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Revitalizing student physical fitness: The vital role of post-pandemic physical activity programs

Przywrócenie kondycji fizycznej uczniów: kluczowa rola programów aktywności fizycznej po pandemii

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Abstract

In post-COVID-19 pandemic conditions, students are not engaging in physical activity both at school and at home, leading to a decline in the quality of students' physical fitness. The objective of this study is to enhance the physical fitness of students by implementing a well-structured, accurate, consistent, and quantifiable physical exercise program, while also monitoring sports activities undertaken by students. This research employs a pseudo-experimental pre-test post-test design. The study sample consisted of 117 students. The selection technique utilized is purposive sampling. The instrument for assessing physical fitness is the Indonesian Physical Freshness Test (TKJI). The data analysis technique employs paired sample t-tests. The findings reveal a significant effect of the sports activity program on students' physical fitness, with an average physical fitness score increase of 13% for Junior High School 01, 11% for Junior High School 39, 9% for Junior High School 14, and 5% for Junior High School 24. This is corroborated by t-test results using a paired sample t-test, with a t-value of −3.754 and a significance value of $p = 0.001$ ($p < 0.05$). Based on these results, it can be concluded that the implementation of sports activity programs in various junior high schools in the city of Padang significantly improves students' physical fitness in the post-COVID-19 pandemic era.

Keywords

Physical Fitness, Sports Activities, COVID-19

Streszczenie

W warunkach po pandemii COVID-19 uczniowie nie angażują się w aktywność fizyczną zarówno w szkole, jak i w domu, co prowadzi do spadku jakości kondycji fizycznej uczniów. Celem tego badania jest poprawa kondycji fizycznej uczniów poprzez wdrożenie dobrze zaplanowanego, dokładnego, konsekwentnego i mierzalnego programu ćwiczeń fizycznych oraz monitorowanie aktywności sportowych podejmowanych przez uczniów. Badanie to ma charakter pseudo-eksperymentalny z projektowaniem przedtestowym i potestowym. Próbka badawcza obejmowała 117 uczniów. Użyta technika doboru to dobor celowy. Instrumentem do oceny kondycji fizycznej jest Indonezyjski Test Świeżości Fizycznej (TKJI). Technika analizy danych polega na użyciu sparowanego testu t. Wyniki wskazują na znaczący wpływ programu aktywności sportowej na kondycję fizyczną uczniów, z przeciętnym wzrostem wyniku kondycji fizycznej o 13% w Gimnazjum nr 01, 11% w Gimnazjum nr 39, 9% w Gimnazjum nr 14 oraz 5% w Gimnazjum nr 24. Wyniki te są potwierdzone przez wyniki testu t przy użyciu sparowanego testu t, z wartością t wynoszącą −3,754 i wartością istotności $p = 0,001$ ($p < 0,05$). Na podstawie tych wyników można wnioskować, że wdrożenie programów aktywności sportowej w różnych gimnazjach w mieście Padang znacząco poprawia kondycję fizyczną uczniów w okresie po pandemii COVID-19.

