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Investigating the Effects of Indigenous Activity Training on Body Composition and Physical Fitness of Indian Children: A Vital Step towards Healthier Futures - A Pilot Study

Anirpan Roy[1], Dr. Atanu Das[2], Dr. Badshah Ghosh[3]

[1] Assistant Professor, Govt. College of Physical Education for Women, Dinhata, Cooch Behar.

[2] Associate Professor, Rabindra Mahavidyalaya Champadanga, Hoogly.

[3] Principal, Govt. College of Physical Education for Women, Dinhata, Cooch Behar.

Corresponding Author: anirpanfootbal@gmail.com

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Abstract:
Introduction: In India, rising childhood obesity and sedentary lifestyles contribute to poor physical fitness, heightening the risk of cardiovascular and other health issues. With a significant portion of children failing to meet physical activity recommendations and engaging in excessive screen time, there is an urgent need for effective interventions. Indigenous activities (IAs), deeply rooted in cultural traditions, offer a unique approach to improving physical fitness while preserving cultural heritage. This pilot study explores the impact of a 4-week IA training program on the physical fitness and body composition of Indian children aged 12 to 14 years. ***Methodology:*** Sixty-seven students from a boys' school in West Bengal were initially assessed for physical fitness. Based on their scores, 45 students were selected and divided into three groups: a control group and two experimental groups. The experimental groups engaged in two different IA training interventions, while the control group did not. Physical fitness components were measured using standard tests before and after the intervention period. Data were analysed using ANCOVA, with Shapiro-Wilk and Levene's tests ensuring normality and homogeneity of variances. ***Results:*** Significant improvements were observed in body composition, flexibility, speed, abdominal core strength, and strength endurance in the experimental groups compared to the control group. Specifically, IA Training Intervention-1 demonstrated more substantial effects on physical fitness parameters compared to IA Training Intervention-2. Notable differences included a greater reduction in BMI and improved flexibility and strength in the group that participated in more intensive IA training. ***Discussion:*** The study confirms that indigenous activity training positively influences various aspects of physical fitness and body composition. IA Training Intervention-1, characterized by more extended and intense sessions, proved more effective. These results align with previous research indicating that structured physical activity improves fitness and health outcomes in children. The incorporation of culturally relevant activities not only enhances physical fitness but also supports cultural preservation. ***Conclusion:*** Integrating IA into physical education programs can effectively improve physical fitness and body composition among Indian children. This pilot study highlights the potential benefits of culturally tailored interventions and supports the need for further research to explore long-term impacts and scalability.
Keywords: Childhood Obesity; Physical Fitness; Indigenous Activities; Cultural Heritage; Body Composition; Physical Activity Interventions; Cardiovascular Health; Sedentary Lifestyle

Introduction:

Childhood obesity, reduced physical activity, and related health issues are growing concerns in India. Research shows that the risk of heart-related illnesses decreases as physical fitness levels increase (Smith et al., 2014). Poor physical fitness, particularly in terms of heart and muscle strength, is linked to childhood obesity (Casonatto et al., 2016). In a study involving 1.6 million students aged 11 to 17 years, Guthold et al. (2020) found that 81% did not meet recommended physical activity levels. Similarly, key aspects of physical fitness that contribute to health include heart and lung fitness, body composition, muscle strength, endurance, and flexibility (Guthold et al., 2020). Physical fitness is a critical aspect of overall health and well-being, especially during childhood and adolescence. In India, where lifestyle changes and sedentary habits are increasingly prevalent, promoting physical fitness among children becomes essential. Engaging in physical activities, especially those of moderate to vigorous intensity, improves physical fitness regardless of sedentary behavior (Marques et al., 2015; Júdice et al., 2017). Notably, excessive screen time, such as playing electronic games, is a prevalent sedentary behavior among children, surpassing recommended limits on both weekdays and weekends (Forde & Hussey, 2015). The World Health Organization reports that 40.2% of children and adolescents exceed two hours per day on electronic devices during weekdays, rising to 75.8% on weekends. Such sedentary habits negatively impact motor development in young individuals (Hardy et al., 2018).

India has the own diversified tradition and culture in different parts of the country. That diversity could be observed due to the geographical area, climatic condition, religion and language. For this reason, more than thousands of indigenous communities had been developed over the past era. This indigenous community developed various kinds of recreational games to spend the leisure time, some cultural rituals and also for the fun & enjoyment. These local Indigenous games are closely associated with the culture and customs of people in each region and do not show their inherent interests and tastes; and are still popular in some parts of the countries. Games like Kho-Kho, Kabaddi, Malkham, Pithoo, Chess, Nodi as hopschoch etc (Gulia, S., & Rajesh, D., 2019) are become very popular and played not only in India but many other countries also. Traditional physical activities, deeply embedded in local cultures, can address these challenges. However, there is limited research on the impact of IAs on physical fitness among Indian children. Understanding this relationship is crucial for promoting healthier lifestyles and preventing health issues. Indigenous activities (IAs), rooted in cultural traditions, offer a unique opportunity to enhance physical fitness while preserving cultural heritage.

So, this study investigates the effects of a 4-week IA training program on physical fitness components in 12- to 14-year-old children. This study bridges the gap by examining the effects of IA training on physical fitness. By focusing on indigenous practices, we aim to promote culturally relevant physical activity while improving health outcomes. The findings can inform educational institutions, policymakers, and communities about the potential benefits of integrating IAs into physical education programs.

