The impact of COVID-19 infection on the quality of life among exercisers and non-exercisers

El impacto de la infección por COVID-19 en la calidad de vida entre personas que hacen ejercicio y personas que no hacen ejercicio

Authors

Lalitwadee Phorthanee [1]
Supaporn Silalertdetkul [1]

[1] Srinakharinwirot University (Thailand)

Corresponding author:
Supaporn Silalertdetkul
ssilalertdetkul@gmail.com

Received: 29-12-25
Accepted: 04-05-26

How to cite in APA

Phorthanee, L., & Silalertdetkul, S. (2026). The impact of COVID-19 infection on the quality of life among exercisers and non-exercisers. *Retos, 81,* 89-101.
https://doi.org/10.47197/retos.v81.118471

Abstract

Introduction: The individuals' quality of life, especially the physical health, psychological health, social relationships, and environment domains, may have been influenced by their exercise behaviour during the COVID-19 pandemic.
Objective: To investigate the impact of COVID-19 infection (COVID) on individuals' quality of life, comparing exercisers and non-exercisers.
Methodology: In total, 328 participants aged 18 to 25 years old participated in the study. Participants were categorised into four distinct groups: COVID exercisers, COVID non-exercisers, non-COVID exercisers, and non-COVID non-exercisers. Participants were asked to complete self-administered questionnaires assessing their general demographics, exercise behaviour, and quality of life across the four aforementioned domains, and their general health, and overall quality of life. Differences between the groups were analysed using two-way ANOVA and sample pair t-tests, and the relationships among variables were examined using Pearson's product-moment correlation.
Results: Participants in the non-COVID exerciser group reported significantly higher scores in terms of their general health, and in the physical health, psychological health, social relationship, and environmental quality of life domains compared to the other three groups. Among the COVID-exercisers, general health was significantly associated with the number of vaccine doses they had received. Among the COVID non-exercisers, the physical health domain was found to be associated with the number of COVID-19 infections they had experienced.
Conclusion: Participants in the non-COVID exerciser group demonstrated significantly better quality of life scores across all the measured domains. This finding emphasises the importance of maintaining an active lifestyle to support a better quality of life during the COVID-19 pandemic.

Keywords

Exercise behavior; quality of life; COVID-19; exercisers; non-exercisers

Resumen

Introducción: La calidad de vida de las personas, especialmente en los dominios de salud física, salud psicológica, relaciones sociales y entorno, puede haber estado influida por su comportamiento de ejercicio durante la pandemia de COVID-19.
Objetivo: Investigar el impacto de la infección por COVID-19 (COVID) en la calidad de vida de los individuos, comparando a quienes realizaban ejercicio con quienes no lo hacían.
Metodología: Participaron en el estudio un total de 328 personas de entre 18 y 25 años. Los participantes se categorizaron en cuatro grupos diferenciados: personas con COVID que realizaban ejercicio, personas con COVID que no realizaban ejercicio, personas sin COVID que realizaban ejercicio y personas sin COVID que no realizaban ejercicio. Se les pidió completar cuestionarios autoadministrados para evaluar sus características sociodemográficas generales, su comportamiento respecto al ejercicio y su calidad de vida en los cuatro dominios mencionados, así como su estado de salud general y su calidad de vida global. Las diferencias entre los grupos se analizaron mediante ANOVA de dos vías y pruebas t para muestras independientes, y las relaciones entre las variables se examinaron mediante la correlación de Pearson.
Resultados: Los participantes del grupo sin COVID que realizaban ejercicio informaron puntuaciones significativamente más altas en salud general, así como en los dominios de salud física, salud psicológica, relaciones sociales y calidad de vida ambiental, en comparación con los otros tres grupos. Entre los participantes con COVID que realizaban ejercicio, la salud general se asoció significativamente con el número de dosis de vacuna recibidas. Entre los participantes con COVID que no realizaban ejercicio, se encontró que el dominio de salud física estaba asociado con el número de infecciones por COVID-19 que habían experimentado.
Conclusión: Los participantes del grupo sin COVID que realizaban ejercicio presentaron puntuaciones significativamente mejores de calidad de vida en todos los dominios evaluados. Este hallazgo pone de relieve la importancia de mantener un estilo de vida activo para favorecer una mejor calidad de vida durante la pandemia de COVID-19.

Palabras clave

Comportamiento de ejercicio; calidad de vida; COVID-19; personas que hacen ejercicio; personas que no hacen ejercicio

Introduction

In 2019, the coronavirus disease (COVID-19) emerged from Wuhan, China, originating from the zoonotic transmission of a bat-borne virus to humans, and went on to cause a global pandemic emergency. COVID-19 has been associated with a range of physical, neurological, and psychological symptoms. Several common symptoms of COVID-19 infection are loss of taste and smell, breathlessness, cough, difficulty sleeping, fatigue, dyspnoea, memory loss, lack of concentration, and sleep disorders (Casas-Apayco et al., 2025; Garrigues et al., 2020; Sawekchan & Silalertdetkul, 2024; Yaiyong et al., 2026). Additionally, in some individuals body composition, substrate oxidation, and appetite perception are impacted by COVID-19 infection (Dachakoon et al., 2026; Kumar et al., 2025; Sawekchan & Silalertdetkul, 2024). Moreover, a lack of ability to perform physical activity and an impairment of individuals' quality of life have been reported in cases with long COVID-19 infection (Szewczyk et al., 2024; Vélez-Santamaría et al., 2023). However, the true impact of COVID-19 infection on the quality of life of individuals in relation to physical activity or exercise remains unclear and warrants further investigation.

Quality of life is defined by the World Health Organisation as an individual's perception of their position in life in relation to their goals, expectations, standards, and concerns (Cai et al., 2021; West et al., 2023). The EQ-5D-5L questionnaire is a commonly applied tool to assess five dimensions of the quality of life, namely mobility, self-care, usual activities, pain or discomfort, and anxiety or depression (Devlin et al., 2022). Another tool to assess quality of life is the World Health Organisation Quality of Life–Brief Version (WHOQOL-BREF) questionnaire, which assesses the quality of life across four domains, namely physical health, psychological health, social relationships, and environment (Cai et al., 2021; Jasem et al., 2024; West et al., 2023).

Following the COVID-19 pandemic, there remains an essential need to examine the impact of COVID-19 infection on individuals' quality of life, in particular to inform rehabilitation strategies and public health interventions aimed at promoting recovery and well-being from COVID-19 infection as well as to inform practices for other potential health crises in the future. Previous studies have demonstrated that the COVID-19 pandemic impacted the quality of life of individuals in many domains, including pain or discomfort, mental health, physical health, physical function, and fatigue (Chen et al., 2020; Hejazian et al., 2025; Szewczyk et al., 2024; Yaiyong et al., 2026). However, it remains unclear how COVID-19 infection affected the quality of life across the various life domains, including general health, physical health, psychological well-being, social relationships, and the environment, which therefore requires further investigation.

