The Study on Physical Activity Programs Affecting Physical Fitness in Working-Age Adults During the Coronavirus Disease 2019 Situation

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Abstract. This research is quasi-experimental research aiming to study the effect of a physical activity promotion program. Compare the physical activity level and physical fitness of working Adult. During the Coronavirus Disease 2019 Situation, the sample group used in the research consisted of 50 people. The research instruments were 1) Physical activity promotion program for working Adult, 2) Physical fitness test, 3) Global Physical. Activity Questionnaire: GPAQ version 2 and 4) Physical activity Recording. Statistics used to compare before and after using the physical activity promotion program. Data were analyzed using Mean, Percentage, Standard Deviation, Two-Way Repeated-Measures MANOVA and Bonferroni for post-hoc procedure. The results were that 1. Physical activity level and amount of exercise of working age personnel of males were higher than females. 2. The physical fitness of the experimental group was better than the control group. Flexibility, muscles strength of hand and forearm, leg muscle strength and endurance, and cardiovascular endurance. There was Not statistically significant between the trial and 8 weeks after the trial. However, after 8 weeks and after 12 weeks the trial, there was significantly different at the statistical level of .05.

Keywords: Physical Activity, Physical Fitness, Working Adults, Corona Virus 2019 (COVID-19)

1 Introduction

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Physical activity as any bodily movement produced by skeletal muscles that requires energy expenditure. Physical activity refers to all movement including during leisure time, for transport to get to and from places, or as part of a person's work. Both moderate- and vigorous-intensity physical activity improve health. Popular ways to be active include walking, cycling, wheeling,

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sports, active recreation and play, and can be done at any level of skill and for enjoyment by everybody. Regular physical activity is proven to help prevent and manage noncommunicable diseases such as heart disease, stroke, diabetes and several cancers. It also helps prevent hypertension, maintain healthy body weight and can improve mental health, quality of life and well-being. (WHO, 2020)

From the epidemic situation of coronavirus disease 2019 that has entered a global pandemic (Pandemic) for Thailand The epidemic has spread to a wide area. This caused the government to announce more and more intensive countermeasures from the provincial, district, sub-district level to the village level. (National Health Commission office and Regional Policy Promoting Office, 2020) The global outbreak of COVID-19 has resulted in closure of gyms, stadiums, pools, dance and fitness studios, physiotherapy centres, parks and playgrounds. Many individuals are therefore not able to actively participate in their regular individual or group sporting or physical activities outside of their homes. Measures to cope with the spread of the coronavirus disease 2019 As a result, the government in each country announced the temporary closure of exercise facilities. whether the stadium Fitness Center Gym, swimming pool, as well as physical therapy center. As a result, people are unable to exercise or engage in normal physical activity. (Bas, Martin, Pollack and Venne, 2020)

The Physical Activity Guidelines for Americans Adults should do at least 150 minutes to 300 minutes a week of moderate-intensity, or 75 minutes to 150 minutes a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. They should also do muscle-strengthening activities on 2 or more days a week. (Piercy KL , Troiano RP , Ballard RM , et al , 2018) to be the model for promoting physical activity which is practiced in many countries. According to the study, physical activity can provide various health benefits (WHO, 2020 ; Bull FC , Al-Ansari SS , Biddle S , et al, 2020 ; Stamatakis E , Bull FC, 2020) i.e. physical activity may help enhance body immunity, prevent coronavirus infection, and reduce severity of symptoms and case fatality rate caused by virus infections (Nieman DC , Wentz LM , 2019; da Silveira MP , da Silva Fagundes KK , Bizuti MR , et al, 2021; Burtscher J , Millet GP , Burtscher M, 2020). Regular physical activity helps reduce and prevent risk factors for coronavirus infection which is the main culprit of lung damage from infection (Sallis JF , Adlakha D , Oyeyemi A , et al, 2019). Moreover, physical activity also promotes cardiovascular health, increases lung capacity, and improves mental health (Piercy KL , Troiano RP , Ballard RM , et al , 2020 ; Buitrago-Garcia D , Egli-Gany D , Counotte MJ , et al, 2020). In addition to regular physical activity which can prevent several chronic diseases and reduce severity of the COVID-19 pandemic, public spaces restriction and social distancing are important policy measures to reduce the spread of SAR-CoV-2 and protect public health. Meanwhile, half of the world's population have now been asked to stay home and avoid many public places (Honey-Roses J , Anguelovski I , Bohigas J , 2020).