Methodology:

Procedure:

A physical fitness test was conducted on 67 students of one popular boys' school of Cooch Behar district of West Bengal, India. Only those students were chosen whose age ranged between 12 to below 14 years. By analysing the result of the fitness test, researcher included 87 students whose score had fallen under level 3 & level 4 category as per the Fitness benchmarks developed by the Expert Committee set up by the Ministry of Youth Affairs and Sports so that the selected students could be able to perform the training. Further as per the Pre-Post Random Group Design the subjects were equally divided into three different groups: Control Group (n=15) and Experimental Group-1 (n=15) and Experimental Group-2 (n=15). Pre-Test data of six Physical fitness components were collected through various standard test at school field Table 1. In between the pre and post-tests only the experimental group-1 followed IA Training Intervention-1 and experimental group-2 followed IA Training Intervention-2. Total six numbers of most popular indigenous activities were selected for the Training Protocol.

Sl. No.	Fitness Components	Test Measures
1	Body Composition	BMI (Body Mass Index)
2	Flexibility	Sit and Reach Test
3	Speed	50-meter Sprint
4	Abdominal Core Strength	Bent Knee Sit Up
5	Strength Endurance	Push Up
6	Cardiovascular Endurance	600 meter Run / Walk

Table 1: The Physical Fitness Components and Test Measures.

Details of IA Training Interventions						
Total No. and names of IA				**Kit-kit, Golla-Chhut, Chhi-Buri, Pakki, Edur-Biral, Rumal Churi**.		
IA Training Intervention-1				**IA Training Intervention-2**		
	Days	Activity	Division	Days	Activity	Division
1st Week	1st	Kit-kit, Golla-Chhut.	5 min. warm up, 40 min. indigenous activity, 5 min cooling down.	1st	Kit-kit, Golla-Chhut.	5 min. warm up, 20 min. indigenous activity, 5 min cooling down.
	2nd	Chhi-Buri, Pakki.	5 min. warm up, 40 min. indigenous activity, 5 min cooling down.	2nd	Chhi-Buri, Pakki.	5 min. warm up, 20 min. indigenous activity, 5 min cooling down.
	3rd	Kit-kit, Chhi-Buri,	5 min. warm up, 40 min. indigenous activity, 5 min cooling down.	3rd	Kit-kit, Chhi-Buri,	5 min. warm up, 20 min. indigenous activity, 5 min cooling down.
	4th	Golla-Chhut, Pakki.	5 min. warm up, 40 min. indigenous activity, 5 min cooling down.	NA	NA	NA
2nd to 4th Week	1st	Kit-kit, Golla-Chhut, Pakki, Rumal Churi.	5 min. warm up, 50 min. indigenous activity, 5 min cooling down.	1st	Kit-kit, Golla-Chhut, Pakki, Rumal Churi.	5 min. warm up, 30 min. indigenous activity, 5 min cooling down.
	2nd	Chhi-Buri, Pakki, Rumal Churi,	5 min. warm up, 50 min. indigenous activity, 5 min cooling down.	2nd	Chhi-Buri, Pakki, Rumal Churi,	5 min. warm up, 30 min. indigenous activity, 5

		Golla-Chhut.			Golla-Chhut.	min cooling down.
	3rd	Kit-kit, Golla-chhut Pakki, Rumal Churi.	5 min. warm up, 50 min. indigenous activity, 5 min cooling down.	3rd	Kit-kit, Golla-chhut Pakki, Rumal Churi.	5 min. warm up, 30 min. indigenous activity, 5 min cooling down.
	4th	Golla-Chhut, Pakki, Chhi-Buri, Kit-Kit.	5 min. warm up, 50 min. indigenous activity, 5 min cooling down.	NA	NA	NA

Table: 2: Details of IA Training Interventions.

Analysis of Data:

After the completion of ten weeks of training program anxiety level of both the groups were again measured and the collected data were analysed by using the IBM SPSS version 20. A one-way analysis of covariance (ANCOVA) was conducted to compare the effects of IA on Post-test result of the Experimental group 1, 2 and Control Group while controlling the Pre-test data as covariate. Shapiro-Wilk test and Levene's test was conducted to meet the assumptions.

Results:

The study revealed that there were significant differences between Control and Experimental groups in Body Compositions (BMI score), Flexibility score, Speed, Abdominal Core Strength and Strength Endurance as F value respectively F (2,41) = 3.630, 176.063, 5.227, 3.762, 4.297 and p= <0.05 (Table 3). The Post hoc tests showed there were significant differences in between scores of three groups. The partial Eta Squared values (Table 3) indicates the effect size and should be compared with the Cohen's guideline (0.2 = Small effect, 0.5 = Moderate effect, 0.8= Large effect). According to that for groups the effect size were small except the Flexibility score and showed 15% to 23.1% of variance in different Physical Fitness components except Flexibility (89.6%) of three groups when controlling the Pre-Test Scores.
Pairwise comparison showed significant difference in Control group and Experimental group 1 in Body Composition, Weight, Flexibility, Speed, Abdominal Core Strength, and Strength Endurance, Cardiovascular Endurance. Also, no significant difference found between Control Group and Experimental group 2 except the Cardiovascular Endurance components.

The results of the Levene's Test (Table 3) were insignificant (p= >0.05), indicated that the group variances did not exist. Hence, the assumption of homogeneity of variances was not violated.

The normality of the data was tested by the Shapiro-wilk formal test. Table 3 shows the insignificant (p= >0.05), indicating the data were normally distributed.

