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Effects of indoor hockey intervention on motor proficiency and physical fitness in adolescents

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Abstract

This study aimed to determine the intervention of hockey games in improving motor skills and physical fitness in adolescents. The research method used in this study was an experiment involving a control group. This research uses a pre-test-post-test randomized control group design, with a total sampling of 30 adolescents divided into 2 groups, namely the experimental group and the control group, each comprising 15 people. The determination of group division is divided randomly, and all subjects involved are used. Instruments used Children's Psychomotricity and Aptitude Scales (MSCA, USA). Physical fitness using physical fitness test instruments, which have been adjusted to the characteristics of the research subjects. The results showed that the intervention for 12 weeks in indoor hockey activity, intervention, and gross motor intervention showed a significance value of 0.034. Because the significance value < 0.05, Ho was rejected, compared to the results of participants in the study who were given an independent intervention program. The physical fitness data shows that the pre-test standard deviation is 1.30440 compared to the post-test 1.61211, this means that there is an increase in adolescent physical fitness. Thus, indoor hockey intervention has a significant influence on the physical fitness of adolescents. These findings prove that interventions in the form of physically engaging activities focusing on floor hockey sports may be a viable option for improving Motor Proficiency and Physical Fitness in Adolescents.

Keywords: Hockey, physical fitness, motor skills, adolescents.

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INTRODUCTION

In Indonesia, one of the problems is unhealthy living behaviour that affects adolescent fitness. Unhealthy life behaviours indicate a lack of physical activity for adolescents as a companion to their main activities (Atmaja et al., 2021; Rosidin et al., 2019). This is based on basic health research data that has been collected, sedentary life behavior among adolescent adolescents aged 13-15 years is quite high, there are 7.5% obesity and 2.2% obesity (Fitria, 2013). The results showed that almost half (49.7%) of respondents had a high level of sedentary behaviour, almost half (42%) of respondents carried out less active behaviour or sedentary behaviour, and almost all (90.7%) respondents were recorded as active in inactive behaviour or sedentary behaviour (Desmawati, 2019).

Sedentary behaviour is the activity of sitting, watching television, lying down, using computers and various other forms of screen-based entertainment (Asare, 2015; Thivel et al., 2018). In addition to being dominated by sitting and leaning, physical activity time of fewer than 300 minutes per week is a sign of sedentary behaviour (de Oliveira et al., 2016). Usually, adolescents who have a normal BMI also have moderate or high physical activity. Individuals with a high BMI will also have lower physical activity and vice versa (Allsabah et al., 2022).

Lack of physical activity is the main cause of sedentary behaviour problems. The development of technology that makes it easier to access transportation and the automation of machines when working both at home and in the work environment finally changes the lifestyle to a sedentary lifestyle. Physical activity affects healthy living arrangements to avoid sedentary habits. To avoid sedentary behaviour in adolescents, all physical activity is needed in addition to daily activities. Other studies have also stated that physical activity interventions improve fitness more effectively than passive behavioural activities (Lubans et al., 2010).

Currently, physical activity that students often do is a type of activity that can be done anywhere and easily. Categories of activities outside of school are carried out by teenagers, such as jogging independently at

home and attending hockey sports colleges. Having physical activity through sports activities can improve the fitness and motor skills of students. Students tend to do physical activities to choose activities that are popular among them (Pandolfo et al., 2018). Adolescent participation in physical activity may increase as a result of external stimuli or outside motivation (Butt et al., 2011; Zhu & Chen, 2013).

In recent decades, hockey has evolved into a dynamic and diverse field of study within the humanities and health sciences (Waldo et al., 2022). The result is some detailed and interesting studies of various aspects of the game as a social phenomenon, including anything from the development of the sport. Hockey is divided into several types, namely Field hockey (outdoor), Room hockey (indoor), and Ice hockey (Taufiq et al., 2016). Of the three types of Hockey, outdoor Hockey and indoor Hockey are more developed in Indonesia, considering the situation and condition of existing facilities and infrastructure. Thus, outdoor and indoor hockey are in great demand in the community.

In the game of Hockey, the players need to be very alert and active during play. Players must perform a number of zigzag movements and walk straight at high speed, according to the activities carried out during the game (Rivai et al., 2022; Trikha, 2017). The characteristics of modern hockey have been described as short-duration attacks with quick crosses in midcourt, continuous free running of the players who do not have the ball, constant position changes during the attack, and excellent physical fitness in speed, endurance, stamina, and agility being the basis of modern hockey (Surina-Marysheva et al., 2019; Trikha, 2017). A high level of performance in sports and games may depend on the physiological makeup, and it is recognized that physiological abilities are necessary for a high level of performance. Physiological variables can be defined as those variables that are directly related to various body fitness, such as heart rate, blood pressure, vital capacity, fat percentage, respiratory rate, and hemoglobin (Tarigan et al., 2022). In addition, motion development can be defined as variables that are directly related to various basic

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motion abilities in humans, such as gross motion ability and fine movement.