It is widely accepted that exercise plays a critical role in enhancing the physical fitness of individuals and improving their overall quality of life. However, the COVID-19 pandemic and widespread social distancing measures and lockdowns reduced the opportunity for exercise and significantly impacted physical activity levels and exercise behaviours, including exercise intensity, duration, and type of activity performed, and forced many to adopt more sedentary lifestyles (García-Campanario et al., 2022; Park et al., 2021; Roever et al., 2023). Regular exercise is known to improve individuals' cardiovascular fitness and quality of life, and has also been shown to reduce fatigue during the recovery phase following COVID-19 infection (Ahmed et al., 2022; Bai et al., 2024; Berry et al., 2025). Interestingly, pulmonary function, exercise behaviour, physical activity, and physical fitness have been widely reported to be associated with individuals' quality of life (Hao et al., 2024; Ozdemir et al., 2020; van der Sar-van der Brugge et al., 2021; Yaiyong et al., 2026; Zavala Crichton et al., 2025). However, the relationships between these appear to differ between individuals who have recovered from COVID-19 and those who have never been infected (Yaiyong et al., 2026). Furthermore, individuals' quality of life and body composition are different between physically active and sedentary individuals (Ozdemir et al., 2020; Silalertdetkul, 2024). Additionally, lower perceived stress and higher perceived health have been reported in long-term exercisers (Komáromi et al., 2025). Despite the findings in prior studies, the effect of COVID-19 infection on the quality of life of individuals who engage in exercise compared to those who do not remains unclear and warrants further investigation.

Consequently, despite the known health benefits of exercise, it remains unclear whether differences in individuals' quality of life, specifically within the domains of physical health, psychological health, social relationships, and environmental satisfaction, exist between exercisers and non-exercisers among young adults. It may be assumed that exercisers would have a better quality of life than non-exercisers,

both among individuals with and without COVID-19 infection. However, further investigation is warranted to better understand these potential differences and their implications in the post-pandemic context. Therefore, the objective of this study was to investigate the impact of COVID-19 on the quality of life of individuals comparing exercisers and non-exercisers, with a particular focus on young men and women.

Method

Study design

This study employed a cross-sectional design based on an online survey, which included questionnaires assessing general demographic information, quality of life, and exercise behaviour. This research was approved by the Human Research Ethics Committee of Srinakharinwirot University (Approval Number: SWUEC-662030). Before participation, all participants were informed about the objectives, procedures, potential risks, and anticipated benefits of the study. Informed consent was obtained from all participants before data collection commenced.

Participants

A total of 328 young men and women participated in this study and were categorised into four groups: COVID-exercisers, COVID-non-exercisers, non-COVID (NCOVID) exercisers, and non-COVID non-exercisers. Participants were eligible for inclusion based on the following criteria: aged between 18 and 25 years old, with a body mass index (BMI) not exceeding 25 kg/m^2. Individuals in the COVID groups were required to have previously tested positive for COVID-19 via either a rapid antigen test (ATK) or a polymerase chain reaction (PCR) test. Participants were classified as exercisers if they had engaged in regular physical exercise over the past six months, defined as participation in exercise at least once per week for a minimum of 30 minutes per session. Conversely, non-exercisers were defined as individuals who had not participated in any structured exercise during the same period.

General information assessment

General demographic and health-related data were collected using a structured questionnaire. The questionnaire included items on the participants' age, gender, body mass, height, and body mass index (BMI), as well as COVID-19-specific information, such as the number of infections, number of vaccine doses received, and duration of recovery following infection. Recovery time was categorised into two groups: 1–3 months and 4–6 months. In addition, participants were asked to respond to open-ended questions regarding any persistent symptoms they had experienced following COVID-19 infection, allowing for a more comprehensive understanding of post-infection health outcomes.

Exercise behaviour assessment

Participants were classified based on their exercise behaviour over the past six months as either exercisers or non-exercisers. Those identified as exercisers were asked to provide additional information regarding their weekly exercise frequency (times per week), session duration (minutes per session), and exercise intensity. These data were collected using closed-ended questionnaire items. Exercise duration was categorised into five groups: 30–45 minutes, 45–60 minutes, 60–75 minutes, 75–90 minutes, and more than 90 minutes per session. Exercise intensity was classified into four levels: low, moderate, vigorous, and combined (i.e., a combination of varying intensities).

Quality of life assessment

Quality of life was assessed using the 26-item World Health Organisation Quality of Life–Brief Version (WHOQOL-BREF) questionnaire (Kangwanrattanakul, 2023; West et al., 2023). This questionnaire consists of questions related to general health, physical health, psychological health, social relationships, and environment domains, along with an overall quality of life score. Each item was rated on a 5-point Likert scale, with response options ranging from 1 to 5 as follows: 1 (not at all or very dissatisfied or very poor or never), 2 (a little or dissatisfied or poor or seldom), 3 (a moderate amount or neither satisfied nor dissatisfied or neither poor nor good or quite often), 4 (very much or satisfied or good or very often), and 5 (an extreme amount or very satisfied or very good or always). Total scores from the

WHOQOL-BREF range from 26 to 130 points, with higher scores indicating a better perceived quality of life. Based on established criteria, the scores were categorised into three levels: 26–60 points indicating a poor quality of life, 61–95 points representing a moderate quality of life, and 96–130 points indicating a good quality of life.

Statistical analysis

All the statistical analyses were conducted using Statistical Package for the Social Sciences (SPSS) software (version 24; IBM Corp., Armonk, NY, USA). Descriptive statistics, including the mean and standard deviation, were calculated for comparing the participants' age, body mass, height, body mass index (BMI), number of COVID-19 infections, number of vaccine doses received, quality of life scores, and exercise behaviour. The normality of the dependent variables was assessed using the Shapiro–Wilk test. The study design included two independent variables: infection status and exercise status. Two-way analyses of variance (ANOVA) were conducted to compare the participants' general characteristics and quality-of-life outcomes between (a) exercisers and non-exercisers and (b) individuals with a history of COVID-19 infection and those who had never been infected (non-COVID). Exercise behaviour and recovery duration following COVID-19 infection were analysed using a one-sample t-test. Statistical significance was set at a p-value of < .05. Correlations between variables were assessed using Pearson's product-moment correlation coefficient, with significance accepted at $p < .05$. A power analysis was conducted using G*Power to determine the required sample size with an assumed a small effect size (Cohen's d = 0.23), a significance level (α) of .05, and a target statistical power (1-β) of .80 (Elaraby et al., 2022; Kang, 2021). The analysis indicated that a total sample size of 302 participants would be required to detect a statistically significant difference between groups. However, to accommodate potential dropouts, the sample size estimate was adjusted upward to 328 participants.