Physical Fitness Components	**Groups**	**Mean & SD (Pre Test)**	**Mean & SD (Post Test)**	**Test results of normality (p=0.05)**	**Test results of Homogeneity (p=0.05)**	**F Value**	**Sig (p=0.05)**	**Eta square**
	Cont.	21.81	22.07			3.630		0.15

Body Composition		±2.43	±2.26	Pre= 0.222 (p= >0.05) Post= 0.087 (p= >0.05)	0.633 (p= >0.05)		p= < 0.05	
	Exp. 1	21.62 ±1.86	21.43 ±1.81					
	Exp.2	22.18 ±1.95	22.22 ±1.91					
Weight	Cont.	43.86 ±4.84	44.54 ±4.75	Pre= 0.121 (p= >0.05) Post= 0.986 (p= >0.05)	0.847 (p= >0.05)	3.883	p= < 0.05	0.159
	Exp. 1	44.74 ±4.27	44.37 4.46					
	Exp.2	45.88 ±6.09	45.64 ±5.72					
Flexibility	Cont.	13.76 ±1.31	13.90 ±1.33	Pre= 0.923 (p= >0.05) Post= 0.473 (p= >0.05)	0.586 (p= >0.05)	176.063	p= < 0.05	0.896
	Exp. 1	14.83 ±0.93	17.47 ±0.83					
	Exp.2	14.13 ±1.31	16.32 ±1.30					
Speed	Cont.	8.42 ±0.46	8.45 ±0.41	Pre= 0.303 (p= >0.05) Post= 0.442 (p= >0.05)	0.516 (p= >0.05)	5.227	p= < 0.05	0.203
	Exp. 1	8.42 ±0.40	8.35 ±0.36					
	Exp.2	8.69 ±0.50	8.65 ±0.50					
Abdominal Core Strength	Cont.	19.27 ±1.53	19.13 ±1.85	Pre= 0.142 (p= >0.05) Post= 0.059 (p= >0.05	0.503 (p= >0.05)	3.762	p= < 0.05	0.155
	Exp. 1	19.40 ±1.30	20.07 ±1.16					
	Exp.2	18.93 ±2.02	19.27 ±1.91					
Strength Endurance	Cont.	10.80 ±1.13	10.53 ±1.13	Pre= 0.54 (p= >0.05) Post= 0.069 (p= >0.05	0.565 (p= >0.05)	4.297	p= < 0.05	0.173
	Exp. 1	11.33 ±1.59	11.67 ±1.50					
	Exp.2	11.47 ±1.64	11.53 ±1.73					
Cardiovascular Endurance	Cont.	2.53 0.04	2.58 0.05	Pre= 0.54 (p= >0.05) Post= 0.069 (p= >0.05	0.351 (p= >0.05)	6.154	p= < 0.05	0.231
	Exp. 1	2.52 ±0.04	2.51 ±0.04					

	Exp.2	2.51 ±0.03	2.51 ±0.03					

Discussion:

The purpose of this study was to investigate the effects of 4-weeks of IA training program on Physical Fitness e.g. Body Composition (BMI), Flexibility, Cardiovascular Endurance, Strength Endurance, Speed and Abdominal Core Strength among 12 to upto 14-year-old children.

Effect on Body Composition:

The significant F-value, [F(2,41)= 3.630, p=<0.05] indicates that there was statistically significant relationship between the IA training program and BMI of the participants. The pairwise comparison shows a significant relationship (p=<0.05) among the control group and Experimental Group-1, conversely no significant relationship among the control group and Experimental Group-2.

These findings are consistent with those of previous studies BMI is widely used to assess overweight and obesity, and it is a strong predictor of obesity when assessed during childhood (Hasselstrøm, H.,et al, 2002). Several studies have found similar results as found in the present study. For example, PA interventions help to improve body composition and assist in maintaining weight loss (Jakicic, J. M.,2009). Physical activity can improve fitness and reduce the risk of obesity and associated health risks linked to higher levels of body fat. (Fogelholm, M.,2010; Hamer, M., & O'Donovan, G., 2010; Ness AR, 2007;). Other studies show physical activity (PA) can improve body composition, which aligns with our findings in PA interventions. Preserving Fat-free mass (FFM) boosts daily energy use, reducing fat mass. PA effectively increases energy expenditure, helping achieve a negative energy balance and faster changes in body composition (Dao, H. H., 2004; Carrel, A. L., 2005; Kain, J., 2004). Several studies conducted under tightly controlled clinical conditions have demonstrated that participation in exercise programs can reduce body fat (Fagard, R., et al. 1985; Harrell, J. S., 1998). Long-term exercise programs spanning several months can also lead to weight loss (Mcmurray, R. G., 2002). Comparatively, control group youths showed less weight gain than those in intervention groups (Mcmurray, R. G., 2002). BMI can fluctuate due to changes in height, weight, bone density, muscle mass, fat, or water content (Cole, T. J., Bellizzi, 2000). Increased physical activity in intervention conditions has been shown to enhance muscle mass (Strong, W. B., 2005). School-age children should participate every day in 60 min or more of moderate to vigorous PA (Mattsson, E., et al, 1997; Blair, S. N., et al, 2004; Andersen, L. B., et al,2006). These results lead us to recommend at least 5 hours of PA per week at an intensity of 70% of the theoretical heart rate peak. Also, they recommended different intensities and types of PA in order to improve their body composition. In our present study also finds a similar result where Experimental group-1 showed grater reduction in BMI score in comparison to Experimental Group-2. Overall findings show significant changes in body weight among participants in an IA training program over Four weeks, suggesting a potential impact on children's Body Composition.