In the United States, there was an absence of previous studies on the benefits of physical activity and advice on maintaining or promoting physical activity during the pandemic while the pre-epidemic physical activity level was generally inadequate. The pandemic prevention measure (Guthold R , Stevens GA , Riley LM , et al, 2018) requires people or working age groups to have knowledge and self-defense behaviors and proper protection for family members in order to be safe from Coronavirus 19 infection. However, if the community lacked the accurate knowledge and is inaccessible to the information thoroughly, this would affect their awareness in self-caring and family protection to prevent infection. The spread of the pandemic would also

increase as it can spread easily through the respiratory system in unprotecting conditions. The situation would cause people severe anxiety and panic attacks which may be likely to notably affect the decline in physical activity. Early studies indicate that physical activity levels have decreased significantly since the start of the pandemic (Ammar A , Brach M , Trabelsi K , et al, 2020; Meyer J , McDowell C , Lansing J , et al, 2020). However, living the lifestyle in the situation of coronavirus disease pandemic 2019, there are restrictions in accordance with preventive measures and social distancing along with the important role of physical activity both physically and mentally. On the other hand, the harmful social, mental and physical health and economic impacts must also be taken into account. The psychological effects of quarantine can be in abundance and have long-term effects including mood swings, depression, stress, mood swings, irritability, insomnia, post-traumatic stress and anxiety. Epidemiological studies have described that not only the act of exercising that can reduce the risks or chances of getting disease, but other physical activities in daily life that involve moderate physical efforts or exercises can also reduce the risk. (Chodzko-Zajko, et al, 2009)

Therefore, there is a great need to promote more physical activity. Under the New Normal from the study of research related to physical activity under the epidemic situation of COVID-19 found that There has been an increase in the amount of online fitness channels produced to help individuals participate in guided exercise, through a programme that is safe, simple and easy to implement (Chen et al., 2020). In some way, PA conduct at home is adapted. There is a basic assumption that the adaptations are mainly in the form of adapting equipment, space, and task difficulty, for example modifying exercises for people who are unable to jump and stand, yet the style of communication is often overlooked and not adapted. Emerging evidence emphases a motivationally adaptive communication style is needed to improve exerciser satisfaction. (Ntoumanis, Thøgersen-Ntoumani, Quested, & Hancox, 2017), Traditional recorded media allows individuals can replay the programmes at the own convenience, but feedback from the instructor to motivate, correct or adjust can be random and it lacks the individualised methods that are typical for APA. There has been a wide uptake on programmes like Zoom for online guided exercise and instructors can give live feedback to the otherwise unidirectional online options from platform like YouTube. Specific programmes. (Kwok Ng, 2020)

For the reasons mentioned above, even in the present, there are various activities or campaigns that can promote the physical activity of working age personnel. The activities can be options for the university or the related agencies to apply for physical activity promotion among working age personnel in Thai context and help to enhance physical performance and reduce sedentary behavior of working age personnel. Additionally, it can also be useful for demonstrating essential policy directions and strategies to promote population health in terms of effectively increasing physical activity and reducing sedentary behavior among Thai populations. This is in line with health promotion, protection and health risk factors of the working-age population that should be formed by the proper lifestyle including the factors contributing to health and safety in the home, workplace, community and public places in order to reduce sickness and injury as much as possible, according to the strategic plan related to Ministry of Health Fiscal Year 2019 under the 20-Year National Strategic Plan (Public Health) and in associated with promoting health and potential of people of all ages. Therefore, physical activity promotion policies were proposed to meet the country policy and the target group, including 5 policies as follows: 1. Active School 2. Active Workplace 3. Active Community 4. National Steps Challenge 5. Tax Measures. Policy proposal to promote physical activity according to the

physical activity promotion plan in 2018-2030, subcommittee in charge of policy proposal development to promote physical activity, division of physical activity for health, department of health, ministry of public health.