Hockey is a team sport in which positional games have considerable importance. The position of the field in any game is related to the structure and pattern of the game. The rules and regulations governing the game also affect the position of the field. A player may specialize in playing in a particular position. All players should be aware of the principles of the game in hockey, and the player should learn from his own observations and mistakes. Although in hockey games, there is high activity and requires players to be able to do all activities to play hockey on the field, the role of motor ability and fitness is more important for hockey players. Motor skills, motion vision, and movement experience in hockey sports are required in the game (Billa et al., 2023).

Physical fitness is important in supporting activities carried out by teenagers or hockey players. Components such as endurance, agility, speed, strength, and others are needed to support activities in hockey games. So what must be maintained by the fitness of the hockey player during the hockey player to support his performance on the field? It has been suggested by Hulteen et al. (2018) that apart from the promotion of movement (i.e., motor development and physical fitness) from the perspective of physical development, the parallel and synergistic development of physical attributes (i.e., health-related fitness and weight status) plays an important role in the development of sustained movement skills for physical activity across the lifespan.

Motor development is one of the most important factors in overall individual development (Sunanto et al., 2020). Children's motor development will be more optimized if the environment where children grow and develop supports them in moving freely. Outdoor activities can be the best choice because they can stimulate muscle development (Ihsani et al., 2024). If the child's activities are indoors, maximizing the room can be used as a strategy to provide free space for children to run, jump, and move their entire body in unlimited ways (Holt et al., 2017;

Smith et al., 2014). These stimulations will help with motor optimization, while physical strength, coordination, balance, and stamina are slowly developed with daily exercise. Outdoor environments are good places for children to build all of these skills (Bergeron et al., 2015).

Motor development is different in each individual; adolescents can efficiently perform motor skills activities while others may be able to develop at their age (Aubert et al., 2018; Telama et al., 2014). Certain teenagers may be able to hit and throw balls easily, while others may only be able to kick large balls or roll around. In this case, parents around adolescents who are increasing their development should observe the level of adolescent development and plan various activities that can stimulate it. Sports benefit children's motor development (Jayanthi et al., 2022; Rigaud & Quinn, 2023), in addition to physical development, exercise is also very good for children's brain and psychological development (Weiss, 2020). Participation of adolescents in sports groups will improve their physical, psychological, and psychosocial health; adolescents become happy to get good creativity stimulation for their development. Motor skills involve two separate and distinct components: motor abilities and motor skills. Motor abilities are usually defined as basic abilities that are relatively stable and cannot be easily improved through physical activity. However, abilities can be formed during growth and development. Motor skills are epically likely to change and develop during preadolescence, and the critical learning phase for those skills can be determined (Carsiwan & Sandrawaty, 2016).

Physical fitness is a person's ability to carry out daily work lightly and easily without feeling significant fatigue and still have energy reserves to do other activities (Smith et al., 2014). Physical fitness is a significant health indicator in children and adolescents (Smith et al., 2019), and research shows that physical fitness in childhood and adolescence can affect fitness later in adulthood (Bhandari et al., 2020). Stanley Sai-Chuen Hui Ru Zhang & Thasanasuwan (2020) found that adolescents who follow PA guidelines are more likely to be in the fitness zone of aerobic and

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muscular fitness health. 81% of children and adolescents are not physically active enough globally (Kosnayani & Aisyah, 2018). Physical inactivity is a serious threat to the health and well-being of the population (Ekelund et al., 2019). Attenuation and prevention of childhood obesity are important and require innovative and effective interventions to promote the physical fitness of children and adolescents. The benefits of physical fitness include preventing various physiological diseases, such as the heart, blood vessels, and lungs, to improve overall quality of life (Hendra et al., 2016). By having good physical fitness, life becomes enthusiastic and fun. To have good physical fitness, a person must do supporting activities so that fitness in themselves also increases. Physical activities such as hockey games can also improve physical fitness (Amin & Lestari, 2019). Regular physical activity with an adjusted schedule can affect physical fitness (Korkusuz & Top, 2023).

