

## **Effect of Virtual Physical Exercise on Mental Health Status During the COVID-19 Pandemic**

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### **Abstract**

In May 2021, the Malaysian government enforced a movement control order (MCO) due to the worsening situation of the COVID-19 pandemic. MCO includes restrictions on outdoor activities and the closure of fitness centres. The active community may experience disquietude because this order affects their healthy living activities outdoor, and partially, it affects them psychologically. To overcome this, several endeavors were made to encourage physical exercise through live virtual physical activity via social media or recorded videos in the broadcasting platform. Therefore, this study aims to measure the mental health status of the community undergoing virtual physical exercise (VPE) program during MCO using a new modified instrument. In this study, 100 participants were randomly participated within the southeast region in Malaysia using the snowball effect strategy. The Depression-Anxiety-Stress Scales (DASS-21) questionnaire was modified into a new survey that was specifically designed to measure stress, anxiety, and depression related to VPE and MCO. The survey was scaled and administered online for data collection. The SPSS software was used for descriptive statistics, and SmartPLS software was used to test the structural equation model between the items. The obtained results showed significant changes in the mental health status [i.e., level of stress, anxiety and depression reduced after joining VPE ( $M = 14.5$ ,  $SD = 13.6$ )]. In addition, depression was significantly correlated with stress and anxiety before and after involvement in VPE ( $p = 0.00$ ). In conclusion, engaging in VPE during the quarantine and restricted movement period can lead to a healthier mental status. This study enlighten the future of physical activities using innovative method through technology, their impact on lifestyle, and the psychological states of the community.

**Keywords:** COVID-19 pandemic, virtual exercise, physical activity, mental health.

### **Introduction**

The COVID-19 pandemic (which started in December 2019) is spreading throughout the world. In May 2021, Malaysia had to undergone total lockdown orders to forestall the COVID-19 virus spreading throughout the nation (New Straits Times, 2020; Tang, 2020). This lockdown orders also known as MCO enforced obligatory for individuals to be quarantined at home, which influenced one's normal routine. Social isolation for certain period of time may have a negative impact on mental health and result in anxiety, stress, and despair (American Psychological Association, 2020, 2021; Shanmugam et al., 2020). Concern and worry about the fluctuation of the COVID-19 cases give negative affect towards individual psychology state. According to the American Psychological Association (2020, 2021), more than half of American community are worried about the COVID-19 virus and it also reported that 38% experience a severe case on mental health. These reports indicate that quarantine orders heavily affect the mental health status. Qiu et al. (2020) also reported that adults and senior citizens have high Peritraumatic Distress Index (CPDI) score and are more susceptible to mental disorders such as depression, anxiety, sleep disorder and stress.

According to the World Health Organization (2020a), mental health has many different types of conditions related to the demeanor, attitude, emotion, or many other mental illnesses combination. Nervousness or anxiety is a psychological disorder with the symptoms such as apprehensive, disorganized thought, rapid changes in blood pressure and heartbeat, tremor, or lightheadedness (Churchill & Richer, 2000). American Psychological Association (2019, 2020, 2021) explained that the stress mechanism was linked to the anxiety where it been triggered and reacted to a traumatic or stressful events specifically in this case they are anxious of getting affected by the COVID-19 virus and also the increasing cases of COVID-19 near them (Abdul Ghani et al., 2021). Once stress triggered, affected individuals may experience hypertension, chest discomfort, headaches, sleep deprivation and irritated skin diseases (Anxiety & Depression Association of America (ADAA), 2021). On the other hand, depression affects more than 200 million individuals worldwide and it also has been reported that severely depressed individual may lead to a suicidal or self-destructive actions (World Health Organization, 2020).

Previous studies has summarized that the isolation and home quarantine had a negative impact on the mental well-being (Ammar et al., 2021; Purssell et al., 2020; Sharma et al., 2020) such as high levels of depression and anxiety, mood disturbances and sleeping disorder. All of these psychological issues are induced by the psychosocial factors such as social disturbance, lack of social support and interaction and also solitude due to the self-isolation and quarantine order by the government (Abdul Ghani et al., 2021; Gellman & Turner, 2013). In this situation, World Health Organisation (WHO) encourages people to practice and increase mental and physical activities at home.