Results

Participants' characteristics

Two-way ANOVA revealed there were no statistically significant differences in terms of the participants' age, $F(3, 324) = 1.91$, $p = .13$, $\eta^2 = .02$); body mass, $F(3, 324) = .51$, $p = .68$, $\eta^2 = .01$; height, $F(3, 324) = 1.61$, $p = .19$, $\eta^2 = .02$; or body mass index, $F(3, 324) = 1.64$, $p = .18$, $\eta^2 = .02$, across the four groups defined by COVID-19 infection history and exercise status. However, two-way ANOVA showed significant differences among participants regarding the number of doses received (vaccine dose count; $F(3, 324) = 4.81$, $p = .003$, $\eta^2 = .04$), and post hoc tests showed higher dose counts in the NCOVID group versus COVID group among the exercisers ($p = .028$) and non-exercisers ($p = .002$). Among those participants who had recovered from COVID-19 infection, the most commonly reported post-infection symptoms included cough, phlegm production, and breathlessness, as well as no symptoms. Additionally, recovery duration following COVID-19 infection showed a trend toward a difference between exercisers and non-exercisers, although this did not reach statistical significance ($p = .08$). Detailed participant characteristics are presented in Table 1.

Table 1. Participant characteristics, including age, body mass, height, body mass index (BMI), number of COVID-19 infections, number of vaccines received, recovery time, and reported post-COVID-19 symptoms among COVID exercisers, COVID non-exercisers, NCOVID exercisers, and NCOVID non-exercisers (N = 328).

Participant characteristics	COVID (N = 164)		NCOVID (N = 164)	
	Exercisers (N = 82)	Non-exercisers (N = 82)	Exercisers (N = 82)	Non-exercisers (N = 82)
Age (yrs)	20.5 ± 1.64	20.8 ± 1.69	20.2 ± 1.66	20.7 ± 1.62
Body mass (kg)	62.6 ± 16.96	61.8 ± 9.98	60.5 ± 10.27	63.3 ± 21.65
Height (cm)	168.9 ± 13.50	170.6 ± 10.02	174.0 ± 33.46	167.2 ± 18.42
Body mass index (kg/m²)	21.0 ± 1.53	21.1 ± 1.75	20.7 ± 1.49	20.8 ± 1.41
Gender				
Men	41	41	41	41
Women	41	41	41	41
Number of COVID-19 infections	1.6 ± 0.52	1.6 ± 0.55	-	-
Number of vaccines received	3.5 ± 0.88	3.5 ± 0.89	3.8 ± 0.80#	3.8 ± 0.71#
Recovery from COVID-19 (month)			-	-
1-3	36 (44%)	39 (48%)	-	-
>3-6	46 (56%)	43 (52%)	-	-

Long COVID-19 symptoms				
Cough	8 (10%)	3 (4%)	-	-
Sore throat	-	1 (1%)	-	-
Itchy throat	1 (1%)	-	-	-
Fatigue	1 (1%)	-	-	-
Phlegm	5 (6%)	1 (1%)	-	-
Breathlessness	-	2 (2%)	-	-
Loss of taste	1 (1%)	-	-	-
No symptoms	73 (89%)	76 (93%)	-	-

Data are presented as the mean ± standard deviation for continuous variables and as number (percentage) for categorical variables. *Indicates a statistically significant difference between exercisers and non-exercisers within either the COVID or NCOVID groups ($p < .05$). #Indicates a statistically significant difference between the COVID and NCOVID groups within either the exerciser or non-exerciser classifications ($p < .05$).

Exercise behaviour

Exercise behaviour differed between the NCOVID and COVID groups. In particular, a statistically significant difference was observed in term of both exercise duration and exercise intensity between the two groups ($p < .001$). Although not statistically significant, exercise frequency in the NCOVID group tended to be higher compared to in the COVID group ($p = .091$). Detailed descriptive and comparative data on the participants' exercise behaviour are presented in Table 2.

Table 2. Exercise frequency, duration, and intensity among COVID exercisers, COVID non-exercisers, NCOVID exercisers, and NCOVID non-exercisers (N = 328).

Exercise behaviour	COVID (N = 164)		NCOVID (N = 164)	
	Exercisers (N = 82)	Non-exercisers (N = 82)	Exercisers (N = 82)	Non-exercisers (N = 82)
Exercise frequency (time/week)	3.3 ± 1.0	-	3.6 ± 1.13	-
1–2	21 (26%)	-	13 (16%)	-
3–4	48 (59%)	-	51 (62%)	-
>4	13 (16%)	-	18 (22%)	-
Exercise duration (minutes/session)				
30–60	63 (77%)	-	65 (79%)	-
61–90	17 (21%)	-	16 (20%)	-
>90	2 (2%)	-	1 (1%)	-
Exercise intensity				
Low	9 (11%)	-	9 (11%)	-
Moderate	25 (30%)	-	30 (37%)	-
Vigorous	9 (11%)	-	12 (15%)	-
Combined	39 (48%)	-	31 (38%)	-

Data are presented as the mean ± standard deviation for continuous variables and as a number (percentage) for categorical variables. *Indicates a statistically significant difference between exercisers and non-exercisers within either the COVID or NCOVID groups ($p < .05$). #Indicates a statistically significant difference between the COVID and NCOVID groups within either the exerciser or non-exerciser classifications ($p < .05$).

Quality of life

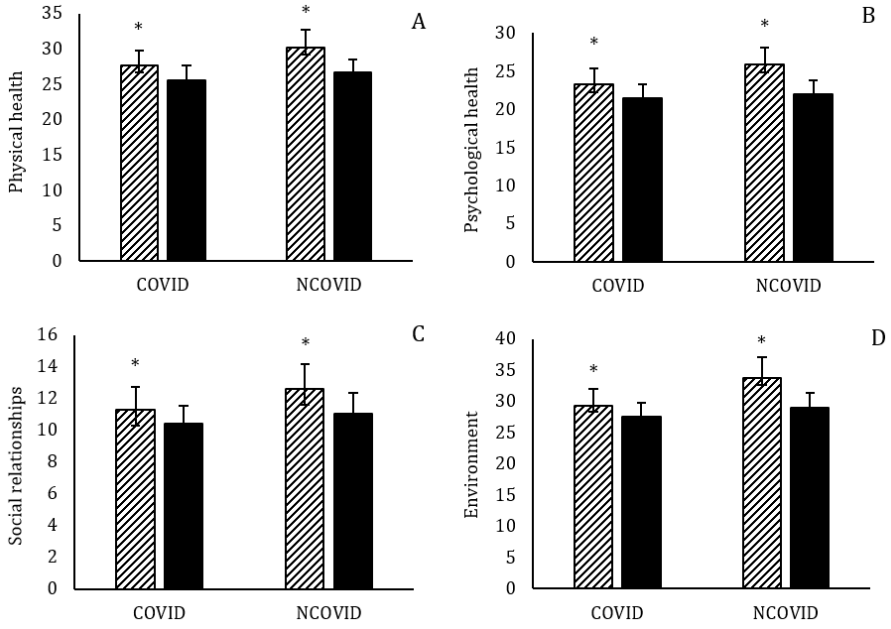
Participants in the NCOVID exerciser group recorded the highest quality of life scores compared to the COVID exercisers, NCOVID non-exercisers, and COVID non-exercisers, respectively. Two-way ANOVA indicated there were significant between-group differences across all the WHOQOL-BREF domains and the total scores regarding physical health, $F(3, 324) = 72.16$, $p < .001$, $\eta^2 = .40$; psychological health, $F(3, 324) = 82.85$, $p < .001$, $\eta^2 = .43$; social relationships, $F(3, 324) = 38.45$, $p < .001$, $\eta^2 = .26$; environment, $F(3, 324) = 80.27$, $p < .001$, $\eta^2 = .43$; general health, $F(3, 324) = 48.31$, $p < .001$, $\eta^2 = .31$; and total score for quality of life, $F(3, 324) = 115.07$, $p < .001$, $\eta^2 = .52$. Post hoc comparisons showed that both the COVID and NCOVID exercisers had significantly higher scores across all the domains compared with their respective non-exerciser counterparts (all, $p < .001$). Moreover, within the exerciser groups, the NCOVID exercisers demonstrated significantly higher scores in all the quality of life domains and in the overall quality of life score compared with the COVID exercisers (all $p < .001$). Among the non-exercisers, the NCOVID group also exhibited significantly higher scores in the physical health ($p = .002$), psychological health ($p = .045$), social relationships ($p = .003$), environment ($p < .001$) domains, and in the total quality of life score ($p < .001$) compared with the COVID non-exercisers. Detailed data for the above are presented in Table 3 and Figure 1.