Effects on Flexibility:

The present study found the significant F- value, [F(2,41)= 176.063, p=<0.05] indicates that there was statistically significant relationship between the IA training program and Flexibility of the participants. The pairwise comparison shows a significant relationship (p=<0.05) among the control group and Experimental Group-1, also found significant relationship among the control group and Experimental Group-2.

In alignment with the present study, prior research involving primary school children engaging in PE-based flexibility programs has shown notable enhancements in hamstring and lumbar extensibility (Coledam et al., 2012; Rodríguez et al., 2008; Mayorga Vega et al., 2014; Rodríguez et al., 1999; Sainz de Baranda et al., 2006). Physiologically, several theories have been proposed to explain the observed increase in hamstring and lumbar extensibility following stretching programs (Weppler & Magnusson, 2010). Traditional theories attribute these improvements to mechanical factors such as viscoelastic and plastic deformation, increased sarcomeres in series, and neuromuscular relaxation. However, a newer theory suggests that sensory adaptations may predominantly drive these changes, especially in short-term flexibility programs (Mayorga Vega et al., 2014). Although the IA training program was not including any direct flexibility intervention-based programme. The results suggest that significant improvements in this parameter can indeed be achieved with a relatively brief IA training program.

Effects on Speed:

The present study found the significant F- value, [F (2,41) = 5.227, p=<0.05] indicates that there was statistically significant relationship between the IA training program and Speed of the participants. The pairwise comparison shows a significant relationship (p=<0.05) among the control group and Experimental Group-1, also found no significant relationship among the control group and Experimental Group-2.

The previous studies also aligned in findings with the present studies that several kinds of physical exercise may put the significant effects on the speed of the children (Polevoy, G. G., 2019; Van Hooren, B., & Croix, M. D. S., 2020; Solum, M., et al., 2020; Ford, P., et al., 2011). The significance of nervous system development during childhood is frequently highlighted, emphasizing that this developmental stage is critical for optimizing neuron structures and connections, thereby enhancing motor qualities based on nerve impulse speed (Szabo et al., 2020). Neuromuscular adaptations, such as improved firing frequencies and coordination, likely contribute to enhanced ability to accelerate and decelerate rapidly and forcefully (Ozmun et al., 1994; Potter, 2006). Also the present study finds significant effects on the abdominal core strength and overall strength of the children which is also directly related to the development of the speed.

Effect on Abdominal Core Strength and Strength Endurance:

The significant F-value, [F(2,41)= 3.762, p=<0.05] indicates that there was statistically significant relationship between the IA training program and Abdominal Strength of the participants. The pairwise comparison shows a significant relationship (p=<0.05) among the control group and Experimental Group-1, conversely no significant relationship among the control group and Experimental Group-2. Also another purpose of this study was to investigate the effects of two different training interventions on strength endurance. The present study found the significant F- value, [F(2,41)= 4.297, p=<0.05] indicates that there was statistically significant relationship between the IA training program and strength endurance of the participants. The pairwise comparison shows a significant relationship (p=<0.05) among the control group and Experimental Group-1, conversely no significant relationship among the control group and Experimental Group-2. The core encompasses the lumbo-pelvic-hip complex (with 29 muscles of insertion) in which the center of gravity is located and where all movements begin (Bergmark, A., 1989). According to H. Vanderburg core is more of the abdominal muscles groups (rectus abdominis, external oblique, internal oblique), which includes the muscles that supports the trunk, including the shoulder girdle and hips. Those muscles of core interlace and integrate each other for core stabilization (Vanderburg, H., 2016). Various study finds different forms of targeted exercise interventions specifically strength training directly and indirectly responsible for the development of core strength and stabilization (Noguchi, T., & Demura, S., 2014; Macaluso, A., & De Vito, G., 2004; Akuthota, V., & Nadler, S. F., 2004; Carter, J. M., et al, 2006; Oliver, G. D., et al., 2010; Tse, M. A., et al., 2005). Also regular physical exercise enhances fitness qualities and motor skills, promoting increased jumps, sudden movements, and strenuous activities that positively develop muscle strength and explosive power in children (Malipatil, R. P., & Patil, S. S., 2016). Adequate physical activity during childhood is vital for growth and development, while prolonged inactivity may reduce muscle mass and bone density (Eliakim et al., 2001; Eliakim, 2004). Conversely, prolonged periods of inactivity may limit opportunities for strenuous physical exertion, potentially leading to diminished muscle mass and bone density over time (Eliakim, 2004). Although the present study did not involve specific strength training in the interventions, it had a significant effect on the cardio-respiratory endurance and overall strength endurance of the children, which could enhance abdominal strength and core stability. Differences in strength development between the two groups may also be because of differences in the rate of mobilization per motor unit, which may be related to nerve impulses (Noguchi, T., et al, 2013). The mechanisms responsible for these gains are not entirely understood nor were they examined in this study, but changes in motor unit activation and motor unit coordination, recruitment and firing are probable mechanisms that can explain, at least in part, these short-term training induced gains (Sailors, M., & Berg, K., 1987). As the control group and Experimental group 2 had a lower exercise frequency or insufficient exercise experience during the mentioned period, their neuromuscular connections may have been more poorly developed. It is possible that neural impulses were not sufficiently transmitted to muscles and the mobilization rate of voluntary muscles was low when these subjects attempted to exert muscle strength. It is difficult to develop abdominal strength and overall strength because the stimulation of general activities of daily living may be insufficient for developing strength.