Individuals should maintain active lifestyle routine to ensure mental and physical stability during difficult times. Sharma et al.(2006) stated that there is a connection between mental and physical health through healthy lifestyle and it has been justified in decreasing numerous mental illnesses. Guo et al. (2020) and Harbour et al. (2008) also reported that vigorous physical activity may reduce psychological disorders symptoms. As a consequence of the MCO due to the COVID-19 pandemic, deficient in physical activity in a daily routine may have a significant role to the worsening condition in the mental health status (Bastemeyer & Kleinert, 2021). Previous studies discussed the effects of COVID-19 pandemic towards physical performance, well-being and emotion (Aksay, 2021; Grajek & Sobczyk, 2021). Major concern of depression developing symptoms was found out during COVID-19 pandemic situation where individuals are commonly afraid of getting ill, job loss and isolation from society (Grajek & Sobczyk, 2021). While, physical performance has been improved significantly in the elderly after engaging with live online exercise programs during COVID-19 pandemic (Aksay, 2021). Undoubtedly, exercise could give positive impact during lockdown period due to the COVID-19 pandemic situation.

Although there are standard operation procedures (SOP) circular permitted some physical activities but it is subject to the strict SOP and group activities are still not allowed (Joseph, 2021; Pfordten, 2021). Since the first catalyst for the early spreading cases of COVID-19 in Malaysia was due to the mass gathering activities (Che Mat et al., 2020), mass gathering activities such as weddings, religious gathering, conferences, seminars sports events, group sports, concert and etc. are banned throughout the MCO (Joseph, 2020; Muhyiddin, 2021). According to the World Health Organization (2020b), an event counts as a mass gathering if it involve large number of people together at the same time and has potential to affect prevention planning and health system in the area where it takes place.

The lockdown obligatory may heavily affected the active group community because they could not participate in mass gathering or involve with any community fitness program including yoga, tai chi, aerobic dance classes, zumba and also cycling either in a wellness centers (Piotrowski & Piotrowska, 2021) or outdoor settings such as recreational parks (Arumugam, 2021). To some period, it could affect their mental health (Beckstein et al., 2020; Raaj et al., 2021; Shanmugam et al., 2020; Wong et al., 2021).

Thus, several individuals and fitness organization took initiatives to set up activities and exercises using technology to connect everyone remotely to overcome movement restriction problems owing to the quarantine order. Diverse efforts were made to ensure these community could still actively involve with the physical activity as a group even in their respective quarantine places. Considering all of the restriction during MCO, this issue can be solved by engaging with physical exercise using online platform virtually either live online or through pre-recorded videos (Abdul Ghani et al., 2021). Previous studies determined that in contrast to self-directed exercise, exercise with guidance of experts (coach, physical trainer or instructor) significantly improved emotional, psychological and social well-being of oneself (Ströhle, 2009). To summarize, this study highlighted the urge to sustain active lifestyle together with others virtually especially from the perspective of the current scenario where individuals had to retain mentally healthy while staying at home isolated from each other.

Therefore, the main objective of this study is to investigate the effect of virtual physical exercises (VPE) on mental health. Other objective also to measure the mental health status through the level of depression, anxiety and stress during the MCO implementation owing to the COVID-19 pandemic outbreak before and after involvement in VPE. In addition, this study intends to determine whether depression, anxiety, and stress correlate with each other and can be reduced through exercise virtually.

## **Methods**

### *Participants*

The snowball technique was employed to collect data for this quantitative study. It was distributed among communities in Southeast Malaysia. Participants were thoroughly selected, particularly those who were physically active before the lockdown implementation.

### *Procedure*

Owing to the MCO implementation, this study used online medium via the Google form survey for data collection. The online survey was disseminated among the community via online messenger platforms such as Facebook, WhatsApp, Telegram and Signal as it were widely used by all populations. The first layer of the snowball technique for data collection was distributed to the registered community who are actively involved with the group exercise and fitness program under community organization. Then, the first layer participants were requested to circulate the survey to others who are pertinent to this study.