Słowa kluczowe

kondycja fizyczna, aktywność sportowa, COVID-19

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Introduction

Students in post-COVID-19 pandemic conditions must have excellent physical fitness quality so that they are not easily exposed to the COVID-19 virus. Physical fitness is the initial capital for students for further achievements, namely physical fitness, cognitive development, motor skills, and effectiveness so that students can learn well and socialize in their environment [1, 2]. The importance of physical fitness exercises for students is to improve the degree of student health such as motor, affective, and cognitive development abilities. If a student's physical fitness level is low, it will affect his health. A person's physical fitness is influenced by various factors including; exercise, nutritious food intake, adequate rest, a good lifestyle, and environmental factors [3]. These factors are interrelated and mutually support each other to achieve good health and quality physical fitness. Promoting a healthy lifestyle in childhood, such as proper physical activity, is significant as a pattern of physical activity attitudes created throughout childhood persist into adulthood [4]. Several studies have examined the bond between the two, gaining knowledge about actual physical fitness and understanding the extent to which they affect physical activity [5–7]. Students who maintain a pattern of regular physical activity will achieve good physical fitness. The quality of students' physical fitness must be maintained during learning activities in post-COVID-19 conditions, learning with an online system, but that does not mean limiting activities while at home, making students inactive and not exercising [8]. In addition, previous studies have assessed the impact of COVID-19, i.e. lifestyle changes related to the COVID-19 pandemic since March 2020 may have worsened many aspects of physical activity and health of children and adolescents [9]. Post-pandemic research on the physical activity of urban youth shows that more than 70% of students have sedentary lifestyles. During the implementation of quarantine activities due to the COVID-19 pandemic, schools frequently operated in a remote format, which could lead to a significant decrease in the physical activity of children and adolescents [10].

A planned, structured, and sustained physical activity that involves repetitive body movements following certain rules aims to improve physical fitness and achievement. The benefits of exercise at this age are for the development of muscles, bones, and nerves; maintaining a healthy weight and achieving optimal mental health; increasing social development, and self-confidence, and enhancing learning ability [11].

Physical activity in post-pandemic students has considerably weakened the immunity of the student body. Some students spend more time playing online games, disrupting their breaks. This condition greatly affects the quality of students' physical fitness. Low physical activity can lead to the emergence of mental disorders during a pandemic, making a person's immune system more vulnerable to diseases or viruses [12]. Low physical activity could weaken the body's immune system, lead to obesity, and disrupt life after returning to normalcy [13]. In essence, students are required to have a high level of physical fitness. If students have good physical fitness, it will boost immunity and learning ability [14]. This is supported by previous findings stating that physical activity with moderate-intensity exercise positively impacts improving the immune system and physical fitness due to the adaptation of exercise sessions that may offer preventive advantages among sedentary individuals [15].

Physical fitness affects functional health related to various body organ functions, affects cardiovascular endurance, muscle strength, muscular endurance, body composition, and various other organ functions. If the level of physical fitness is low, it will influence the state of health, leading to slow motor development, poor learning ability, low memory, and lack of motivation in learning. Health is a precious gift, but it will not be achieved by itself, but through effort. Health isn't everything, but everything becomes meaningless without health. Physical activity in physical education and health sports is essential not only for maintaining physical fitness but also the level of physical and mental health [16, 17]. Weak body immunity can cause physiological changes, especially the increase of cortisol or stress hormones. Stress is the body's reaction to any changes that might arise from the environment, body, or mind that require an adjustment or response. The body reacts to these changes through physical, mental, and emotional responses.

Based on the observations made in January 2022 at junior high schools throughout the city of Padang, the assessment teacher stated that students' physical activity still falls in the low category. This is due to the evolving modern lifestyle and the prevalence of sedentary lifestyles, especially in major cities in Indonesia. The lifestyles of students and young people lean more towards exploring the current global trends. Moreover, due to continuous technological advancements and during the COVID-19 pandemic, students often spend their free time on social media, playing online games until midnight, and engaging in less productive activities [18], [19]. Children who do not meet the guidelines for beneficial physical activity do not enhance their muscle fitness and motor competence to achieve health benefits. The inferior quality of a student's physical fitness is detrimental as it will affect the degree of health, and the student will face limitations in various motor, affective, and cognitive skills [20, 21].

Minimizing the low level of physical fitness in students can be achieved through proper and measurable physical activity exercises. Some fundamental components of physical ability in the execution of student physical activity programs in terms of muscle concepts include endurance, strength, speed, flexibility, agility, balance, and coordination. In terms of metabolic processes, they consist of aerobic power and anaerobic power [22, 23]. The students practiced sports three to four times a week with measurable intensity, as well as playing sports. For fitness control, students are also encouraged to measure resting and basal pulse at least once a week.