We aimed to compare the effects of 12 weeks of physical fitness of working Adult within the control group and the experimental group before and after 12 weeks. We hypothesized that physical activity promotion program would result in experimental group greater improvements in physical fitness measures compared to control group after 12 weeks.

2 Methods

Participants: Fifty working adults who are free of inherited illnesses and flaws that prevent them from engaging in physical exercise, such as high blood pressure, heart disease, bone disease, etc. (Control, n=25) and (Experiment, n=25). 50 individuals made up the study sample, which was split into two groups with 25 each: the experimental group and the control group.

Personnel employed at Maha Sarakham Province University who completed a total physical activity questionnaire with less than or equal to 600 MET-minutes per week were the sample group for the research study. From all participating universities, 50 respondents were chosen at random, split into two groups of 25 each using block randomized allocation, and then separated into two groups: the experimental group and the control group.

The sample size was obtained using the test power analysis and influence size, based on the study by Jort Veen et al. (2022) titled Effects of Reallocating Time Spent in Different Physical Activity Intensities on Sarcopenia Risk in Older Adults: An Isotemporal Substitution Analysis. The power of the exam is set at a level of 0.80. At least 25 participants were included in the sample because of the statistical significance threshold at the.05 level (=.05). The sample group may also have the option to abandon the trial while taking part in the research study throughout the 12-week program. The sample size was thus expanded by the researcher to 4 individuals each group (15%). 58 people made up the whole sample.

The participants were familiarized with the experimental procedure and associated risks and gave their written informed consent to participate. This study was performed in compliance with the Committee on Ethics for Research in Humans Mahasarakham University Division of Research (MSU-EC 291-233/2022).

3 Data Analyses

In evaluating mean differences on two or more dependent criteria variables at once, multivariate analysis of variance (MANOVA) is used to determine the statistical significance of the influence of one or more independent variables (Bray & Maxwell, 1985). Kolmogorov-Smirnov tests, Box's M Test of Equality of Covariance Matricesa, Wilks' lambda (Olson, 1976; Stevens, 1979) was used to test the assumption of homogeneity of variances, and Bonferroni for the Post-hoc method were employed to ensure that all data were normal.

4 Results

1. The results of testing within the control group revealed that the resting pulse (P=0.010), strength of the hand and forearm muscles (P=0.001), and circulatory endurance (P=0.030) were substantially different (P.05). Comparative findings of disparities in physical fitness. Leg muscular strength and endurance (P=0.060), joint flexibility (P=0.090), and P=0.090 did not vary.

2. The results of testing withing the experimental group showed that there were statistically significant differences in the upper blood pressure (P=0.020), flexibility of the joints (P=0.001), strength of the hand and forearm muscles (P=0.001), strength and endurance of the leg muscles (P=0.001), and circulatory endurance (P=0.001). Diastolic blood pressure (P=0.080) did not vary from resting pulse (P=0.410).

3. Comparative analysis of differences in physical fitness between the control group and the experimental group revealed significant differences in resting pulse (P=0.729), upper blood pressure (P=0.832), diastolic blood pressure (P=0.210), joint flexibility (P=0.738), hand and forearm muscle strength (P=0.153), leg muscle strength and endurance (P=0.823), and circulatory endurance (P=0.394). After 12 weeks, there were no changes in these points.

Table 1 shows the mean and standard deviation of the sample's age, weight, height and body mass index.