Table 3. Total score, general health score, and scores for the physical health, psychological health, social relationships, and environment domains in assessing individuals' quality of life among COVID exercisers, COVID non-exercisers, NCOVID exercisers, and NCOVID non-exercisers (N = 328).

Quality of life	COVID (N = 164)		NCOVID (N = 164)	
	Exercisers (N = 82)	Non-exercisers (N = 82)	Exercisers (N = 82)	Non-exercisers (N = 82)
Physical health	27.6 ± 2.08	25.5 ± 2.13*	30.2 ± 2.54#	26.6 ± 1.84*#
Psychological health	23.3 ± 2.10	21.4 ± 1.91*	25.9 ± 2.22#	22.0 ± 1.80*
Social relationships	11.3 ± 1.39	10.4 ± 1.16*	12.6 ± 1.53#	11.0 ± 1.37*#
Environment	29.3 ± 2.76	27.5 ± 2.31*	33.7 ± 3.29#	29.0 ± 2.38*#
General health	7.6 ± 0.99	7.0 ± 0.85*	8.5 ± 0.93#	7.2 ± 0.74*
Total score	99.0 ± 6.89	91.8 ± 6.13*	111.0 ± 8.80#	95.7 ± 5.92*#

Data are presented as the mean ± standard deviation. *Indicates a statistically significant difference between exercisers and non-exercisers within both the COVID and NCOVID groups ($p < .05$). #Indicates a statistically significant difference between the COVID and NCOVID groups within either the exerciser or non-exerciser classifications ($p < .05$).

Figure 1. Physical health (A), psychological health (B), social relationships (C), and environment (D) domain scores in assessing individuals' quality of life for COVID exercisers, COVID non-exercisers, NCOVID exercisers, and NCOVID non-exercisers (N = 328). Data are presented as the mean ± standard deviation. *Indicates a statistically significant difference between exercisers (▨) and non-exercisers (■) within both the COVID and NCOVID groups ($p < .05$).



Relationships between parameters

There were associations found between individuals' quality of life and variables such as body mass, BMI, exercise frequency, number of COVID-19 infections, and number of vaccine doses received; these also differed by exercise status and by COVID-19 infection status. Among COVID-exercisers, BMI was significantly correlated with the social relationships domain ($p = .01$), while the vaccine dose count was significantly associated with general health ($p = .003$) and showed a trend-level association with the total quality-of-life score ($p = .08$). In addition, exercise frequency was significantly associated with the environment domain ($p = .02$) and showed a positive trend toward an association with general health ($p = .05$), psychological health ($p = .08$), and the total quality-of-life score ($p = .08$). The environment domain showed a trend toward being correlated with exercise duration ($p = .09$) and body mass ($p = .10$). Among the NCOVID exercisers, the general health domain was significantly correlated with body mass ($p = .04$) and BMI ($p = .01$), and also showed a positive trend toward a correlation with exercise duration ($p = .09$) and exercise frequency ($p = .10$). Furthermore, body mass showed a trend toward correlation with the environment domain ($p = .06$) and the total quality-of-life score ($p = .07$), while height exhibited a borderline association with the social relationships ($p = .05$) and psychological health ($p = .08$) domains. Among non-exercisers, the COVID group showed a negative association between the number of COVID-19 infections and the physical health domain score ($p = .01$), while the NCOVID group showed a positive

trend toward an association between the social relationship domain and body mass (p = .09). The detailed correlation coefficients and significance levels are presented in Table 4.

Table 4. Relationships between the quality of life domains and body mass (BM), height (H), body mass index (BMI), exercise duration (DU), exercise frequency (F), number of COVID-19 infections (CO), and number of vaccines received (V) among COVID exercisers, COVID non-exercisers, NCOVID exercisers, and NCOVID non-exercisers (N = 328).

	BM		H		BMI		DU		F		CO		V	
	r	p	r	p	r	p	r	p	r	p	r	p	r	p
COVID exercisers														
Physical health	-.01	.91	.10	.36	.14	.26	-.03	.82	.05	.67	-.12	.34	.11	.33
Psychological health	-.01	.89	-.03	.77	.10	.40	-.04	.71	.19	.08	-.19	.09	.13	.26
Social relationships	.08	.46	.07	.46	.28*	.01	.09	.40	-.07	.51	-.05	.68	.06	.59
Environment	.18	.10	.05	.66	.02	.85	.19	.09	.27*	.02	-.09	.44	.16	.16
General health	-.05	.64	.06	.59	-.02	.89	.13	.25	.21	.05	-.11	.35	.32**	.003
Total score	-.07	.51	.06	.57	.12	.29	.09	.40	.20	.08	-.15	.18	.19	.08
COVID non-exercisers														
Physical health	.07	.53	.08	.49	.01	.92	-	-	-	-	-.30*	.01	.07	.81
Psychological health	-.12	.28	-.16	.16	-.04	.73	-	-	-	-	-.01	.91	.09	.44
Social relationships	.04	.70	.07	.55	.03	.78	-	-	-	-	-.07	.52	.06	.60
Environment	.05	.64	.06	.58	.01	.96	-	-	-	-	.04	.72	.11	.32
General health	-.01	.96	.05	.66	-.09	.43	-	-	-	-	.05	.69	.05	.65
Total score	.01	.90	-.02	.84	.01	.91	-	-	-	-	-.10	.38	.10	.39
NCOVID exercisers														
Physical health	.12	.27	-.05	.68	.06	.62	.16	.15	.12	.27	-	-	.06	.62
Psychological health	.15	.18	-.20	.08	.09	.43	.12	.27	-.01	.99	-	-	.10	.35
Social relationships	.15	.18	-.21	.05	.12	.28	.15	.17	.09	.44	-	-	.02	.88
Environment	.21	.06	-.16	.14	.19	.10	.12	.30	.05	.69	-	-	.10	.37
General health	.23*	.04	-.01	.93	.28*	.01	.19	.09	.18	.10	-	-	.04	.75
Total score	.20	.07	-.16	.15	.16	.16	.17	.13	.09	.44	-	-	.09	.44
NCOVID non-exercisers														
Physical health	.18	.11	-.18	.10	.01	.96	-	-	-	-	-	-	-.07	.53
Psychological health	.12	.27	-.13	.26	.11	.32	-	-	-	-	-	-	-.08	.47
Social relationships	-.19	.09	-.03	.81	-.14	.21	-	-	-	-	-	-	.01	.97
Environment	-.01	.97	-.02	.88	.03	.83	-	-	-	-	-	-	.11	.31
General health	.11	.33	-.01	.98	.05	.66	-	-	-	-	-	-	.08	.46
Total score	.06	.59	-.11	.33	.02	.89	-	-	-	-	-	-	.01	.92