By engaging in physical activity through exercise, the body releases endorphins to reduce pain and provide positive energy. Thus, exercising often results in feelings of happiness and pleasure [24]. Physical activity can boost the body's immunity. Continuous exercise increases white blood cells, reinforcing the body's defense system and enabling it to fend off any invading viruses [25]. Exercising at the right intensity is beneficial for enhancing body immunity. Numerous studies show that exercise can help increase stamina. Some criteria for effective

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exercise to boost the body's immune system include frequency, duration, consistency, and type of exercise, all of which play a pivotal role in enhancing the body's immune system [26]. A robust immune system helps shield the body from viruses and diseases. The aim of this study is to devise a precise and suitable physical activity exercise program to enhance students' physical fitness post-COVID-19.

The purpose of this study is to elucidate the situation and ameliorate the quality of physical fitness of junior high school students through a physical activity program via sports in Padang City.

Materials and methods

This research is of a quantitative type, employing real-experimental methods without involving control variables. Real experiments are studies that approximate genuine experiments. The population for this study consisted of 250 students. Sampling was executed using purposive sampling, selecting a total sample of 117 students from four schools (Junior High School 1 Padang, Junior High School 14 Padang, Junior High School 24 Padang, and Junior High School 39 Padang). Instruments in this study utilized the Indonesian Physical Fitness Test (TKJI). Data collection techniques were executed in three stages. First, designing and validating physical activity programs through sports activities for junior high school students involved physical education experts, training science experts, exercise physiology experts, and sports and health physical education teachers. Second, a pre-test was conducted to gather initial data on the students' level of physical fitness before the treatment. Third, post-test measurements were taken to ascertain the level of physical fitness of students after receiving treatment, which was administered four times a week over 24 sessions. The TKJI's validity and reliability values are 0.95 and 0.96, respectively [27]. Data analysis techniques used in this study included the Normality test and Paired sample t-test, using Microsoft Excel and SPSS.

PHYSICAL FITNESS TRAINING PROGRAM

Name :
Gender :
Age :
School Name :

Physical Fitness Components	Forms of Sports Activities	Time	Training Intensity	Week											
				IV				V				VI			
				1	2	3	4	1	2	3	4	1	2	3	4
Resting Pulse															
Heart and Lung Endurance	1. *Jogging* 2. Swimming 3. Cycling														
Muscular endurance	1. *Squat Jump* 2. *Plank* 3. Wall Squat														
Strength	1. *Push Up* 2. Wheelbarrow Play 3. Up and Down The Bench														
Flexibility	1. Kayang 2. Rhythmic Gymnastics Sit 3. Kissing knees														
Agility	1. Jump Rope 2. *Shuttle Run* 3. Obstacle Play														
Game	1. Football 2. Volleyball 3. Basketball 4. Badminton														

Figure 1. Physical fitness training program

Results

The research results and discussion sections will be presented sequentially. This includes the percentage data of pre-test and post-test results, prerequisite tests, and hypothesis tests. These will be detailed according to the problem formulation: The effect of physical activity programs on improving students' physical fitness post-COVID-19 pandemic. In detail, the presentation is as follows:

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Table 1. Percentage increase in physical fitness of students after being given treatment

School	Data		
	Pre-test	Post-test	%
Junior 1	380	430	13%
Junior 39	191	212	11%
Junior 14	313	340	9%
Junior 24	403	422	5%

According to Table 1, there's a notable difference in students' physical fitness quality between the pre-test and post-test. The physical fitness capability of Junior High School 01 rose by 13%, that of Junior High School 39 by 11%, Junior High School 14 by 9%, and Junior High School 24 by 5%, as depicted in the Figure 2.