Physiological variables	N =50	$\bar{x}$	SD
1. Age (year)	Control	39.96	7.55
	Experiment	39.72	9.33
2. Weight (kg)	Control	61.2	11.98
	Experiment	61.68	8.83
3. Height (cm)	Control	162.28	8.76
	Experiment	163.16	7.25
4. Body Mass Index (kg/m^2)	Control	23.08	2.83
	Experiment	23.16	2.89

From Table 1, the fundamental characteristics of the control group: The mean age is 39.96 years (SD = 7.55) weight is 61.20 kg (SD.= 11.98) The average height is 162.28 cm (SD.= 8.76) and the average BMI is 23.08 kg/m2 (SD.= 2.83)

The fundamental characteristics of the experimental group: The mean age is 39.72 years (SD = 9.33) weight is 61.68 kg (SD.= 8.83) The average height is 163.16 cm (SD.= 7.25) and the average 23.16 kg/m2 (SD.= 2.89)

Table 2 The results of two-way repeated measure (MANOVA) of physical fitness with each group

	Testing Results

Testing list		Before Testing		After 8-week trial		After 12-week trial		F	p-value
		$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD		
1. Resting Heart Rate (bpm)	Control	84.24	11.93	79.40	8.45	78.36	9.38	5.78	0.010*
	Experiment	81.00	12.22	79.44	8.12	78.88	11.32	0.91	0.41
2. systolic pressure (mmHg)	Control	116.68	25.66	116.68	14.97	122.84	18.09	2.23	0.12
	Experiment	124.04	16.93	116.32	11.80	117.56	13.06	4.5	0.020*
3. diastolic pressure (mmHg)	Control	80.40	12.09	77.64	8.48	82.60	12.54	2.52	0.09
	Experiment	79.88	9.67	75.40	13.56	75.84	6.89	2.78	0.08
4. flexibility (cm)	Control	19.70	8.68	21.10	7.67	22.70	7.05	2.91	0.09
	Experiment	20.44	8.94	21.96	8.97	23.36	9.14	8.82	0.001*
5. muscle strength	Control	0.48	0.12	0.53	0.12	0.52	0.13	8.44	0.001*
(Kg/weight)	Experiment	0.49	0.14	0.53	0.13	0.58	0.13	6.73	0.001*
6. muscular endurance	Control	35.12	8.83	36.88	7.68	37.80	8.39	2.95	0.06
(rep)	Experiment	35.80	10.07	37.72	7.82	40.08	7.51	6.75	0.001*
7. cardiovascular endurance	Control	2.25	0.14	2.25	0.11	2.27	0.11	4.65	0.030*
(rep)	Experiment	2.20	0.13	2.30	0.09	2.34	0.10	24.9	0.001*

* the statistical significance threshold at the.05 level (=.05).

From table 2, The control group's resting heart rate (bpm) (P=0.010), muscular strength (P=0.001), and cardiovascular endurance (P=0.030) significantly different (P<.05). However, there were no changes in systolic pressure (P=0.120), diastolic pressure (P=0.090), flexibility (P=0.090), and muscular endurance (P=0.060).

The experimentsl group's systolic pressure (P=0.020) flexibility (P=0.001), muscular strength (P=0.001), muscular strength (P=0.001), muscular endurance (P=0.001) and cardiovascular endurance (P=0.001) statistically differed (P<.05). However, there is no cahnges in resting heart rate (bpm) (P=0.0410) and diastolic pressure (P=0.080).

Table 3 The findings of the two-way repeated measure (MANOVA) comparison of physical fitness differences between the control group and the experimental group

Testing List	group	SS	*df*	*MS*	*F*	p-value
1. Resting Heart Rate (bpm)	between	9.976	1	9.976	0.121	0.729
	within	3949.49	48	82.281		
	total	3959.47	49			
2. systolic pressure (mmHg)	between	6.969	1	6.969	0.046	0.832
	within	7341.69	48	152.952		
	total	7348.66	49			
3. diastolic pressure (mmHg)	between	125.876	1	125.876	1.613	0.21
	within	3745.6	48	78.033		
	total	3871.48	49			
4. flexibility (cm)	between	7.119	1	7.119	0.113	0.738
	within	3016.83	48	62.851		
	total	3023.95	49			
5. muscle strength (Kg/weight)	between	0.031	1	0.031	2.112	0.153
	within	0.699	48	0.015		
	total	0.73	49			
6. muscular endurance (rep)	between	2.42	1	2.42	0.051	0.823
	within	2289	48	47.688		
	total	2291.42	49			
7. cardiovascular endurance (rep)	between	0.007	1	0.007	0.74	0.394
	within	0.434	48	0.009		
	total	0.441	49			

* the statistical significance threshold at the.05 level (=.05).