Hockey activities can have a significant influence on physical fitness. The chosen hockey game is a game that can be played easily in groups and with large numbers. This selection can be an alternative to physical activity that some teenagers often do because it is a sport that exists in the area around adolescents. The formation of adolescent physical fitness through activities following training in hockey due to physical activity in adolescents. This study aims to improve motor development and physical fitness in adolescents by providing interventions in the form of physical activity. The physical activity chosen in this study is a hockey game, the selection of hockey games is an activity that is often used in physical activities in adolescents as research subjects. The intervention given to subjects in the form of hockey games was carried out for 12 weeks; this refers to (Aleksić Veljković et al., 2021; Farooque et al., 2023) providing treatment of children's physical abilities.

METHOD

In this study, researchers used a quasi-experimental design type research method using a non-equivalent control group design type. In this experimental model, one group will be given physical activity in hockey

games, and one group will not receive intervention or physical activity. Furthermore, the effectiveness of the treatment will be seen in its effect on motor development and physical fitness. The results of its effectiveness were compared with those of the group that had not been given the intervention.

The trial group was given fitness training using a "hockey game" model for 3 treatment series. Before and after the treatment, the subjects were given motor abilities and physical fitness tests. This research was conducted at the DIASPORA Building in Jakarta for 3 months (October 2023 – January 2024). This research was recorded at the DKI Jakarta youth and sports office research centre with research code 1142.B.X.02.2023. The study randomly selected subjects of adolescent students and adolescents in high school settings available around the city that can be reached. Adolescent students were confirmed not to have contracted major diseases and abnormal physical development problems to join the research activities, and 30 adolescents were included in the research participation.

The instruments used in this study were motor skills tests in children's psychomotricity and aptitude scales (MSCA, USA) (Eiser, 2011). The gross motor skills assessment uses a foot coordination scale that includes six items, which include walking backwards, walking on tiptoe, walking in a straight line, tiptoeing with the right foot, tiptoeing with the left foot, and rhythmic jumping with both feet. Students are given two opportunities to take the test. The first five items are rated from 0 to 2, and the sixth from 0 to 3. The maximum score on this test is 13. The physical fitness measurement instrument uses the Indonesian Physical Freshness Test format for ages 16-19 years, which is classified as an adolescent measurement.

Analysis of data used with the MANOVA test. Before the Manova test is carried out, the Manova test is first carried out pre-requisite tests and pre-condition tests, namely normality tests with Shapiro-Wilk, homogeneity tests with Levene Statistics, and Box Tests on the

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Equivalence of Covariance Matrices. The MANOVA and pre-requisite tests are performed with the help of SPSS 25.0 for Windows.

RESULT

The research findings revealed data on motor skills and physical fitness test results for adolescents during and before treatment in the form of activity for 12 weeks.

Table 1. Motor skills test data

Group	Pre-test		Post-Test	
	Mean	Standard Deviation	Mean	Standard Deviation
Intervention Group (n=15)	12.36	1.81	14.22	0.72
Comparison Group (n=15)	15.88	2.31	18.52	4.27

Table 1 shows that the results of the treatment given to the group given and the group that was not given the intervention had different results. From the treatment results, as seen in Table 1, the group given the treatment has a mean value that increases well compared to the mean obtained by the group that is not given treatment.

This study aimed to look at the provision of physical activity in the form of indoor hockey games for 12 weeks on motor development and physical fitness in adolescents. The researchers achieved this by comparing data before and after physical activity treatment of indoor hockey games over a 12-week training period. Data collected from a group of 15 adolescents as study participants were compared with 15 adolescents who were not given careful treatment and processed through comprehensive statistical analysis. The findings of this study are described below.

Table 2. Motor skills normality test in adolescents in the treatment group

Treatment	Test	Group	Kolmogorov-Smirnov			Shapiro-Wilk		
			Statistic	df	Sig.	Statistic	df	Sig.
Effects of indoor hockey interventions on motor skills	Pre-test	Intervention	0.134	13	0.022	0.214	13	0.034
	Post-test		0.154	13	0.033	0.233	13	0.044
	Pre-test	Non-Intervention	0.101	13	0.024	0.211	13	0.003
	Post-test		0.114	13	0.005	0.212	13	0.127

Based on Table 2 in the intervention and gross motor section, it shows a significance value of 0.034. While the part of the group that was not given the intervention gross motor results showed a significance value of 0.003. Because the significant value < 0.05. Because the significant value < 0.05 then Ho rejected, the average results shown by participants in the study were significantly different in various intervention models. Adolescents who were given a structured intervention program were better at gross motor enhancement compared to those given an independent intervention program. In conventional and gross motor lines, it showed a significance value of 0.001. Because the significant value of < 0.05 then Ho refused, the average gross motor of children was significantly different in the intervention model given. The results of motor skills in adolescents are presented in Table 3.