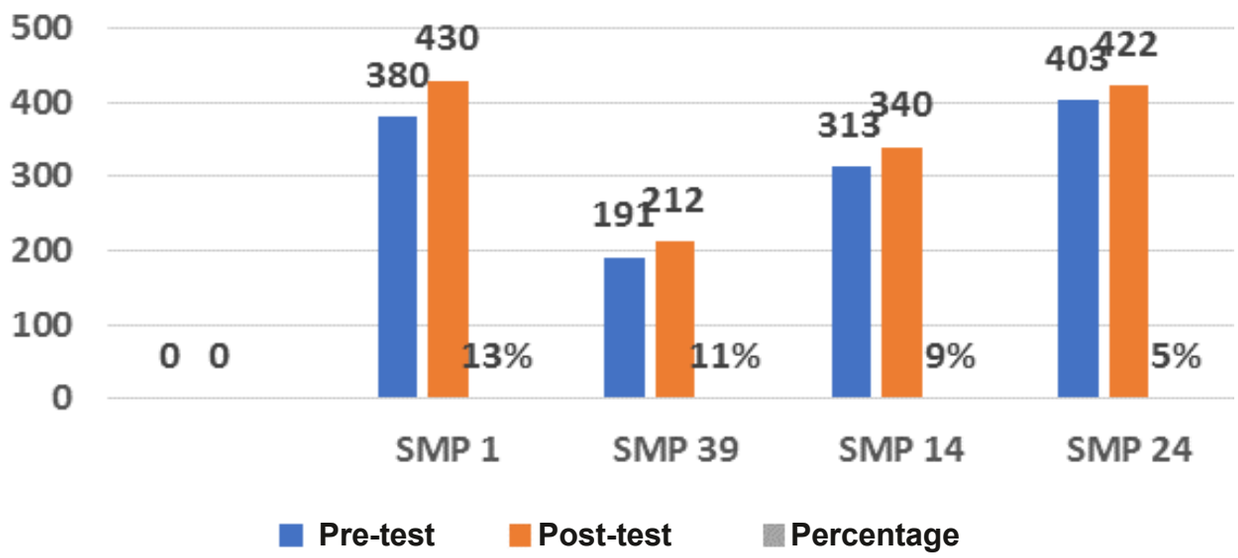

Figure 2. Percentage of increase in Physical Fitness Quality of Junior High School students between pre-test and post-test

Normality test

Post-COVID-19 pandemic, the physical fitness quality of students from Junior High School 01, Junior High School 14, Junior High School 24, and Junior High School 39 in Padang City during both pre-test and post-test primarily showed a significant decline. During the pre-test, out of 117 respondents, 50 students (42.7%) were rated with a "Less Than Average" physical fitness quality, 55 students (47%) with a "Below Average" physical fitness quality, and 12 students (10.2%) with an "Average" physical fitness quality. For the post-test, 40 students (34.1%) were "Less Than Average", 41 students (35%) were "Below Average", 31 students (26.4%) were "Average", and 5 students (4.3%) were "Good". Notably, no student achieved an "Excellent" rating during either the pre-test or post-test. Per Table 2, the data is indicative of a normally distributed population because Lo < Label.

Table 2. Summary of normality test results

Group	Group	Mean	Lo	L table
Junior High School Pre-Test 01	11.9	0.1022	0.1566	Usual
Junior High School Post-Test 01	13.4	0.1341	0.153	Usual
Junior High School Pre-Test 14	10.1	0.1503	0.1591	Usual
Junior High School Post-Test 14	11	0.1423	0.1591	Usual
Junior High School Pre-Test 24	12.6	0.1535	0.1566	Usual
Junior High School Post-Test 24	13.2	0.1496	0.153	Usual
Junior High School Pre-Test 39	8.7	0.1888	0.190	Usual
Junior High School Post-Test 39	9.6	0.1313	0.190	Usual

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Hypothesis test results

Testing of the research hypothesis was conducted based on the results of data analysis and the interpretation of the paired sample t-test analysis. The results from hypothesis testing were in alignment with the previously formulated hypothesis, which states: "There is an effect of physical activity programs on improving students' physical fitness after the COVID-19 pandemic." Based on the results of this analysis, data was presented in Table 3.