As shown in table 3, the two-way repeated measure (MANOVA) comparison of physical fitness differences between the control group and the experimental group revealed that there were no differences in resting heart rate (P=0.729), systolic pressure (P=0.832), diastolic pressure (P=0.210), flexibility (P=0.738), muscle strength (P=0.153), muscular endurance (P=0.823), and cardiovascular endurance (P=0.394) before and after the 12-week trial.

Table 4 The results of Bonferroni for the Post-hoc procedure

	Testing Resul

Testing List		Week 1 Week 8		Week 1 Week 12		Week 8 Week 12	
		MD	**p-value**	**MD**	**p-value**	**MD**	**p-value**
1. Resting Heart Rate (bpm)	Control	4.84	0.07	5.880*	0.02	1.04	1.00
	Experiment	1.56	1.00	2.12	0.52	0.56	1.00
2. systolic pressure (mmHg)	Control	3.96	0.50	-2.20	1.00	-6.16	0.11
	Experiment	7.720*	0.01	6.48	0.18	-1.24	1.00
3. diastolic pressure (mmHg)	Control	2.76	0.57	-2.20	1.00	-4.96	0.08
	Experiment	4.48	0.20	4.04	0.07	-0.44	1.00
4. flexibility (cm)	Control	-1.39	0.97	-3.00	0.18	-1.60	0.07
	Experiment	-1.52	0.15	-2.92*	0.00	1.396*	0.04
5. muscle strength (Kg/weight)	Control	-0.01	1.00	-.044*	0.01	-.038*	0.01
	Experiment	0.00	1.00	-.046*	0.00	-.048*	0.03
6. muscular endurance (rep)	Control	-3.16	0.29	-3.76	0.11	-0.60	1.00
	Experiment	-1.92	0.49	4.280*	0.00	-2.36	0.06
7. cardiovascular endurance (rep)	Control	-0.05	0.25	-0.08	0.06	-0.03	0.35
	Experiment	-.097*	0.00	-.138*	0.00	-.041*	0.01

* the statistical significance threshold at the.05 level (=.05).

Comparing table 4 to the control group using Bonferroni, there were no changes between the pre-, post-8-week, and post-12-week flexibility trials (P=0.97, 0.18, and 0.07). Also, there was no change in muscle endurance throughout all three phases (P=0.29, 0.11, and 1.00), and there was no difference in cardiovascular endurance when comparing before, after an 8-week trial, and after a 12-week trial (P=0.25, 0.06, and 0.35, respectively). In contrast, there was no difference in muscular strength between the beginning and end of the 8-week study (P=1.00). However, there was a significant difference between the 8-week and 12-week trials (P=0.04).

Using Bonferroni to compare table 4 to the experimental group, there was no change in flexibility between the start and finish of the 8-week trial (P=1.00). However, there was a statistically significant difference (P=0.04) between the 8-week and 12-week trials. Like muscular strength, there was no change between the beginning and conclusion of the 8-week trial in terms of flexibility (P=1.00). Nonetheless, there was a statistically significant difference between the 8-week and 12-week trials (P=0.03). As with muscular endurance, there was no change between the beginning and conclusion of the 8-week trial in terms of flexibility (P=0.49). However, there was a significant difference between the 12-week trials at the beginning and end (P=0.00). Conversely, there was no change in cardiovascular endurance across all three stages (P=0.00, 0.00, and 0.01 respectively).

5 Discussion

Working-age personnel in the 12-week experimental group were found to have statistically significant differences in their physical fitness in the following areas: joint flexibility, strength in the hands and forearms, strength and endurance in the legs, endurance in the circulatory system, and upper blood pressure. Diastolic blood pressure and resting pulse, however, are not different. However, the resting pulse, the forearm and hand muscle strength, and the circulatory system's endurance all differ statistically significantly from the control group. The flexibility of their joints, their upper and lower blood pressure, and the strength and endurance of their leg muscles, on the other hand, are not significantly different between the groups, and it has also been demonstrated that there is no difference when comparing the groups.