Effect on Cardiovascular Endurance:

The present study found the significant F- value, [F(2,41)= 6.820, p=>0.05] indicates that there was statistically significant relationship between the IA training program and Cardiovascular endurance of the participants. The pairwise comparison shows a significant relationship (p=>0.05) among the control group and Experimental Group-1, also found significant relationship among the control group and Experimental Group-2.

Previous studies in which children performed an extra-curricular circuit training program confirmed a significant improvement on both muscular and Cardiorespiratory fitness (Annesi et al., 2005; Ignico and Mahon, 1995; Wong et al., 2008). Regular exercise leads to the enlargement of the heart's left ventricle and improvements in cardiac contractility. This results in an increase in stroke volume—the amount of blood pumped out of the heart with each beat. As stroke volume increases, the heart can maintain the same cardiac output (amount of blood pumped per minute) with fewer beats per minute, thereby lowering the resting heart rate (Levine et al., 1990). Also the present study finds significant effects on the other fitness components and body composition of the children which is also directly related to the development of the Cardiovascular Endurance.

Recommendations for the IA training Intervention:

The present study shows that the IA training Intervention-1 is more effective and put significant effects on physical fitness of the children than the IA training Intervention-2. The previous studies also suggested that the physical activity plays a crucial role in managing weight and promoting health among children. Research has shown that engaging in two to three hours of moderately intense physical activity each week can significantly reduce visceral obesity and adiposity in overweight children (Gutin, B., et al, 2002; LeMURA, 2002; Owens, S., 1999). World Health Organization (WHO) recommendations show that an average of 60 min of moderate to vigorous physical activity per day is required for the health of the youth. However, an average of more than 60 min of moderate to vigorous physical activity per day brings about additional benefits (Bull FC, et al., 2020). Furthermore, the introduction of physical education classes in school curricula has been effective in controlling adiposity among obese children (Owens, S., et al, 1999). Also, current guidelines recommend that children engage in at least 60 minutes of age-appropriate physical activity daily or on most days of the week (Strong, W. B., et al, 2005). However, it has been observed that many children do not meet these recommendations, which can have negative implications for their health and weight (American Pediatric Association). For preschool-aged children, structured physical activity such as football, swimming, ballet, gymnastics, regular walking, and motor skill development activities like ball-catching and rope skipping should be encouraged for at least 60 minutes daily (Garcia, 2002). Additionally, it is important for children to engage in unstructured physical activities such as climbing trees, running, playing outdoors, and limiting sedentary activities to no more than 60 minutes per day (American Pediatric Association). The intervention program also integrated principles of integrative neuromuscular training (Myer, G. D., et al, 2011), incorporating reaction with various stimulus, agility, fundamental human movements like running, jumping, and essential movement skills like sprinting. So, the current study echoes these findings by revealing significant alterations in Physical Fitness among children participating in a four weeks IA training intervention- 1 minimum of four times a week and 50 to 60 minutes per sessions as mentioned, indicating a potential impact on physical fitness components.

Limitations and Strength of the present study

This study presents both strengths and limitations that warrant discussion. Our findings are specifically relevant to healthy boys aged 12 to under 14. Notably, we did not account for several factors that could potentially influence children's physical fitness and overall development, such as biological maturity (e.g., Tanner stages), physical activity levels (e.g., intensity and duration), media consumption (e.g., screen time), and socioeconomic status (e.g., parental education, occupation, income). Furthermore, as this was a pilot study, the duration and sample size were relatively small.

Despite these limitations, several strengths should be acknowledged. Firstly, the training intervention included six IA of India, which holds significant cultural and traditional importance. Secondly, both the IA intervention and the Physical Fitness tests required minimal equipment, enhancing accessibility and feasibility. Thirdly, the study reported findings from a comprehensive range of physical fitness tests commonly used and documented in various fitness assessments worldwide, including the stand-and-reach test, 50-meter sprint test, 12-minute run/walk test, Sit-up Test, and Abdominal strength Core test.

Additionally, the applied field tests assessed both health-related (such as cardiorespiratory endurance measured by the 9-minute run test and flexibility evaluated by the Sit-and-reach test; Strength Endurance evaluated by Push Up) and skill-related (such as speed assessed by the 50-meter sprint test) components of physical fitness in youth. Assessing health-related physical fitness in children is crucial as attributes like cardiorespiratory endurance established in childhood can persist into adulthood, predicting future physical fitness levels (Beunen et al., 1997; Twisk et al., 2000). Moreover, skill-related physical fitness serves as a significant predictor of children's activity levels; research suggests that children with higher motor skill levels tend to engage in more physical activity over subsequent years compared to those with lower motor skill levels (Lopes et al., 2011).

Conclusion:

This study investigated the effects of 4-week IA training interventions on various physical fitness parameters among 12 to 14-year-old children. The findings revealed a statistically significant relationship between the IA training program and BMI, abdominal strength, strength endurance, flexibility, and speed among the participants. Specifically, significant improvements were observed in BMI and flexibility in both experimental groups compared to the control group. The study's results are consistent with previous research indicating that physical activity interventions can effectively enhance body composition and fitness levels in children. Moreover, the significant gains in speed and strength endurance suggest that the IA training program positively influenced neuromuscular adaptations and motor skills crucial for rapid and forceful movements. These findings underscore the importance of structured physical activity interventions in promoting overall physical fitness and health in school-age children. Future research should explore long-term effects and optimal strategies for enhancing specific fitness components through IA training programs.