*Instruments*

This study used a Depression Anxiety Stress Scales-21 items (DASS-21) survey as a reference, and the structure underwent minor modification to suit study objectives. DASS-21 consists of 21 items and been divided into three main subscales which were depression, anxiety and stress (7 items for each subscales) (Lovibond & Lovibond, 1995). First section of the survey was added with the demographic data, including age and roles during the online program (coach, instructor, or participant), as general information of the participants. Second section of the survey was the random 21 questions related to the depression, anxiety and stress subscales with the four response options from 0 (did not apply to me at all) to 3 (applied to me very much).

According to the Beaufort et al. (2017) and Lovibond & Lovibond (1995), the scores of the three subscales were calculated as follows:

- i. The depression subscale with the questions of 3, 5, 10, 13, 16, 17 and 21. It was labelled as normal (0–9), mild depression (10–12), moderate depression (13–20), severe depression (21–27), and extremely severe depression (28–42).
- ii. The anxiety subscale with the questions of 2, 4, 7, 9, 15, 19, and 20. It was labelled as normal (0–6), mild anxiety (7–9), moderate anxiety (10–14), severe anxiety (15–19), and extremely severe anxiety (20–42).
- iii. The stress subscale with the questions of 1, 6, 8, 11, 12, 14, and 18. It was labelled as normal (0–10), mild stress (11–18), moderate stress (19–26), severe stress (27–34), and extremely severe stress (35–42).

A pilot study was conducted earlier to ensure the validity and reliability of the instrument. Two items from the questionnaire (B21 and A1) were removed because the item loadings value was smaller than 0.5 (Chin, 1998; Vinzi et al., 2010). The Cronbach’s coefficient  $\alpha$  resulted in a value of more than 0.7 for each subscale (depression = 0.81, anxiety = 0.78, and stress = 0.88) for the internal consistency of the items which indicated good distribution among the participants (Ab Hamid et al., 2017)

*Data Analysis*

Descriptive statistics for demographic data were analysed with each variable was reported using percentage of responses towards each item in the survey. As for mental health status results, overall scores of the DASS-21 scale were presented as the mean (SD) via the SPSS software and Smart PLS-SEM software was used to interpret the relationship model between each subscale (depression, anxiety and stress) and its effect following the VPE program.

**Results**

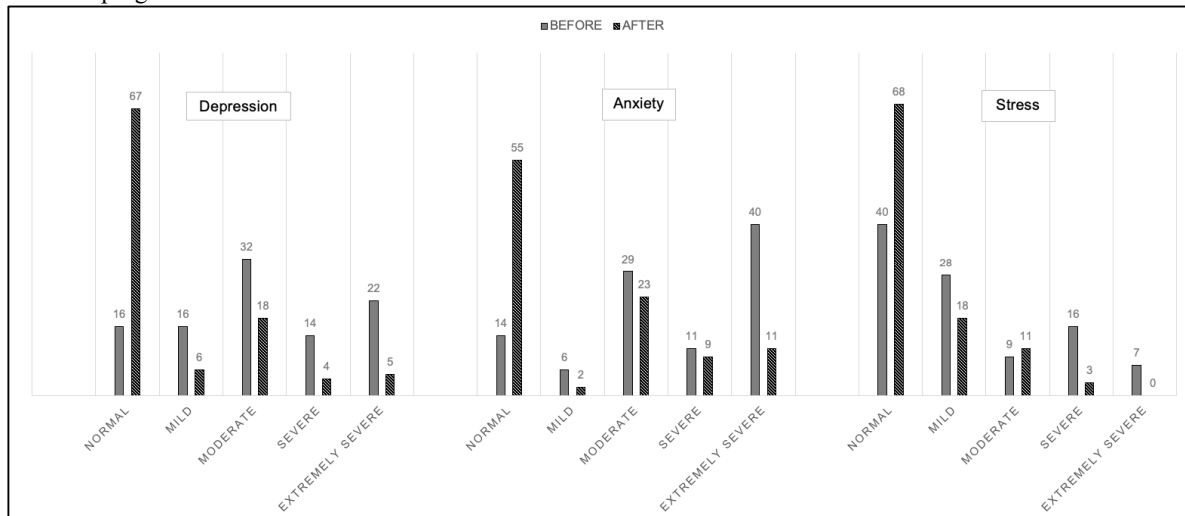
This study included 100 respondents from the sports active community in southeast Malaysia.