Table 3. The paired sample t-test results of the effect of physical activity programs on improving students' physical fitness after the COVID-19 pandemic

	Paired Differences							
				95% Confidence Interval of the Difference				
	M	SD	SE	Lower	Upper	t	df	Sig.
pre-test − post-test	−1.56250	2.35465	0.41625	−2.41144	−0.71356	−3.754	31	0.001

M: Mean; SD: Standard deviation; SE: Standard Error Mean

From the paired sample test results shown in Table 3, the significance value of p is observed to be 0.001, and the t-value is −3.754. Given that the significance value of p is 0.001, which is less than 0.05, this implies that H0 is rejected. Consequently, there is a significant influence of the physical activity programs on improving students' physical fitness after the COVID-19 pandemic. Therefore, the research hypothesis stating that "There is a significant effect of physical activity programs on improving students' physical fitness after the COVID-19 pandemic" has been verified.

Discussion

The discussion in this study is based on theoretical studies and statistical calculations and refers to the conclusions of the analysis that has been conducted. This discussion will address the hypothesis proposed in the study, which posits that there is a significant influence of the main factors of the study. The discussion of the results of the analysis can be described as follows: "There is an effect of physical activity programs on improving students' physical fitness after the COVID-19 pandemic."

The benefits of implementing physical activity programs through sports for high school students are: (1) Understanding the condition of physical fitness quality, (2) Determining the appropriate exercise program for improving physical fitness, (3) Evaluating the success and failure of physical exercise programs, (4) Conducting physical fitness tests periodically and regularly, and (5) Encouraging the desire to enhance physical fitness through physical activity or various forms of sports training. Sports activities can be conducted both outdoors and indoors. Examples include aerobic physical exercises using stationary bicycle tools and other exercises. Scientific research confirms that stationary bicycle training has a notable impact on blood pressure, pulse rate, and VO_{2Max} [28].

Findings reveal that the physical fitness of junior high school students in the city of Padang is mostly subpar. Such a low fitness level adversely affects health, resulting in slow motor development, impaired learning ability, diminished memory, and decreased motivation. More physically fit children tend to engage in physical activity than their less fit counterparts, which enriches their environmental exploration and motor skills acquisition. This activity subsequently benefits their cognitive growth [29, 30]. The quality of physical fitness impacts functional health, influencing cardiovascular endurance, muscle strength and endurance, body composition, and various other organ functions [31]. During the COVID-19 pandemic, there's a reluctance to engage in outdoor activities due to fears of virus exposure, leading to decreased motivation for physical activity.

Analysis reveals that the physical fitness of junior high school students in the city of Padang has notably improved by the introduction of a physical activity program through sports after the COVID-19 pandemic. This improvement aligns with previous research indicating that fitness coaching through sports training programs, both at home and school in the new normal and post-pandemic era, positively impacts students' physical fitness [32]. Through physical activities, students receive both physical and mental nourishment. Regular exercise fosters a healthy body, fitness, and resilience, which subsequently enhances student achievement [33]. Incorporating physical activity into academic lessons boosts overall activity levels, mitigates body mass increases, and correlates with improved academic scores [34].

[35] highlighted the advantages of physical activity: blood pressure and cholesterol regulation, heart disease and stroke risk reduction, weight maintenance, stress reduction, heart and circulatory system strengthening, bone and muscle fortification, joint flexibility maintenance, and depression symptom alleviation, ultimately elevating the quality of life. The World Health Organization (WHO) in 2017 advised children and adolescents aged 6-17 years to engage in 60 minutes of moderate-intensity exercise daily. High-intensity sessions can reduce this frequency to three times weekly, supplemented by thrice-weekly muscle-strengthening activities. Activities like running and jumping are advocated for bone density enhancement.