Reference:

Smith, J. J., Eather, N., Morgan, P. J., Plotnikoff, R. C., Faigenbaum, A. D., & Lubans, D. R. (2014). The health benefits of muscular fitness for children and adolescents: a systematic review and meta-analysis. *Sports medicine*, *44*, 1209-1223.

Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2020). Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1· 6 million participants. *The lancet child & adolescent health*, *4*(1), 23-35.

Casonatto, J., Fernandes, R. A., Batista, M. B., Cyrino, E. S., Coelho-e-Silva, M. J., de Arruda, M., & Vaz Ronque, E. R. (2016). Association between health-related physical fitness and body mass index status in children. *Journal of Child Health Care*, *20*(3), 294-303.

Marques, A., Santos, R., Ekelund, U. L. F., & Sardinha, L. B. (2015). Association between physical activity, sedentary time, and healthy fitness in youth. *Medicine and science in sports and exercise*, *47*(3), 575-580.

Júdice, P. B., Silva, A. M., Berria, J., Petroski, E. L., Ekelund, U., & Sardinha, L. B. (2017). Sedentary patterns, physical activity and health-related physical fitness in youth: a cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity*, *14*, 1-10.

Forde, C., & Hussey, J. (2015). How children use active videogames and the association between screen time and physical activity. *Games for health Journal*, *4*(4), 312-317.

Hardy, L. L., Ding, D., Peralta, L. R., Mihrshahi, S., & Merom, D. (2018). Association between sitting, screen time, fitness domains, and fundamental motor skills in children aged 5–16 years: cross-sectional population study. *Journal of physical activity and health*, *15*(12), 933-940.

Tan, J. S., Nonis, K., & Chan, L. Y. (2020). The effect of traditional games and free play on motor skills of preschool children. *International Journal of Childhood, Counselling and Special Education*, *1*(2), 204-223.

Iasha, V., Al Ghozali, M. I., Supena, A., Wahyudiana, E., Setiawan, B., & Auliaty, Y. (2020, September). The traditional games effect on improving students working memory capacity in primary schools. In *Proceedings of the 4th International Conference on Learning Innovation and Quality Education* (pp. 1-5).

Hamidian Iahromi, N., Rezaeeyan, F., & Haghighat, S. (2012). The effect of native and local games on the students' visual/motional growth among mental retarded students in pre-school and elementary first-graders in the city of Shiraz. *Exceptional Education*, *3*(111), 29-38.

Hasselstrøm, H., Hansen, S. E., Froberg, K., & Andersen, L. B. (2002). Physical fitness and physical activity during adolescence as predictors of cardiovascular disease risk in young adulthood. Danish Youth and Sports Study. An eight-year follow-up study. *International journal of sports medicine*, *23*(S1), 27-31.

Jakicic, J. M. (2009). The effect of physical activity on body weight. *Obesity*, *17*(S3), S34-S38.

Fogelholm, M. (2010). Physical activity, fitness and fatness: relations to mortality, morbidity and disease risk factors. A systematic review. *Obesity reviews*, *11*(3), 202-221.

Hamer, M., & O'Donovan, G. (2010). Cardiorespiratory fitness and metabolic risk factors in obesity. *Current opinion in lipidology*, *21*(1), 1-7.

Ness AR, Leary SD, Mattocks C, *et al.* Objectively measured physical activity and fat mass in a large cohort of children. *PLoS Med* 2007;4:e97.

Dao, H. H., Frelut, M. L., Oberlin, F., Peres, G., Bourgeois, P., & Navarro, J. (2004). Effects of a multidisciplinary weight loss intervention on body composition in obese adolescents. *International Journal of Obesity*, *28*(2), 290-299.

Carrel, A. L., Clark, R. R., Peterson, S. E., Nemeth, B. A., Sullivan, J., & Allen, D. B. (2005). Improvement of fitness, body composition, and insulin sensitivity in overweight children in a school-based exercise program: a randomized, controlled study. *Archives of pediatrics & adolescent medicine*, *159*(10), 963-968.

Kain, J., Uauy, R., Vio, F., Cerda, R., & Leyton, B. (2004). School-based obesity prevention in Chilean primary school children: methodology and evaluation of a controlled study. *International journal of obesity*, *28*(4), 483-493.

Fagard, R., M'Buyamba-Kabangu, J. R., Staessen, J. A., Vanhees, L., & Amery, A. (1985). Physical activity and blood pressure.

Harrell, J. S., Gansky, S. A., McMurray, R. G., Bangdiwala, S. I., Frauman, A. C., & Bradley, C. B. (1998). School-based interventions improve heart health in children with multiple cardiovascular disease risk factors. *Pediatrics*, *102*(2), 371-380.

Mcmurray, R. G., Harrell, J. S., Bangdiwala, S. I., Bradley, C. B., Deng, S., & Levine, A. (2002). A school-based intervention can reduce body fat and blood pressure in young adolescents. *Journal of Adolescent Health*, *31*(2), 125-132.

Cole, T. J., Bellizzi, M. C., Flegal, K. M., & Dietz, W. H. (2000). Establishing a standard definition for child overweight and obesity worldwide: international survey. *Bmj*, *320*(7244), 1240.

Strong, W. B., Malina, R. M., Blimkie, C. J., Daniels, S. R., Dishman, R. K., Gutin, B., ... & Trudeau, F. (2005). Evidence based physical activity for school-age youth. *The Journal of pediatrics*, *146*(6), 732-737.