*Demographic Data*

The majority of participants were 20–29 years old (74%), and most of the respondents were involved as a participant in either live events or via a recorded video of a VPE program (85%) compared to those who involved as an instructor (8%) or coaches (7%) of the program.

*Mental Health Status*

Figure 1 shows the percentage of depression, anxiety and stress scores of DASS-21 before and after engaging in the VPE program.



**Figure 1:** Percentage of depression, anxiety and stress before and after engaging in the VPE program

Figure 1 clearly shows that before joining the VPE program, for all three subscales, the extremely severe and severe score was high. The score decreased after joining the VPE program. A decrease was especially significant for stress subscales, and the score decreased to zero percentage, which indicated a positive response towards the VPE program. Regarding the normal score, all three subscales showed significantly higher score values, which indicated that after joining the VPE program, all participants gave positive feedback towards the normal score for mental status.

Figure 2 illustrates the mean score of all three subscales. The mean scores for DASS-21 subscales after the VPE program (3.59 for depression, 4.2 for anxiety and 3.99 for stress) were significantly lower than those before engaging with the VPE program (9.21 for the depression, 8.77 for the anxiety and 8.26 for the stress).

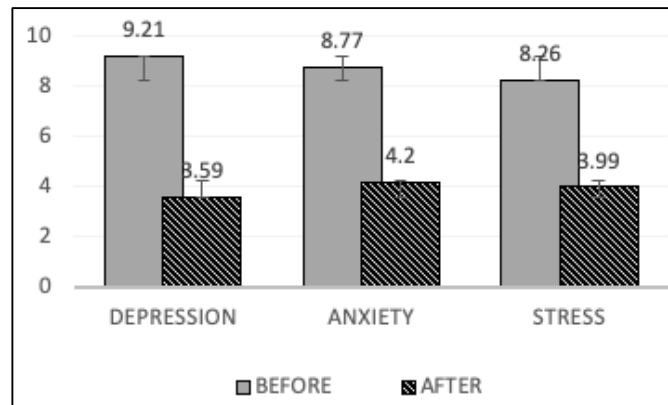


Figure 2: Mean score of depression, anxiety and stress before and after engaging in the VPE program

Furthermore, Table 1 shows that the mean scores were significantly lower after engaging with the VPE program with 11.78 compared to those before engaging in the VPE program (26.2), which indicated that the VPE program positively affected the mental status of all participants. Table 1 shows the overall results of paired t-test analysis before and after involvement in the VPE program.

Table 1: Paired t-test statistics for the DASS-21 subscales score

Mental health subscales	Engagement in the VPE program	Mean	t-value	p-value (Sig 2-tailed)
Stress	Before	8.26	8.19	.000
	After	3.99		
Anxiety	Before	8.77	9.44	.000
	After	4.20		
Depression	Before	9.21	11.34	.000
	After	3.59		
<b>Overall</b>	Before	26.24	10.6	.000
	After	11.78		

There are significant differences before and after engaging in the VPE program: stress ( $t = 8.2, p = 0.0$ ), anxiety ( $t = 9.4, p = 0.0$ ), depression ( $t = 11.34, p = 0.0$ ) and overall results ( $t = 10.6, p = 0.0$ ). These results indicate that the mental health status significantly improved after the participants engaged in the VPE program.

#### *Structural Sequential Model of Depression–Anxiety–Stress*

The model was analysed using Smart PLS-SEM before and after the engagement with the VPE program.