*Indicates a statistically significant correlation at p < .05. **Indicates a statistically significant correlation at p < .01.

Discussion

This study investigated the quality of life of individuals in relation to exercise behaviour among individuals with and without a history of COVID-19 infection. The key findings were that the quality of life scores related to individuals' general health, and the physical health, psychological health, social relationships, and environmental quality-of-life scores were highest among exercisers who had never been infected with COVID-19, followed by COVID exercisers, non-exercisers without a history of infection, and non-exercisers with prior COVID-19 infection, respectively. Furthermore, individuals' quality of life was found to be significantly associated with their exercise behaviour, anthropometric measures, such as BMI, and the number of COVID-19 vaccine doses received. These associations varied across the study participant groups, highlighting the differential impacts of exercise status and infection history on individuals' perceived quality of life.

Regular physical exercise has long been widely recognised for its role in enhancing well-being and increasing life satisfaction. In the present study, individuals who engaged in regular exercise reported significantly higher scores in relation to their general health, and in the physical health, psychological health, social relationships, and environment domains of the quality of life compared with non-exercisers, irrespective of their COVID-19 infection status. These findings align with prior research that has consistently shown greater quality of life scores across multiple domains among physically active individuals compared to those with sedentary lifestyles (Huang et al., 2023; Ozdemir et al., 2020; Slimani et al., 2020). For instance, a recent study found that individuals engaging in low to vigorous intensity exercise reported higher overall quality of life scores (Lancaster & Callaghan, 2022). Physical activity may particularly benefit individuals in recovering from COVID-19. For instance, cardiovascular fitness and muscular strength have been shown to improve following exercise interventions in post-COVID-19 populations (Berry et al., 2025; Sick et al., 2025). In addition, physical activity levels and physical fitness have been reported to be positively associated with the overall quality of life of individuals (Hao et al.,

2024; Ozdemir et al., 2020; Zavala Crichton et al., 2025). Specific evidence also suggests that the mental health domain of the quality of life can be significantly improved through individuals engaging in exercise during recovery from COVID-19 infection (Ahmed et al., 2022; De Sousa et al., 2021). In the current study, exercise frequency was significantly associated with the environmental domain of quality of life, and both exercise frequency and duration showed a trend toward positive correlations with the psychological and environmental domains, general health, and the total quality of life scores among exercisers. These associations are consistent with previous findings in the literature showing that the frequency and intensity of physical activity are positively correlated with psychological well-being, social relationships, and environmental satisfaction (Slimani et al., 2020). Collectively, these results underscore the importance of engaging in regular physical activity as a means of enhancing various domains of the quality of life, including general health, and the environment and psychological health domains.

In the present study, it was found that the quality of life scores across multiple domains differed significantly between participants who had been infected with COVID-19 and those who had never been infected. Specifically, individuals in the COVID-19 group reported lower scores in terms of their overall quality of life, as well as in the physical health, psychological health, social relationships, and environment domains, compared with those in the NCOVID group, regardless of their exercise status. These findings are consistent with previous research demonstrating that COVID-19 infection negatively impacts multiple domains of the quality of life (Park et al., 2021; Rahman et al., 2022). In particular, the physical health, social relationships, and environment domains appear to be the most affected by post-infection consequences (Park et al., 2021; Rahman et al., 2022). Additionally, the current study revealed that various quality of life domains, including psychological health, social relationships, environment, general health, and total score associations with various factors, such as body mass, height, BMI, exercise duration, and exercise frequency, varied between the COVID and NCOVID groups, particularly among the exercisers. A previous study reported that individuals infected with COVID-19 reported experiencing greater pain or discomfort that affected their quality of life compared with those without COVID-19 infection (Yaiyong et al., 2026). Therefore, it would be interesting to investigate the impact of exercise behaviour related to COVID-19 infection on the quality of life of overweight or obese individuals. In the present study, the general health-related quality-of-life scores were found to be significantly associated with the number of COVID-19 vaccine doses received; this finding is consistent with prior studies reporting associations between vaccination status and physical functioning (Yalçın-Çolak et al., 2023). Additionally, previous studies have reported differences in quality of life, physical activity, and psychological well-being between individuals who received the COVID-19 vaccine and those who did not (Kuodi et al., 2023; Montero-López et al., 2022). Notably in the present study, the number of COVID-19 infections showed a significant negative correlation with the physical health domain in non-exercisers and a trend toward a negative association with the psychological domain in exercisers. These findings suggest that both the acute and long-term impacts of COVID-19 may contribute to a diminished quality of life of individuals across the physical, psychological, and social dimensions. These differences were observed between the infected and non-infected groups, and among the exercise subgroups in post-COVID recovery. These findings suggest that COVID-19 infection significantly impairs general health and the key quality-of-life domains of individuals, highlighting the need for targeted interventions to support recovery and improve individuals' well-being, particularly among those who are less physically active.

Exercise behaviour was found to differ between the COVID-19 and NCOVID groups in the present study. Specifically, exercise duration and intensity were significantly higher in the NCOVID group compared with the COVID group, while exercise frequency showed a non-significant trend toward higher values among the NCOVID participants. Participants in the NCOVID group also reported a greater engagement in moderate and vigorous intensity activities; however, no significant difference was observed between the groups with respect to low-intensity exercise. These findings are consistent with previous research demonstrating differences in the total time spent engaging in vigorous exercise and walking activities between COVID-19-infected and non-infected individuals (García-Campanario et al., 2022). Additionally, some earlier studies reported finding no significant differences in exercise duration, frequency, or intensity between COVID-19 and non-COVID-19 groups (Sawekchan & Silalertdetkul, 2024; Yaiyong et al., 2026), suggesting that post-infection changes in exercise behaviour may vary depending on the population's characteristics. Moreover, another study reported a correlation between exercise and resilience during COVID-19 among paramedics (Lancaster & Callaghan, 2022).