But when comparing the pairs of Bonferroni, it can be seen that the strength and endurance of the leg muscles, the strength and flexibility of the joints, the strength and endurance of the muscles in the hand and forearm, and the endurance of the circulatory system of the samples did not differ between the specimens before the trial and after the 8-week trial, but when comparing the samples after the 8-week trial with the 12-week trial, there were significant differences. According to the WHO research, work-related physical activity is advantageous for physical performance and cardiovascular health. Boost muscular endurance and strength Reduced joint flexibility and improved cardiovascular endurance (WHO, 2010). at most universities in developing nations. Only students have access to the sports and fitness facilities. Many workers cannot utilize these. Even though colleges cover significant medical costs for staff members. Sturm (2002) found that the cost of medical care for overweight workers was 36% greater than the cost for non-overweight employees, and the cost of medications was 77% higher. These payments cover the cost of prescription drugs, medical expenditures, outpatient examination and treatment costs, laboratory radiology, and medical insurance premiums. Indirect expenses include lost time from higher absences and lower productivity. If we don't take advantage of this chance, we will lose it. (Strum, R. 2002) According to Lowe's (2008) research, encouraging physical exercise among people of working age may improve overall health, reduce absenteeism, and save medical costs. (Lowe, A. 2008) As a result of workplace health promotion activities, Robert and Bertera (1990) and Proper and Mechelen (2008) have produced empirical evidence of lower health care costs, decreased absenteeism, improved body wholeness and strength, and illness and sickness avoidance. According to (Proper, K., & van Mechelen, W. 2008) and (Robert L. and Bertera, D. 1990), physical activity should be a regular component of everyday life to maintain physical health. Examples of this include household chores, regular physical activity, exercise, and sports. These motions are what allow your body to build itself up to be physically fit and prepared to carry out numerous jobs effectively. However, being physically healthy is crucial in every aspect of life wherever in the globe. because being physically healthy makes people happier. Body mass index, joint flexibility, muscular strength, muscle endurance, and circulatory endurance made up the health- and fitness-related components (USDHHS, 2010). According to the American College of Sports Medicine (ACSM), exercise that was linked to performance may improve health (Chodzko-Zajko, et al, 2009). Mana Medical Associates (2019) pointed that as part of physical fitness, a healthier lifestyle may enhance quality of life, lower the chance of injury, and lengthen life expectancy. Each component of the body needs to function physically in the right way. Additionally, maintaining a healthy body and mind may lessen stress. 2020 (DU Chukwudo). To improve performance on a personal and institutional level in light of the present corona virus pandemic

and to improve the physical fitness and health of the university's working age staff, physical exercise is crucial as part of health promotion. Additionally, higher levels of physical activity now will strengthen bodies and decrease sedentary behavior in people of working age, and it can be used to develop significant policy directions and strategies to promote population health in terms of raising physical activity levels and lowering sedentary behavior among the Thai population.

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References

[1] Ammar, A., Brach, M., Trabelsi, K., Chtourou, H., Boukhris, O., Masmoudi, L., . . . Ahmed, M. (2020). Effects of COVID-19 home confinement on eating behaviour and physical activity: results of the ECLB-COVID19 international online survey. Nutrients, 12(6), 1583.

Bas, D., Martin, M., Pollack, C., & Venne, R. (2020). The Impact of COVID-19 on Sport, Physical [2] Activity and Well-being and its Effects on Social Development. United Nations. doi:https://doi.org/10.18356/a606a7b1-en

[3] Bertera, R. L. (1990). The effects of workplace health promotion on absenteeism and employment costs in a large industrial population. American journal of public health, 80(9), 1101-1105.

[4] Bray, J. H., Maxwell, S. E., & Maxwell, S. E. (1985). Multivariate analysis of variance: Sage.

[5] Buitrago-Garcia, D., Egli-Gany, D., Counotte, M. J., Hossmann, S., Imeri, H., Ipekci, A. M., . . . Low, N. (2020). Occurrence and transmission potential of asymptomatic and presymptomatic SARS-CoV-2 infections: A living systematic review and meta-analysis. PLoS medicine, 17(9), e1003346.