#### *Measurement Model*

According to the Hair et al. (2018) and Ramayah et al., (2018a, 2018b), factor loadings, average variance extracted (AVE), and composite reliability (CR) were examined and the value should be greater than 0.5 for factor loadings; 0.5 for the AVE and 0.7 for the CR.

Table 2. Full collinearity analysis of Depression-Anxiety-Stress model

	BEFORE VPE					AFTER VPE					
	Items	Loading	CA	CR	AVE	Items	Loading	CA	CR	AVE	
Stress	B11s	0.835	0.877	0.906	0.582	Stress	A11	0.870	0.897	0.945	0.743
	B12	0.870					A12	0.855			
	B14	0.60					A14	0.916			
	B18	0.78					A18	0.844			
	B1	0.678					A1	X			
	B6	0.745					A6	0.808			
	B8	0.788					A8	0.874			
Anxiety	B15	0.794	0.738	0.844	0.443	Anxiety	A15	0.73	0.930	0.918	0.618
	B19	0.635					A19	0.701			
	B20	0.50					A20	0.752			
	B2	0.662					A2	0.808			
	B4	0.540					A4	0.855			
	B7	0.746					A7	0.828			
	B9	0.780					A9	0.815			
Depression	B10	0.780	0.809	0.863	0.518	Depression	A10	0.852	0.930	0.944	0.706
	B13	0.880					A13	0.853			
	B16	0.730					A16	0.909			
	B17	0.674					A17	0.756			
	B21	X					A21	0.868			
	B3	0.613					A3	0.897			
	B5	0.598					A5	0.731			

Table 2 and Figure 3 show that, all factor loadings are greater than 0.5 (0.500 to 0.919); AVE value range is above 0.5, i.e., 0.500 to 0.694 (*high reliability*). Although the value of anxiety before VPE is lower than 0.5 (0.443), the CR value range for all is above 0.7, i.e., 0.844 to 0.945 (*high reliability*) thus, this value is accepted and lastly the Cronbach Alpha's (CA) value range is above 0.7, i.e., 0.738 to 0.930 (*high reliability*) indicated that all three conditions for reliability and convergent validity of the measures hold and good.

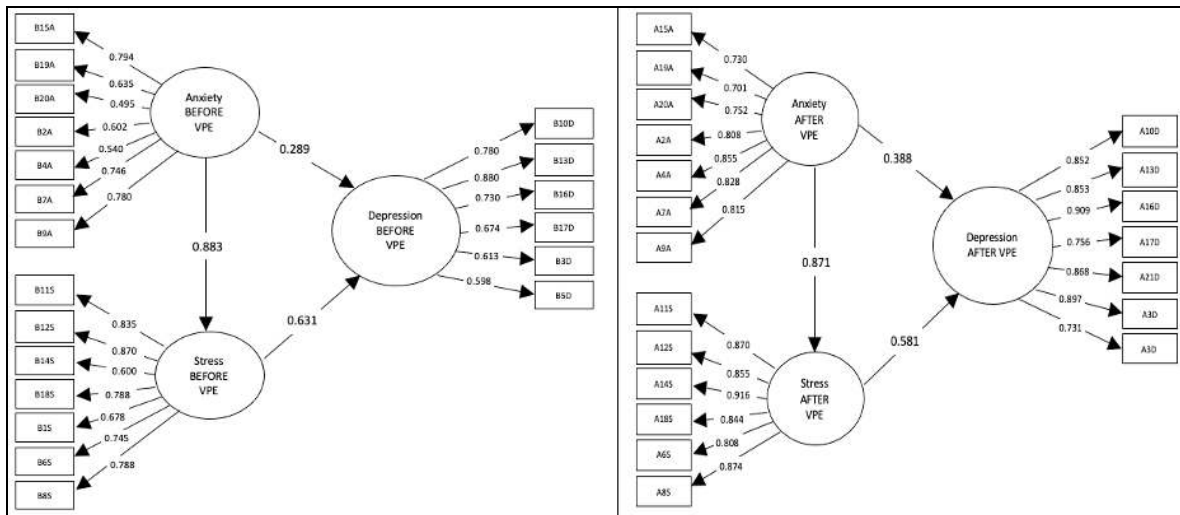


Figure 3: Items loading analysis model before and after engagement in the VPE program

Next, Henseler et al. (2015) suggested criterion heterotrait–monotrait ratio (HTMT) to assess discriminant validity with the value of the HTMT ratio is less than 0.85 to confirm constructs are distinct.