Mattsson, E., Larsson, U. E., & Rössner, S. (1997). Is walking for exercise too exhausting for obese women?. *International journal of obesity*, *21*(5), 380-386.

Blair, S. N., LaMonte, M. J., & Nichaman, M. Z. (2004). The evolution of physical activity recommendations: how much is enough?. *The American journal of clinical nutrition*, *79*(5), 913S-920S.

Andersen, L. B., Harro, M., Sardinha, L. B., Froberg, K., Ekelund, U., Brage, S., & Anderssen, S. A. (2006). Physical activity and clustered cardiovascular risk in children: a cross-sectional study (The European Youth Heart Study). *The Lancet*, *368*(9532), 299-304.

Bergmark, A. (1989). Stability of the lumbar spine: a study in mechanical engineering. *Acta Orthopaedica Scandinavica*, *60*(sup230), 1-54.

Vanderburg, H. (2016). *Fusion workouts: Fitness, yoga, pilates, and barre*. Human Kinetics,9-14.

Noguchi, T., & Demura, S. (2014). Effect of Differences in the Exercise Frequency of Young People on Abdominal Strength and Muscle Thickness. *American Journal of Sports Science and Medicine*, *2*(6), 218-221.

Macaluso, A., & De Vito, G. (2004). Muscle strength, power and adaptations to resistance training in older people. *European journal of applied physiology*, *91*, 450-472.

Akuthota, V., & Nadler, S. F. (2004). Core strengthening. *Archives of physical medicine and rehabilitation*, *85*, 86-92.

Carter, J. M., Beam, W. C., McMahan, S. G., Barr, M. L., & Brown, L. E. (2006). The effects of stability ball training on spinal stability in sedentary individuals. *The Journal of Strength & Conditioning Research*, *20*(2), 429-435.

Oliver, G. D., Adams-Blair, H. R., & Dougherty, C. P. (2010). Implementation of a core stability program for elementary school children. *Athletic Training & Sports Health Care*, *2*(6), 261-266.

Tse, M. A., McManus, A. M., & Masters, R. S. (2005). Development and validation of a core endurance intervention program: implications for performance in college-age rowers. *The Journal of Strength & Conditioning Research*, *19*(3), 547-552.

Malipatil, R. P., & Patil, S. S. (2016). The effect of Yoga and physical exercise on leg explosive strength and agility variables of secondary school students. *European Journal of Physical Education and Sport Science*.

Momčilović, V., Momčilović, Z., & Cenić, S. (2019). Effects of experimental model of explosive strength in regular physical education classes. *Facta Universitatis, Series: Physical Education and Sport*, 569-576.

Eliakim, A. (2004). Growth and exercise in health and disease—What every paediatrician needs to know. *Paediatric Respiratory Reviews*, *5*, S3-S10.

Eliakim, A., Scheett, T. P., Newcomb, R., Mohan, S., & Cooper, D. M. (2001). Fitness, training, and the growth hormone→ insulin-like growth factor I axis in prepubertal girls. *The Journal of Clinical Endocrinology & Metabolism*, *86*(6), 2797-2802.

Noguchi, T., Demura, S. I., Shimada, S., Kobayashi, H., Yamaji, S., & Yamada, T. (2013). Effect of Sports Club Activities on the Physique and Physical Fitness of Young Japanese Males. *World Journal of Education*, *3*(6), 27-32.

Sailors, M., & Berg, K. (1987). Comparison of responses to weight training in pubescent boys and men. *Journal of sports medicine and physical fitness*, *27*(1), 30-37.

Coledam, D.H.C., Arruda, G.A., & Ramos de Oliveira, A. (2012). Chronic effect of static stretching performed during warm-up on flexibility in children. *Revista Brasileira de Cineantropometria e Desempenho Humano*, *14*(3), 296-304.

Rodríguez, P.L., Santonja, F.M., López-Miñarro, P.A., Sáinz de Baranda, P., & Yuste, J.L. (2008). Effect of physical education stretching program on sit-and-reach score in schoolchildren. *Science & Sports*, *23*(3), 170-175.

Mayorga Vega, D., Merino Marban, R., Vera Estrada, F., & Viciana, J. (2014). Effect of a short-term physical education-based flexibility program on hamstring and lumbar extensibility and its posterior reduction in primary schoolchildren. *Kinesiology*, *46*(2.), 227-233.

Rodríguez, P.L., Santonja, F., Canteras, M., Delgado, M.., Fernández, J., & Balsalobre, J. (1999). Mejora de la extensibilidad isquiosural tras un programa escolar de estiramientos. [Improvement of hamstring extensibility after school program of stretching. In Spanish.] *Selección*, *8*(4), 157-164.

Sainz de Baranda, P., Rodríguez, P.L, Santonja, F.M., López, P.A., Andújar, P., Ferrer V., & Pastor, A. (2006). Effects of hamstring stretching exercises on the toe-touch test in elementary schoolchildren. *Journal of Human Movement Studies*, *51*(4), 277-289.

Weppler, C.H., & Magnusson, S.P. (2010). Increasing muscle extensibility: A matter of increasing length or modifying sensation? *Physical Therapy*, *90*(3), 438-449.

Polevoy, G. G. (2019). The development of speed-power qualities of schoolchildren with different typologies applying coordination training. *Pedagogics, psychology, medical-biological problems of physical training and sports*, (1), 43-46.