The findings of [36] relate physical fitness to self-concept, character value development in students, and significant contributions to academic achievement. [37] showed that by utilizing physical fitness control books, there was an observable average score increase in physical fitness among elementary

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students. Enhanced physical fitness potentially translates to improved cognitive learning capabilities, fostering better academic outcomes. Physical activity, by enriching cognitive vitality and stimulating the nervous system, bolsters cognitive function [38–40].

Studies by [41] in the United States and [42] in Norway found that exercise influences the risk of infections and the immune system. Sedentary individuals face heightened risks of diseases like coronary heart disease and diabetes mellitus, whereas moderate-intensity exercise bolsters the immune system. Additional studies have affirmed that exercise enhances mental health, self-confidence, cognitive capabilities, and alleviates anxiety, depression, and negative moods [43, 44].

Immunity enhancement is feasible through regular physical exercise or sports. A weakened immune system increases susceptibility to infections from pathogenic organisms. Notably, the primary immune component in the blood, leukocytes, can be revitalized through activities like 30-minute aerobic exercises conducted five times weekly. This promotes leukocyte functionality. Consistent movement and exercise, when guided by proper exercise principles, yield beneficial biological and adaptive effects on the body [45].

Recommended sports or physical exercises should be adequate but not excessive, as over-exertion can impair the immune system. High-intensity, prolonged exercises can weaken immunity. Athletes undergoing intense training often face infections due to training-induced psychological stress and physical strains [46]. However, exercise can also augment metabolic health, mental well-being, muscle strength, and avert organ-related ailments.

Light to moderate aerobic exercise can elevate platelet counts. The primary benefits of such exercises include increased leukocyte (especially lymphocytes and neutrophils) and platelet counts in the circulatory system. These increments are also contingent on exercise intensity and duration [47, 48]. Moderate-intensity exercise bolsters the immune system, while excessive, high-intensity, prolonged sessions can impair it. Immune functionality can be enhanced through aerobic or anaerobic gymnastic exercises, conducted 2-3 times weekly for 25-30 minutes. Frequency and intensity can be augmented over time [49]. Proper, consistent physical activity and exercises are pivotal for achieving peak physical fitness levels [50].

Currently, a significant proportion of students engage minimally in both light and intense sports. Over a quarter of children globally possess a handheld computer by the age of eight. This indicates that countless children are ensnared by online gaming, which can harm their health due to factors like radiation, disrupted sleep patterns, and prolonged sedentary behavior. Prolonged inactivity can hamper the immune system, necessitating encouraging children to be more active [51]. Initiating exercise early during a COVID-19 infection is vital, but one must consider physical limitations for safe re-engagement [52].

According to [53], below-minimum physical fitness levels manifest as physical inefficiency, emotional instability, fatigue, and incapacity to handle physical and emotional challenges. Conversely, adequate physical fitness is characterized by executing daily tasks without exhaustion while maintaining energy reserves. Health promotion policies and physical activity programs ought to focus on enhancing cardiorespiratory fitness, muscle fitness, and speed/agility [54–56].

Conclusion

This research concludes that the implementation of a well-planned, correct, orderly, and measurable exercise activity program has a significant influence on improving the quality of students' physical fitness after the COVID-19 pandemic. In a situation where students are facing a reduction in physical activities both at school and at home during the pandemic, this program has proven its usefulness with positive results. Based on research data, it was found that the average score of physical fitness of students in each junior high school in Padang City experienced an increase, which was beneficial for enhancing the health and physical condition of students as a whole. Moreover, the use of data analysis procedures that employ the paired sample t-test confirms the significant results of this exercise activity program. Thus, the implementation of a well-organized and tested physical exercise program that remains consistent can be an efficient solution to counteract the decline in students' physical fitness due to the pandemic and potentially enhance their quality of life and well-being in the future.

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