Table 3. Discriminant validity analysis results

	BEFORE			AFTER		
	Depression	Anxiety	Stress	Depression	Anxiety	Stress
Depression	0.719	0.846		Depression	0.840	0.894
Anxiety		0.665		Anxiety		0.768
Stress	0.886	0.883	0.763	Stress	0.918	0.871
						0.862

As shown in Table 3, all ratios are less than 0.85 approximately and aligned with the high reliability CA results thus, it was confirmed and good for discriminant validity.

*Structural model*

This study used bootstrapping procedure (5000 sample re-sample) as suggested by Hair et al. (2019 and Ramayah et al. (2018b) to analyse the path coefficients, standard errors, *t*-values, and *p*-values for the structural model. In addition, Hahn & Ang (2017), reported that the *t*-value greater than 1.96 together with *p*-values lower than 0.05 then, the structure model validity was confirmed.

Table 4: Path coefficients analysis results

	Before		After	
	T-value	P-value	T-value	P-value
Anxiety → Depression	2.921	0.04	4.364	0.00
Anxiety → Stress	41.025	0.00	33.047	0.00
Stress → Depression	7.060	0.00	6.576	0.00

Table 4 and Figure 4 shows that the *t*-value range is greater than 1.96 (2.921 to 41.025), and the *p*-value range is lower than 0.05 (0.04 to 0.000); therefore, it can be concluded that the *structural model is significantly correlated*.

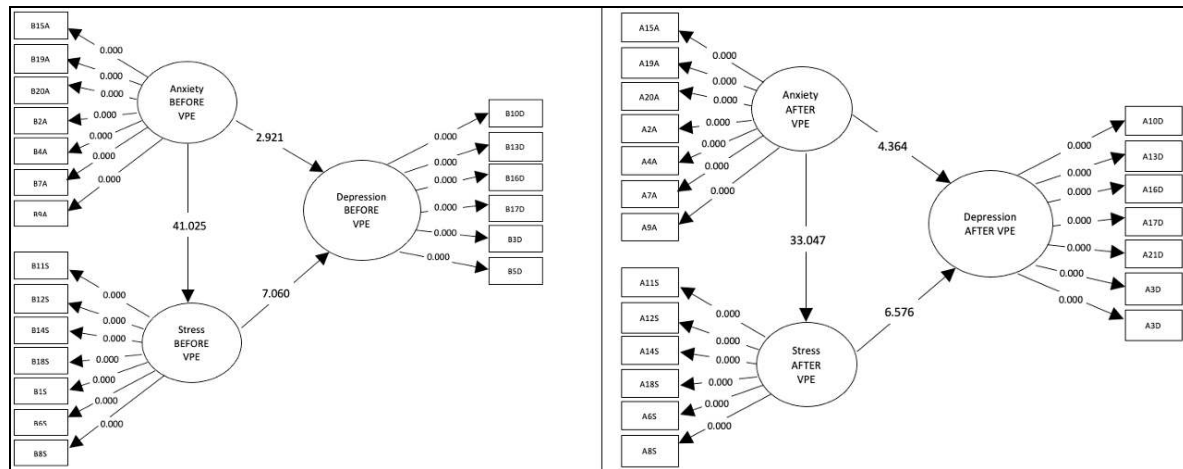


Figure 4: Path coefficients model before and after engagement in the VPE program

The obtained results show that depression, anxiety and stress are significantly correlated with each other before and after engaging in the VPE program, which indicates that subscales in mental health are highly correlated with physical activity via online medium.