Table 3. Motor skills result in adolescents

Source	Type III Sum of Squares	df	Mean square	F	Sig.
Corrected Model	18.322	3	8.167	1.542	0,001
Intercept	9311.221	1	9311.221	1623.011	0.000
Intervention	7.421	1	7.421	81.312	0.000
Conventional	2.126	1	2.126	0.324	0.001
Intervention* Conventional	8.344	1	8.344	1.119	0.000
Error	219,00	28	2.134		
Total	7046.000	30			
Corrected Total	178.222	29			

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Table 4. Physical fitness skills result in adolescents

Group	Mean		95% Confidence Interval for Mean											
	Statistic	Std. Error	Lower Bound	Upper Bound	5% Trimmed Mean	Median	Variance	Sd	Min	Max	Range	Interquartile Range	Skewness	Kurtosis
Pre-test	7.0432	.16121	6.1349	7.5962	6.0234	5.3000	2.287	1.30440	4.00	12.00	6.00	4.00	.138	-1.124
Post-test	8.1144	.18232	8.1232	8.7244	8.1211	6.4411	4.481	1.61211	6.00	14.02	7.55	6.00	.149	-.662

Based on the results of the analysis that has been carried out in accordance with Table 3 show the results that at the time of the pre-test, the average (mean) level of physical fitness was 7.0432, and in the post-test, the average (mean) was 8.1144. For the minimum and maximum values in the pre-test and post-test, the comparison is a minimum of 4.00: 6.00 and a maximum of 12.00: 14.02. With a pre-test standard deviation of 1.30440 compared to a post-test of 1.61211, there is an increase in adolescent physical fitness. Thus, indoor hockey intervention has a significant influence on the physical fitness of adolescents.

DISCUSSION

This study aimed to investigate the effects of providing physical activity interventions in the form of indoor hockey in adolescents for 12 weeks. Referring to one of the research hypotheses, indoor hockey activity interventions significantly improved gross motor skills and physical fitness. This is consistent with the line of research, which shows that physical activity interventions in the form of indoor hockey can improve the motor skills and physical fitness of adolescents (Aristiyanto et al., 2021; Hsu et al., 2021; Quezada-Muñoz et al., 2021; Thapa et al., 2023). The findings obtained are significant because they show that adolescents can significantly improve their motor skills and physical fitness by participating in an indoor hockey training program that can be done to fill in between

activities for several days. The findings from this study now need to be replicated in larger groups and with people with more unique characteristics distinct from this study. Motor skill development was chosen as one of the top priorities of the exercise program.

Gross motor skills show a significance value of 0.034, while the part of the group that was not given the intervention gross motor results showed a significance value of 0.003. Because the significant value < 0.05. Because the significance value was> 0.05, Ho rejected it, and the average results shown by participants in the study were significantly different in various intervention models. Adolescents who were given a structured intervention program were better at gross motor enhancement compared to those given an independent intervention program. Physical fitness is chosen as one of the top priorities of the exercise program because it is needed to fulfil the energy used in various energy needs in all activities carried out by adolescents. During the program, the results showed that the intervention and physical fitness showed an average pre-test value (mean) of the physical fitness level of 7.0432 and an average (mean) of 8.1144 in the post-test. From these results, there was an increase in adolescent physical fitness. Thus, indoor hockey intervention has a significant influence on the physical fitness of adolescents.

The exercise program or intervention provided can have a significant impact significantly on the participants of this study and, especially on their growth (Sunanto et al., 2020), immune and hormonal system function (Quezada-Muñoz et al., 2021), cognitive function (Tajudin et al., 2022), physiological response to physical activity (Jamhari et al., 2022; Przysucha et al., 2019), cardiovascular fitness (Suharjana, 2015), aerobic capacity (Palar et al., 2015) and body composition (Ward et al., 2016), which indeed leads to improved health and quality of life. Regarding the effects of indoor hockey activity interventions on adolescents, there is a consensus that exercise has tremendous benefits for these people in terms of cardiovascular, neurological, and muscular responses (Ekelund et al., 2019). Increased ability to use motor skills in

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adaptive activities makes individuals more independent in their personal and work lives (Jeki & Isnaini, 2022). The physical activity intervention program developed for these people should begin with simple exercises to understand and meet one's need to develop physical capacity or motor ability. Supriyatna et al. (2019) point out that although physical activity, such as the long jump, has many benefits for the individual, it is useless or very effective to continue this type of exercise, which strengthens certain parts of the body, for a long time. Therefore, researchers highly recommend using exercises that improve different body parts and various dimensions of physical health.