One limitation of the present study is the absence of an objective measure of the overall physical activity level. It is recommended that future studies should incorporate validated physical activity assessments in relation to the quality of life outcomes, to better understand the interaction between activity levels and recovery from COVID-19. However, it is clear that the current findings emphasise the potential benefits of regular exercise for maintaining physical health, mental well-being, social engagement, and stress reduction during and after illnesses, such as COVID-19 infection. Promoting consistent exercise habits may be a valuable strategy for enhancing the quality of life and supporting recovery among individuals affected by the COVID-19 pandemic.

Most participants in the present study reported asymptomatic COVID-19 infections, both in the exerciser and non-exerciser groups. This finding is consistent with previous research indicating that many individuals experience no symptoms during the acute phase or recovery period of COVID-19 infection (Mizumoto et al., 2020; Stavem et al., 2021; Yaiyong et al., 2026). Recovery from mild or asymptomatic COVID-19 cases without long COVID symptoms generally occurs within three to six months (Di Fusco et al., 2023; Stavem et al., 2021), which corresponds with the recovery timeline reported by most participants in the current study, who were primarily young adults. This duration may have been sufficient to allow for their near-complete physical recovery before they participated in the study assessments. Nevertheless, some participants reported lingering symptoms potentially associated with long COVID infection. These included cough, sore throat, fatigue, excessive phlegm production, difficulty breathing, and loss of taste, all of which are commonly observed in post-acute COVID-19 conditions. This observation aligns with previous studies that have identified fatigue, cough, and loss of taste as prevalent symptoms persisting beyond the acute phase of COVID-19 infection (Malkova et al., 2021; Sawekchan & Silalertdetkul, 2024; Townsend et al., 2020; Yaiyong et al., 2026). Studies have shown that even without physical symptoms of COVID-19 infection, many people have reported low quality of life scores due to the remaining consequences of COVID-19 on their psychological health, physical health, and physical function (Huang et al., 2022; Kim et al., 2024; Kim et al., 2023). This suggests that COVID-19 infection may have latent sequelae that impair the health-related quality-of-life domains. Therefore, although the majority of participants in the present study experienced minimal or no physical symptoms, a subset of individuals reported ongoing physical health, psychological health, social relationships, and environmental issues when considering these domains in assessing their quality of life, consistent with long COVID infection. These findings underscore the variable nature of post-COVID symptomatology and highlight the continued need for follow-up care and rehabilitation strategies, particularly among populations with persistent symptoms following infection.

Conclusions

The main finding of this present study indicated that participants in the non-COVID exerciser group demonstrated higher scores in general health, and in the physical health, psychological health, social relationships, and environment domains of the quality of life among young men and women. Notably, individuals' quality of life across several domains were influenced by both prior COVID-19 infection and exercise behaviour. Furthermore, the quality of life outcomes were found to be not only associated with exercise behaviour, but also anthropometric variables, such as BMI, and the number of COVID-19 vaccine doses received, with variations observed between exercisers and non-exercisers, as well as between individuals with and without a history of COVID-19 infection. These findings highlight the complex interplay between lifestyle factors and health outcomes in the context of COVID-19 infection. Future research is warranted to further explore how different types of sport or exercise training, training status, levels of physical fitness, overall health status, and age groups may differentially influence the quality of life of individuals. Such investigations could guide more public health recommendations and rehabilitation programmes aimed at improving physical and psychological well-being across diverse populations.

Acknowledgements

The authors extend their sincere gratitude to the research team in the Department of Sports Science, Faculty of Physical Education, Sports, and Health, particularly the principal advisor, for their invaluable guidance and support throughout this study. Deep appreciation is also expressed to all volunteers for their time, cooperation, and dedication in participation.

Conflict of interest

The authors confirm that they have no conflicts of interest to declare.

Financing

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author contributions

LP and SS conceptualised and designed the research; SS contributed to supervising the research, helped interpret the results and wrote the manuscript; LP performed data collection, analysed the data, interpreted the results, and wrote the first draft of the manuscript. All authors have read and approved the final version of the manuscript and agree with the order of presentation of the authors.

References

Ahmed, I., Inam, A. B., Belli, S., Ahmad, J., Khalil, W., & Jafar, M. M. (2022). Effectiveness of aerobic exercise training program on cardio-respiratory fitness and quality of life in patients recovered from COVID-19. *European Journal of Physiotherapy*, *24*(6), 358-363. https://doi.org/10.1080/21679169.2021.1909649

Bai, B., Xu, M., Zhou, H., Liao, Y., Liu, F., Liu, Y., Yuan, Y., Geng, Q., & Ma, H. (2024). Effects of aerobic training on cardiopulmonary fitness in patients with long COVID-19: a randomized controlled trial. *Trials*, *25*(1), 649. https://doi.org/10.1186/s13063-024-08473-3

Berry, C., McKinley, G., Bayes, H. K., Anderson, D., Lang, C. C., Gill, A., Morrow, A., Sykes, R., Taggart, D., Kamdar, A., Welsh, P., Dawkes, S., McConnachie, A., & Gray, S. R. (2025). Resistance exercise therapy after COVID-19 infection: a randomized clinical trial. *JAMA Netw Open*, *8*(11), e2534304. https://doi.org/10.1001/jamanetworkopen.2025.34304

Cai, T., Verze, P., & Bjerklund Johansen, T. E. (2021). The quality of life definition: where are we going? *Uro*, *1*(1), 14-22. https://doi.org/10.3390/uro1010003

Casas-Apayco, L., Moscoso-Otoya, G., Saffa-Vidal, A., Rodríguez-Córdova, K., Márquez-Hidalgo, J., & Reyes-Bossio, M. (2025). Sport training behaviors and emotional responses associated with temporomandibular disorders in student athletes during the COVID-19 pandemic. *Retos*, *70*, 414-426. https://doi.org/10.47197/retos.v70.110010

Chen, N., Zhou, M., Dong, X., Qu, J., Gong, F., Han, Y., Qiu, Y., Wang, J., Liu, Y., Wei, Y., Xia, J., Yu, T., Zhang, X., & Zhang, L. (2020). Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet*, *395*(10223), 507-513. https://doi.org/10.1016/s0140-6736(20)30211-7

Dachakoon, N., Sriramatr, S., Mitranun, W., Anek, A., & Silalertdetkul, S. (2026). Effects of COVID-19 infection on maximal oxygen consumption, gas exchange, and substrate oxidation in young adults with overweight or obesity. *Retos*, *77*, 358-369. https://doi.org/10.47197/retos.v77.118324

De Sousa, R. A. L., Improta-Caria, A. C., Aras-Júnior, R., de Oliveira, E. M., Soci Ú, P. R., & Cassilhas, R. C. (2021). Physical exercise effects on the brain during COVID-19 pandemic: links between mental

and cardiovascular health. *Neurological Sciences*, *42*(4), 1325-1334. https://doi.org/10.1007/s10072-021-05082-9