**Discussion**

The findings of this study reported a positive relationship between virtual exercise and mental health status. This was aligned with the previous studies that shown exercise via online medium significantly improve mental health status (Abdul Ghani et al., 2021; Deng et al., 2020; Dogra et al., 2018; Goodwin, 2003). Zeng et al. (2018) also stated that exercising using virtual reality technology may positively affect mental disorders, especially anxiety and depression symptoms. According to Krivokapić (2016) active lifestyle involving regular physical exercise may improve many types of psychological disorder. The MCO implementation has caused the individual’s active routine with the community to be affected. However, with the innovative efforts and methods via online technology, they could implement that routine together again even though in their respective quarantine home. These also resulted in their mental health status getting better and improved.

Throughout the years, the COVID-19 pandemic had many negative effects and the MCO implementation had caused the level of stress, anxiety and depression increases for most people owing to quarantine and social distancing. Communities had to adjust and adapt to the new norm of life to avoid spreading or getting infected by the virus. Therefore, the VPE program could assist them to have alternative methods to keep their well-being active and healthy and stay connected with others.

According to Frost et al. (2020), there are many technologies invented for health purposes to aid physical activity among people. It can be also used to reduce cognitive distress, improve mood, and increase daily performance. This claim agrees with the results of this study, where using technology, it is possible to positively affect mental health. Technology also connected people thus, it could help them boost up their spirits

to keep on living during difficult times. VPE provides significant contribution by improving spirituality via interaction and connection online. Findings shows that stress and anxiety are correlated and significantly affect depression. Therefore, people can avoid becoming depressed when they are less stressed and less anxious.

The obtained results can be explained as follows. When people are involved in the VPE program at home, they are comfortable and have good conditions in self-care during practice, i.e., they can drink water whenever they want to and exercise when they feel like doing it. Home environments bring benefits that can enhance the quality of mental healthcare during pandemics (Abdul Ghani et al., 2021)

### Conclusion

Active community are heavily affected with the strict SOP implemented throughout the MCO. The present study shows that despite the initial downfall on the mental well-being with all the anxiety and lack of motivation to do physical activities, they were able to overcome it and engage with the new norm of VPE at home. This study demonstrated the positive impact of the VPE towards mental health status during quarantine period. The present study also conducted in order to learn about active communities' perspectives on the MCO scenario and how they dealt with pandemic COVID-19. Previous findings (Adu et al., 2021; Ammar et al., 2021; Beckstein et al., 2020; Kontoangelos et al., 2020; Otu et al., 2020; Pursell et al., 2020; Qiu et al., 2020; Shanmugam et al., 2020; Sharma et al., 2020; Sundarasan et al., 2020; Wong et al., 2021) reported the psychological concerns due to the pandemic and lockdown orders and these has strengthen the objectives of this study to search for the alternative ways to overcome the issues. Furthermore, considering that the lockdown order and the constraint on outdoor group activities in the public environment will be prolonged, it can be suggested that online exercise can help the community to maintain active lifestyle in the future.

Initial perception in hoping things to normalize has given negative impact on individual's mental well-being however, by accepting the reality, they learn to adopt to the situations and improved their perceptions thus searching for alternatives ways to keep active and healthy. New perception of the activities during the new norm not only focused on the physical appearances but also on the mental and social health as a whole (Jankowska, 2021). VPE observed in this study also covered wide usage of technology as medium thus give options and encourage people to experience variety of physical exercises provided by many resources online (Raiola & Domenico, 2021) They also could get connected to everyone. Kaur et al. (2020) stated that social support through interactive medium could increase one's motivation and keep them engaged as they exercised and prolonged the period of time. Interactive physical activities accompanied by music and graphic boost physiological response during exercise thus reduce levels of depression, anxiety and stress (Ballmann, 2021; Bradt et al., 2016; Chtourou et al., 2015; Terry et al., 2020)

It can be concluded that during MCO, before engaging in the VPE program, all participants had a high level of extremely severe for mental health status. After engaging in the VPE program, the mental health status significantly improved. Findings of this study has shown decreasing levels in depression, anxiety and stress following physical activity. The level of mental status was normal for most participants afterwards, which indicated that the VPE program provided positive feedback towards psychological well-being. Therefore, the VPE program successfully improved mental health status particularly for depression, anxiety and stress.

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