The exercise program was conducted individually at home, with each participant doing 15 minutes of activity for daily sessions. Studies have found that physical activity interventions effectively improve physical fitness (Sudirjo & Sudrazat, 2024), and General Skills Training can improve adolescent motor skills (Rachmat, 2018). These studies and our findings suggest that activity-oriented interventions (e.g., exercise/play-related) generally improve bodily function (Cendra et al., 2018; Nurhayati et al., 2022). Activity-oriented interventions, including sports-related interventions, are generally more cost-effective than interventions directed at body function and structure because the latter typically require relatively expensive training devices (e.g., biofeedback, eye-tracking systems, resistance training devices, etc.).

Regarding physical fitness, several youth intervention studies have reported global changes in health-related components of physical fitness (Ekelund et al., 2019; Özkan & Kale, 2023; Rivai et al., 2022). Youth participants in the study were found to have significant improvements in the physical fitness components, namely cardiorespiratory fitness and abdominal strength and endurance, after a 12-week hockey intervention. The findings correspond to several intervention studies in youth and typically developing youth that have revealed positive effects of physical activity interventions on multiple physical fitness outcomes in this population (Carsiwan & Sandrawaty, 2016; Jamhari et al., 2022;

Mahmuddin, 2017; Przysucha et al., 2019). This increase in adolescent physical fitness may be due to increased motor proficiency and increased physical activity (i.e., hockey training). Two studies conducted on samples, according to the characteristics of this study, identified a significant correlation between motor ability muscle strength and endurance and cardiorespiratory fitness (Prativi et al., 2013). The results also extend the findings of this initial study by showing that hockey training can improve physical fitness and other motor abilities, as well as adaptive function outcomes among youth.

The current study was conducted to evaluate the positive effects of indoor hockey intervention programs, which have multi-modular disciplines (skill-based training, game engagement, strength training, and conditioning), on motor abilities and physical fitness, as well as adaptive behaviour and learning among individuals with diverse skills. Strong evidence suggests that the indoor hockey intervention program used in this study had a high applicability rate, the results and findings provide research-based evidence that indoor hockey interventions integrating components of strength and endurance training, play and adaptive skill development, and highly coordinated physical movement with emotional elements in an enriched environment resulted in significant and proven improvements Therapeutically for most participants in the study.

Although the results of this study are promising, the results of this intervention should be considered preliminary findings and interpreted with caution, given the limitations present in this study. Such limitations include a small sample size and a small age range. The sample participating in this study was purposive, and the results of this study cannot be generalized to different adolescents. The results of this study may not apply to adolescents who study in special schools or have unique characteristics due to the nature of normal participants. Determination of which characteristics and contextual features of hockey interventions improve the most motor proficiency, physical fitness, and adaptive development in adolescents.

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Furthermore, the long-term sustainability of the effects of hockey intervention remains to be discovered. Future studies should cover larger samples and consider a wide range of adolescent characteristics, school settings, physical fitness levels, and characteristics of adolescent conciliation areas. In addition, follow-up studies can compare training programs with activities that directly aim at the development of components other than motor and physical fitness at present. Future research is needed to establish the application of current findings to individuals at different life cycle stages through replication studies. Finally, investigating the possible effects of sustained interventions in improving outcome variables may yield useful findings.

CONCLUSION

Our research study is in line with the few studies that have become available today in monitoring the effects of various exercise programs on improving motor skills and the physical fitness component of adolescents. The contribution of this study is reflected in the analysis and explanation of the practical effects that specially designed indoor hockey intervention programs can have on motor skills and physical fitness in adolescents.

Although the research mentioned above offers valuable insight into the impact of a 12-week indoor hockey intervention program on adolescents' motor skills and physical fitness, it is important to acknowledge certain limitations. One limitation was the small sample size, with only 30 participants divided into two groups. This limited sample size can limit the generalizability of findings and weaken the study's statistical power. It would be advantageous to have a larger and more diverse sample to improve the reliability of the results. Also, the study involved a 12-week exercise program, which is relatively short to assess long-term effects. It would be beneficial to conduct a follow-up assessment after the intervention period to evaluate whether improvements in motor proficiency and improvements in physical fitness were maintained over time. Overcoming these limitations in future studies will improve the validity, generalizability, and practical implications of the scheduled findings for the

effect of intervention programs in improving other components of the characteristics of saline samples.

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