercise duration was significantly greater among men than women in the NCOVID group. Moreover, women reported post-COVID symptoms such as cough and breathlessness more frequently than men.

Interestingly, young overweight women in the COVID group experienced mild to moderate pain or discomfort dimension in quality of life, higher than those in the NCOVID group in the present study. This is consistent with previous research showing that participants reported mild to moderate pain or discomfort dimension in quality of life (Daher et al., 2020). The mobility, self-care, usual activities, and anxiety or depression scores in quality of life did not show significant differences between the two groups in this study. A previous study had demonstrated that participants reported mild to moderate mobility issues, difficulties in self-care, limitations in daily activities, and anxiety or depression following recovery from severe COVID-19 (Daher et al., 2020). Although the long-term effects of COVID-19 remain uncertain, it has been suggested that COVID-19 cause oxidative stress, leading to an imbalance of free radicals in the body (Pierce et al., 2022). Additionally, the immune system's response to the virus triggers pro-inflammatory cytokines, which can lead to symptoms such as shortness of breath, fatigue, headaches, and musculoskeletal pain (Yong, 2021). In some cases, individuals also experience cognitive dysfunction (Pierce et al., 2022). In the current study, quality of life correlates with height, body mass, and exercise behaviour, with these associations differing between the COVID and NCOVID groups. This is consistent with previous research that revealed quality of life associated with physical activity and body composition (Hao et al., 2024; Zavala Crichton et al., 2025). Overall, these findings suggest that COVID-19 infection may impact post-recovery in quality of life, particularly in relation to the pain or discomfort dimension in young overweight women. Therefore, the effects of COVID-19 may be influenced by factors such as infection severity, gender, and exercise behaviour.

The findings of the present study indicated that exercise frequency differed between the COVID and NCOVID groups among most overweight men and women. Specifically, male participants reported higher exercise frequency and longer duration compared to their female counterparts. In addition, men engaged in moderate to high intensity exercise, whereas women predominantly engaged in light to moderate intensity exercise. Despite these gender-based variations, no statistically significant differences were observed in exercise intensity or duration between the COVID and NCOVID groups. This is consistent with previous research reported no differences in exercise frequency, duration, or intensity between individuals previously infected with COVID-19 and those who were not infected (Sawekchan & Silalertdetkul, 2024). Other studies have highlighted an increase in sedentary behaviour following COVID-19 infection (Baker & Castelli, 2024; Topothai et al., 2023). Nonetheless, it has been demonstrated that engaging in aerobic, resistance, and breathing exercises at least twice weekly with sessions lasting approximately 60 minutes can improve physical activity capacity, pulmonary function, and respiratory muscle strength in individuals recovering from COVID-19 (Hockele et al., 2022). Additionally, exercise reduced fatigue and dyspnea, improved exercise capacity, and enhanced pulmonary function during both the acute and chronic recovery phases of COVID-19 (Ahmed et al., 2022). These findings suggest that while gender plays a role in influential exercise behaviours among overweight individuals, the status of having experienced COVID-19 does not significantly influence the exercise intensity or duration. In the present study, young overweight men and women engaged in regular moderate-intensity exercise for approximately one hour per session. Therefore, this consistent exercise behaviour may explain the unchanged pulmonary function observed in both the COVID and NCOVID groups.

In the present study, most of the young overweight men and women reported no symptoms, followed by cough and breathlessness, after recovery from COVID-19 infection. However, the young overweight women experienced cough, breathlessness, sore throat, and loss of taste more than men, while men reported no symptoms more than women during recovery from COVID-19 infection. This is consistent

with previous research demonstrating breathlessness and cough following recovery from COVID-19 (Malkova et al., 2021; Townsend et al., 2020). Shortness of breath was commonly reported symptom following both severe and mild COVID-19 infection (Malkova et al., 2021; Wu et al., 2021). A previous study demonstrated that both men and women experienced loss of taste following recovery from mild COVID-19 infection (Sawekchan & Silalertdetkul, 2024). Moreover, it had been reported that fatigue up to ten weeks after recovery from mild symptoms of COVID-19 infection (Townsend et al., 2020). The recovery period for COVID-19 varies, typically around two weeks for mild cases and approximately three to six weeks for severe cases (Organization, 2022). The participants in the present study were recovering from COVID-19 infection for more than six months. Exercise duration, intensity, and frequency in men were higher than in women. Therefore, most young overweight men and women have no symptoms following COVID-19 infection, and this might be associated with recovery time and exercise behaviour.

Young overweight men and women who experienced mild COVID-19 symptoms exhibit normal pulmonary function with no significant differences between the two groups. These findings align with previous research indicating that upper respiratory tract infections tend to be less severe than lower respiratory tract infections, often resulting in no significant changes in lung volume (Berg et al., 2025; Nakagawara et al., 2022). Consistent with previous research indicating that pulmonary function remains within normal ranges after recovery from mild COVID-19 infection (Berg et al., 2025; van den Borst et al., 2021). It has been shown that lung function typically returns to normal within six months in young adults following mild COVID-19 infection (Woravutrangkul & Chukijrungroat, 2024), and pulmonary function generally improve over time with continued recovery after recovering from COVID-19 infection (Wu et al., 2021). Conversely, other studies have found that reduced FVC and FEV1 values are associated with recovery from severe COVID-19 infection (Finney et al., 2021; Wu et al., 2021). This impairment led to extensive pulmonary vascular dilation and lung tissue damage, resulting in severe hypoxemia (Mo et al., 2020). Interestingly, exercise has been shown to support improvements in lung function following COVID-19 infection (Brandao-Rangel et al., 2025). Additionally, the FEV1/FVC ratio was associated with both systolic and diastolic blood pressure among women in the NCOVID group. These findings are consistent with previous research demonstrating that pulmonary function is related to blood pressure (Casselbrant et al., 2024; Takase et al., 2023). Consequently, no change in pulmonary function was observed in this present study may be explained by several factors: the mild severity of infection, sufficient recovery time (six months to one year), and regular engagement in moderate-to-high intensity exercise among participants.

Conclusions

The findings of this study indicated that young overweight women in the COVID group experienced mild to moderate pain or discomfort dimension in quality of life more frequently than those in the NCOVID group, despite no significant differences in symptoms, exercise behaviour, FEV1, FVC, or the FEV1/FVC ratio between the two groups. Furthermore, exercise frequency was higher among young overweight men compared to women in both groups, while exercise duration was significantly greater among men in the NCOVID group. Overweight women also reported cough and breathlessness more frequently than men following COVID-19 infection. Variations in the association between quality of life and height and between FEV1/FVC ratio and blood pressure across the COVID and NCOVID groups. The absence of significant differences in pulmonary function and symptoms between the two groups may be related to variations in individual exercise behaviours and the stage of recovery following COVID-19. Future research should include pre-infection measurement of pulmonary function, quality of life, and exercise behaviour to better evaluate the long-term impact of COVID-19 infection. Additionally, factors such as age differences, physical activity levels, health-related fitness, the number of vaccine doses received, the frequency of prior COVID-19 infections, and the time elapsed since infection may also influence the observed recovery from COVID-19 and warrant further investigation.

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Conflict of interest

The author declares that there are no conflicts of interest.

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