[6] Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., . . . Chou, R. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. British journal of sports medicine, 54(24), 1451-1462.

[7] Burtscher, J., Burtscher, M., & Millet, G. P. (2020). (Indoor) isolation, stress, and physical inactivity: Vicious circles accelerated by COVID-19? Scandinavian journal of medicine & science in sports, 30(8), 1544.

[8] Chen, C., ZHANG, X., JU, Z., & HE, W. (2020). Advances in the research of cytokine storm mechanism induced by Corona Virus Disease 2019 and the corresponding immunotherapies. Chinese journal of burns, E005-E005.

[9] Chodzko-Zajko, W. J., Proctor, D. N., Singh, M. A. F., Minson, C. T., Nigg, C. R., Salem, G. J., & Skinner, J. S. (2009). Exercise and physical activity for older adults. Medicine & science in sports & exercise, 41(7), 1510-1530.

[10] Chukwudo, D. U. (2020). Issues of Health-Related Physical Fitness of the Adult Learner. In Handbook of Research on Adult Learning in Higher Education (pp. 199-220): IGI Global.

[11] Da Silveira, M. P., da Silva Fagundes, K. K., Bizuti, M. R., Starck, É., Rossi, R. C., & de Resende E Silva, D. T. (2021). Physical exercise as a tool to help the immune system against COVID-19: an integrative review of the current literature. Clinical and experimental medicine, 21(1), 15-28.

[12] Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2018). Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1• 9 million participants. The lancet global health, 6(10), e1077-e1086.
[13] Honey-Roses, J., Anguelovski, I., Bohigas, J., Chireh, V., Daher, C., Konijnendijk, C., & Nieuwenhuijsen, M. (2020). The impact of COVID-19 on public space: A review of the emerging questions.[CrossRef][Google Scholar].
[14] Lowe, A. (2008). Promoting the health and fitness of school faculty, staff, and administrators in a southeastern Louisiana school district. The ICHPER-SD Journal of Research in Health, Physical Education, Recreation, Sport & Dance, 3(2), 62.
[15] Meyer, J., McDowell, C., Lansing, J., Brower, C., Smith, L., Tully, M., & Herring, M. (2020). Changes in physical activity and sedentary behavior in response to COVID-19 and their associations with mental health in 3052 US adults. International journal of environmental research and public health, 17(18), 6469.
[16] Ng, K. (2020). Adapted physical activity through COVID-19. European Journal of Adapted Physical Activity, 13(1), 1.
[17] Ntoumanis, N., Thøgersen-Ntoumani, C., Quested, E., & Hancox, J. (2017). The effects of training group exercise class instructors to adopt a motivationally adaptive communication style. Scandinavian journal of medicine & science in sports, 27(9), 1026-1034.
Olson, C. L. (1976). On choosing a test statistic in multivariate analysis of variance. Psychological bulletin, 83(4), 579.
[18] Organization, W. H. (2020). Protocol for assessment of potential risk factors for coronavirus disease 2019 (COVID-19) among health workers in a health care setting, 23 March 2020. Retrieved from
[19] Piercy, K. L., Troiano, R. P., Ballard, R. M., Carlson, S. A., Fulton, J. E., Galuska, D. A., . . . Olson, R. D. (2018). The physical activity guidelines for Americans. Jama, 320(19), 2020-2028.
[20] Proper, K., & van Mechelen, W. (2008). Effectiveness and economic impact of worksite interventions to promote physical activity and healthy diet. Geneva: World Health Organization.
[21] Sallis, J. F., Adlakha, D., Oyeyemi, A., & Salvo, D. (2020). An international physical activity and public health research agenda to inform coronavirus disease-2019 policies and practices. Journal of Sport and Health Science, 9(4), 328.
[22] Stevens, J. (1979). Comment on Olson: choosing a test statistic in multivariate analysis of variance.
[23] Sturm, R. (2002). The effects of obesity, smoking, and drinking on medical problems and costs. Health affairs, 21(2), 245-253.
[24] World Health Organization, t. (2010). Global recommendations on physical activity for health: World Health Organization.