Devlin, N., Pickard, S., & Busschbach, J. (2022). The development of the EQ-5D-5L and its value sets. In N. Devlin, B. Roudijk, & K. Ludwig (Eds.), *Value Sets for EQ-5D-5L: A Compendium, Comparative Review & User Guide* (pp. 1-12). Springer. https://doi.org/10.1007/978-3-030-89289-0_1

Di Fusco, M., Cappelleri, J. C., Anatale-Tardiff, L., Coetzer, H., Yehoshua, A., Alvarez, M. B., Allen, K. E., Porter, T. M., Puzniak, L., Cha-Silva, A. S., Lopez, S. M. C., & Sun, X. (2023). Impact of COVID-19 infection on health-related quality of life, work productivity and activity impairment by symptom-based long COVID status and age in the US. *Healthcare*, *11*(20), 2790. https://doi.org/10.3390/healthcare11202790

Elaraby, A., Shahein, M., Bekhet, A. H., Perrin, P. B., & Gorgey, A. S. (2022). The COVID-19 pandemic impacts all domains of quality of life in Egyptians with spinal cord injury: a retrospective longitudinal study. *Spinal Cord*, *60*(8), 757-762. https://doi.org/10.1038/s41393-022-00775-0

García-Campanario, I., Vanlinthout, L. E., Toro, R., Mangas, A., & Lagares-Franco, C. (2022). Impact of COVID-19 on physical activity and lifestyles in post-confinement sports science undergraduates. *International Journal of Environmental Research and Public Health*, *19*(15), 9115. https://doi.org/10.3390/ijerph19159115

Garrigues, E., Janvier, P., Kherabi, Y., Le Bot, A., Hamon, A., Gouze, H., Doucet, L., Berkani, S., Oliosi, E., Mallart, E., Corre, F., Zarrouk, V., Moyer, J. D., Galy, A., Honsel, V., Fantin, B., & Nguyen, Y. (2020). Post-discharge persistent symptoms and health-related quality of life after hospitalization for COVID-19. *Journal of Infection*, *81*(6), e4-6. https://doi.org/10.1016/j.jinf.2020.08.029

Hao, H., Yuan, Y., Li, J., Zhao, D., Li, P., Sun, J., & Zhou, C. (2024). Association between physical activity and health-related quality of life among adults in China: the moderating role of age. *Frontiers in Public Health*, *12*, 1334081. https://doi.org/10.3389/fpubh.2024.1334081

Hejazian, S. S., Vemuri, A., Vafaei Sadr, A., Shahjouei, S., Bahrami, S., Shouhao, Z., Abedi, V., & Zand, R. (2025). The health-related quality of life among survivors with post-COVID conditions in the United States. *Plos One*, *20*(5), e0320721. https://doi.org/10.1371/journal.pone.0320721

Huang, C. Y., Huang, W. H., & Yen, H. Y. (2023). An exploration of sedentary behavior, physical activity, and quality of life during the COVID-19 outbreak. *International Journal of Public Health*, *68*, 1605585. https://doi.org/10.3389/ijph.2023.1605585

Huang, L., Li, X., Gu, X., Zhang, H., Ren, L., Guo, L., Liu, M., Wang, Y., Cui, D., Wang, Y., Zhang, X., Shang, L., Zhong, J., Wang, X., Wang, J., & Cao, B. (2022). Health outcomes in people 2 years after surviving hospitalisation with COVID-19: a longitudinal cohort study. *The Lancet Respiratory Medicine*, *10*(9), 863-876. https://doi.org/10.1016/s2213-2600(22)00126-6

Jasem, Z. A., Manee, F., Alqattan, D. M., & Smith, T. M. (2024). Impact of post-acute sequelae of COVID-19 on lives of patients post-intensive care unit discharge: a cross-sectional study. *Medical Principles and Practice*, *33*(5), 452-461. https://doi.org/10.1159/000539781

Kang, H. (2021). Sample size determination and power analysis using the G*Power software. *Journal of Educational Evaluation for Health Professions*, *18*, 17. https://doi.org/10.3352/jeehp.2021.18.17

Kangwanrattanakul, K. (2023). Mapping of the World Health Organization Quality of Life Brief (WHOQOL-BREF) to the EQ-5D-5L in the general Thai population. *Pharmacoecon Open*, *7*(1), 139-148. https://doi.org/10.1007/s41669-022-00380-0

Kim, J., Duru, E. E., Weir, P., & Lee, S. (2024). Long COVID is associated with decreased quality of life and increased mental disability. *COVID*, *4*(11), 1719-1730. https://doi.org/10.3390/covid4110120

Kim, Y., Bae, S., Chang, H. H., & Kim, S. W. (2023). Long COVID prevalence and impact on quality of life 2 years after acute COVID-19. *Scientific Reports*, *13*(1), 11207. https://doi.org/10.1038/s41598-023-36995-4

Komáromi, L., Somogyi, A., & Szabo, A. (2025). The biopsychosocial health model differentiates long-term exercisers from non-exercisers: a cross-sectional study. *Health Science Reports*, *8*(2), e70476. https://doi.org/10.1002/hsr2.70476

Kumar, S., Gogoi, H., Singh, S., Verma, M. K., Nara, K., Choudhary, S., & Govindasamy, K. (2025). Impact of gender, urbanization, and food preference on university students' body composition post-COVID-19. *Retos*, *69*, 166-182. https://doi.org/10.47197/retos.v69.113972

Kuodi, P., Gorelik, Y., Zayyad, H., Wertheim, O., Beiruti Wiegler, K., Abu Jabal, K., Dror, A. A., Elsinga, J., Nazzal, S., Glikman, D., & Edelstein, M. (2023). Association between BNT162b2 vaccination and

health-related quality of life up to 18 months post-SARS-CoV-2 infection in Israel. *Scientific Reports*, *13*(1), 15801. https://doi.org/10.1038/s41598-023-43058-1

Lancaster, M. R., & Callaghan, P. (2022). The effect of exercise on resilience, its mediators and moderators, in a general population during the UK COVID-19 pandemic in 2020: a cross-sectional online study. *BMC Public Health*, *22*(1), 827. https://doi.org/10.1186/s12889-022-13070-7

Malkova, A., Kudryavtsev, I., Starshinova, A., Kudlay, D., Zinchenko, Y., Glushkova, A., Yablonskiy, P., & Shoenfeld, Y. (2021). Post COVID-19 syndrome in patients with asymptomatic/mild form. *Pathogens*, *10*(11), 1408. https://doi.org/10.3390/pathogens10111408

Mizumoto, K., Kagaya, K., Zarebski, A., & Chowell, G. (2020). Estimating the asymptomatic proportion of coronavirus disease 2019 (COVID-19) cases on board the Diamond Princess cruise ship, Yokohama, Japan, 2020. *Euro Surveill*, *25*(10), 2000180. https://doi.org/10.2807/1560-7917.Es.2020.25.10.2000180