Van Hooren, B., & Croix, M. D. S. (2020). Sensitive periods to train general motor abilities in children and adolescents: do they exist? A critical appraisal. *Strength & Conditioning Journal*, *42*(6), 7-14.

Solum, M., Lorås, H., & Pedersen, A. V. (2020). A golden age for motor skill learning? Learning of an unfamiliar motor task in 10-year-olds, young adults, and adults, when starting from similar baselines. *Frontiers in psychology*, *11*, 538.

Ford, P., De Ste Croix, M., Lloyd, R., Meyers, R., Moosavi, M., Oliver, J., ... & Williams, C. (2011). The long-term athlete development model: Physiological evidence and application. *Journal of sports sciences*, *29*(4), 389-402.

Szabo, D. A., Neagu, N., & Sopa, I. S. (2020). Research regarding the development and evaluation of agility (balance, coordination and speed) in children aged 9-10 years. *Health, Sports & Rehabilitation Medicine*, *21*(2).

Ozmun, J. C., Mikesky, A. E., & Surburg, P. R. (1994). Neuromuscular adaptations following prepubescent strength training. *Medicine and science in sports and exercise*, *26*(4), 510-514.

Potter, C. (2006). Book Review: Children's Exercise Physiology. *European Physical Education Review*, *12*(2), 239-242.

Annesi, J. J., Westcott, W. L., Faigenbaum, A. D., & Unruh, J. L. (2005). Effects of a 12-week physical activity protocol delivered by YMCA after-school counselors (Youth Fit for Life) on fitness and self-efficacy changes in 5–12-year-old boys and girls. *Research quarterly for exercise and sport*, *76*(4), 468-476.

Ignico, A. A., & Mahon, A. D. (1995). The effects of a physical fitness program on low-fit children. *Research Quarterly for Exercise and Sport*, *66*(1), 85-90.

Wong, P. C., Chia, M. Y., Tsou, I. Y., Wansaicheong, G. K., Tan, B., Wang, J. C., ... & Lim, D. (2008). Effects of a 12-week exercise training programme on aerobic fitness, body composition, blood lipids and C-reactive protein in adolescents with obesity. *Annals Academy of Medicine Singapore*, *37*(4), 286.

Levine, B. D., Lane, L. D., Buckey, J. C., Friedman, D. B., & Blomqvist, C. G. (1990). Left ventricular pressure-volume and Frank-Starling relations in endurance athletes. Implications for orthostatic tolerance and exercise performance. Circulation, 81(2), 915-921.

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public health reports*, *100*(2), 126.

Beunen, G., Ostyn, M., Simons, J., Renson, R., Claessens, A. L., Eynde, B. V., ... & Van't Hof, M. A. (1997). Development and tracking in fitness components: Leuven longitudinal study on lifestyle, fitness and health. *International journal of sports medicine*, *18*(S 3), S171-S178.

Twisk, J. W., Kemper, H. C., & van MECHELEN, W. (2000). Tracking of activity and fitness and the relationship with cardiovascular disease risk factors. *Medicine and science in sports and exercise*, *32*(8), 1455-1461.

Lopes, V. P., Rodrigues, L. P., Maia, J. A., & Malina, R. M. (2011). Motor coordination as predictor of physical activity in childhood. *Scandinavian journal of medicine & science in sports*, *21*(5), 663-669.

Gutin, B., Barbeau, P., Owens, S., Lemmon, C. R., Bauman, M., Allison, J., ... & Litaker, M. S. (2002). Effects of exercise intensity on cardiovascular fitness, total body composition, and visceral adiposity of obese adolescents. *The American journal of clinical nutrition*, *75*(5), 818-826.

LeMURA, L. M., & Maziekas, M. T. (2002). Factors that alter body fat, body mass, and fat-free mass in pediatric obesity. In *Database of Abstracts of Reviews of Effects (DARE): Quality-assessed Reviews [Internet]*. Centre for Reviews and Dissemination (UK).

Owens, S., Gutin, B., Allison, J., Riggs, S. H. A. R. O. N., Ferguson, M., Litaker, M. A. R. K., & Thompson, W. I. L. L. I. A. M. (1999). Effect of physical training on total and visceral fat in obese children. *Medicine and science in sports and exercise*, *31*(1), 143-148.

OWENS, S., GUTIN, B., ALLISON, J., RIGGS, S., FERGUSON, M., LITAKER, M., & THOMPSON, W. (1999). Effect of physical training on total and.

Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, Carty C, Chaput JP, Chastin S, Chou R, Dempsey PC, DiPietro L, Ekelund U, Firth J, Friedenreich CM, Garcia L, Gichu M, Jago R, Katzmarzyk PT, Lambert E, Leitzmann M, Milton K, Ortega FB, Ranasinghe C, Stamatakis E, Tiedemann A, Troiano RP, Ploeg HPvd, Wari V, Willumsen JF. World Health Organization 2020 guidelines on physical activity and sedentary behavior. British journal of sports medicine. 2020; 54(24):1451-62.

Strong, W. B., Malina, R. M., Blimkie, C. J., Daniels, S. R., Dishman, R. K., Gutin, B., ... & Trudeau, F. (2005). Evidence based physical activity for school-age youth. *The Journal of pediatrics*, *146*(6), 732-737.

Myer, G. D., Faigenbaum, A. D., Ford, K. R., Best, T. M., Bergeron, M. F., & Hewett, T. E. (2011). When to initiate integrative neuromuscular training to reduce sports-related injuries and enhance health in youth?. *Current sports medicine reports*, *10*(3), 155-166.