Montero-López, E., Peralta-Ramírez, M. I., Ortego-Centeno, N., Callejas-Rubio, J. L., Ríos-Fernández, R., & Santos-Ruiz, A. (2022). Psychological and quality of life effects of vaccination against COVID-19 in patients with systemic autoimmune diseases. *Lupus*, *31*(14), 1808-1815. https://doi.org/10.1177/09612033221134203

Ozdemir, F., Cansel, N., Kizilay, F., Guldogan, E., Ucuz, I., Sinanoglu, B., Colak, C., & Cumurcu, H. B. (2020). The role of physical activity on mental health and quality of life during COVID-19 outbreak: A cross-sectional study. *European Journal of Integrative Medicine*, *40*, 101248. https://doi.org/10.1016/j.eujim.2020.101248

Park, K. H., Kim, A. R., Yang, M. A., Lim, S. J., & Park, J. H. (2021). Impact of the COVID-19 pandemic on the lifestyle, mental health, and quality of life of adults in South Korea. *Plos One*, *16*(2), e0247970. https://doi.org/10.1371/journal.pone.0247970

Rahman, M. A., Sagar, S. K., Dalal, K., Barsha, S. Y., Ara, T., Khan, M. A. S., Saha, S., Sarmin, T., Hossian, M., Nabi, M. H., Rahman, M. L., & Hawlader, M. D. H. (2022). Quality of life among health care workers with and without prior COVID-19 infection in Bangladesh. *BMC Health Services Research*, *22*(1), 823. https://doi.org/10.1186/s12913-022-08174-0

Roever, L., Cavalcante, B. R. R., & Improta-Caria, A. C. (2023). Long-term consequences of COVID-19 on mental health and the impact of a physically active lifestyle: a narrative review. *Annals of General Psychiatry*, *22*(1), 19. https://doi.org/10.1186/s12991-023-00448-z

Sawekchan, N., & Silalertdetkul, S. (2024). Effects of COVID-19 infection on eating behaviors, appetite perceptions, and exercise behaviours. *Journal of Sports Science and Techonology*, *24*(1), 52-64. https://he01.tci-thaijo.org/index.php/JSST/article/view/269743

Sick, J., Steinbacher, V., Kotnik, D., König, F., Recking, T., Bengsch, D., & König, D. (2025). Exercise rehabilitation in post COVID-19 patients: a randomized controlled trial of different training modalities. *European Journal of Physical and Rehabilitation Medicine*, *61*(1), 130-140. https://doi.org/10.23736/s1973-9087.24.08487-9

Silalertdetkul, S. (2024). Estimating the total and regional body fat of physically active men is not appropriate for sedentary men. *Physical Education Theory and Methodology*, *24*(3), 388–395. https://doi.org/10.17309/tmfv.2024.3.06

Slimani, M., Paravlic, A., Mbarek, F., Bragazzi, N. L., & Tod, D. (2020). The relationship between physical activity and quality of life during the confinement induced by COVID-19 outbreak: a pilot study in Tunisia. *Frontiers in Psychology*, *11*, 1882. https://doi.org/10.3389/fpsyg.2020.01882

Stavem, K., Ghanima, W., Olsen, M. K., Gilboe, H. M., & Einvik, G. (2021). Persistent symptoms 1.5-6 months after COVID-19 in non-hospitalised subjects: a population-based cohort study. *Thorax*, *76*(4), 405-407. https://doi.org/10.1136/thoraxjnl-2020-216377

Szewczyk, W., Fitzpatrick, A. L., Fossou, H., Gentile, N. L., Sotoodehnia, N., Vora, S. B., West, T. E., Bertolli, J., Cope, J. R., Lin, J. S., Unger, E. R., & Vu, Q. M. (2024). Long COVID and recovery from Long COVID: quality of life impairments and subjective cognitive decline at a median of 2 years after initial infection. *BMC Infectious Diseases*, *24*(1), 1241. https://doi.org/10.1186/s12879-024-10158-w

Townsend, L., Dyer, A. H., Jones, K., Dunne, J., Mooney, A., Gaffney, F., O'Connor, L., Leavy, D., O'Brien, K., Dowds, J., Sugrue, J. A., Hopkins, D., Martin-Loeches, I., Ni Cheallaigh, C., Nadarajan, P., McLaughlin, A. M., Bourke, N. M., Bergin, C., O'Farrelly, C., . . . Conlon, N. (2020). Persistent fatigue following SARS-CoV-2 infection is common and independent of severity of initial infection. *Plos One*, *15*(11), e0240784. https://doi.org/10.1371/journal.pone.0240784

van der Sar-van der Brugge, S., Talman, S., Boonman-de Winter, L., de Mol, M., Hoefman, E., van Etten, R. W., & De Backer, I. C. (2021). Pulmonary function and health-related quality of life after COVID-19 pneumonia. *Respiratory Medicine*, *176*, 106272. https://doi.org/10.1016/j.rmed.2020.106272

Vélez-Santamaría, R., Fernández-Solana, J., Méndez-López, F., Domínguez-García, M., González-Bernal, J. J., Magallón-Botaya, R., Oliván-Blázquez, B., González-Santos, J., & Santamaría-Peláez, M. (2023). Functionality, physical activity, fatigue and quality of life in patients with acute COVID-19 and Long COVID infection. *Scientific Reports*, *13*(1), 19907. https://doi.org/10.1038/s41598-023-47218-1

West, E. C., Williams, L. J., Stuart, A. L., & Pasco, J. A. (2023). Quality of life in south-eastern Australia: normative values for the WHOQOL-BREF in a population-based sample of adults. *BMJ Open*, *13*(12), e073556. https://doi.org/10.1136/bmjopen-2023-073556

Yaiyong, C., Mitranun, W., Anek, A., Sriramatr, S., & Silalertdetkul, S. (2026). Differences in quality of life, pulmonary function, and exercise behaviour in young overweight individuals with and without COVID-19. *Retos*(76), 198-210. https://doi.org/10.47197/retos.v76.117630

Yalçın-Çolak, N., Kader, Ç., Eren-Gök, Ş., & Erbay, A. (2023). Long-term symptoms and quality of life in persons with COVID-19. *Infectious Diseases and Clinical Microbiology*, *5*(3), 212-220. https://doi.org/10.36519/idcm.2023.248

Zavala Crichton, J. P., Titus-Cabrera, A., Navarro-Henríquez, F., Álvarez-Opazo, J. J., Yáñez-Sepúlveda, R., Ortiz-Marholz, P., Hinojosa-Torres, C., Cristi-Montero, C., Solís-Urra, P., & López-Gil, J. F. (2025). Associations between physical fitness, body composition, and health related quality of life among inactive university students. *Retos*, *73*, 757-769. https://doi.org/10.47197/retos.v73.117510

Authors and translators' details:

Lalitwadee Phorthanee	lalitwadee.aom@g.swu.ac.th	Author
Supaporn Silalertdetkul	ssilalertdetkul@gmail.com	Author