



Determining the Impact of Adapted Yoga Training on Physical Functioning in Students with Mild Intellectual Disability

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Abstract

Background. Individuals with mild intellectual disability (ID) often encounter challenges in physical functioning, impacting their overall well-being and quality of life. Traditional exercise programs may not always be accessible or effective for this population due to various barriers. Adapted yoga programs have emerged as a promising alternative, offering tailored interventions to address the unique needs of individuals with ID.

Objectives. The study aimed to close this gap by examining the effect of a structured, modified yoga programme on factors related to physical functioning.

Materials and methods. A total of 40 students with mild ID, aged between 11 and 15 years, were selected from Special Schools in Coimbatore, Tamil Nadu. A quasi-experimental design was used in this study. The participants were divided into an experimental group undergoing an 8-week adapted yoga program and a control group maintaining regular activities. Physical function parameters were assessed using standardized tests measuring cardiorespiratory endurance, muscular strength and endurance, flexibility, body composition, and balance. The adapted yoga program, conducted by qualified instructors, comprised 8 weeks of sessions, 5 days a week, each lasting 45 to 60 minutes. Statistical analyses confirmed the normal distribution of data and employed paired sample t-tests to assess pre- and post-test differences, with SPSS version 20.0 used for analysis, setting the significance level at 0.05.

Results. After undergoing 8 weeks of adapted yoga training, the results showed a significant improvement in the upper body strength ($p < 0.04$), lower body strength ($p < 0.001$), core strength ($p < 0.002$), flexibility ($p < 0.00$), and static balance ($p < 0.00$). However, there was no significant difference in body fat and cardiorespiratory endurance between adapted yoga training.

Conclusions. This study highlights the potential of adapted yoga programs as an intervention for improving physical functioning in students with mild ID. These findings indicate that the implementation of adapted yoga can be a valuable and accessible intervention for enhancing physical functioning in this population.

Keywords: intellectual disability, adapted yoga, physical functioning, muscular strength, endurance.

Introduction

Physical activity is essential for maintaining a healthy lifestyle and has several advantages for people of all ages (Donnelly et al., 2016; Gao et al., 2018). Regular exercise helps build a robust cardiovascular system, improves muscular strength and endurance, and cultivates healthy bones and

weight management (Herting & Chu, 2017; Ruegsegger & Booth, 2017; Bidzan-Bluma & Lipowska, 2018; Kohl et al., 2013). In addition, physical activity has beneficial effects on mental health by combining reduced stress, symptoms of anxiety and depression, and enhanced mood and sleep (James et al., 2023; Jacinto et al., 2023; Bouzas et al., 2018).

Persons with ID is a diverse and distinct population of restrictions in intellectual functioning and adaptive behaviours (Wang et al., 2021; Yang et al., 2022). According to the American Association on Intellectual and Developmental Disabilities (AAIDD), ID is defined by significant limitations

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in both intellectual functioning (IQ) and adaptive behaviour, which manifest during the developmental period (Rayes et al., 2022). These limitations often impact a person's ability to effectively navigate day-to-day activities, communicate, and participate in social interactions (Kharbat et al., 2020; Bouzas et al., 2018; Bartoszesky et al., 2021). While the severity of ID varies among individuals, those classified with mild ID typically demonstrate intellectual functioning within the range of approximately 50 to 70 IQ points (Rayes et al., 2022; Lynnes et al., 2009; Carter & Swank, 2014).

Physical activity interventions tailored to the needs of individuals with ID are essential for promoting their overall health and well-being (Yan et al., 2022; Jacob et al., 2023). However, traditional exercise programs may not always be suitable or accessible for individuals with mild ID due to various cognitive, sensory, and motor impairments (Bouzas et al., 2018; Lirola et al., 2020; Réadaptation, 2023). In this context, adapted yoga programs have emerged as a promising alternative for promoting physical health and functioning in this population.

Yoga is a holistic mind-body practice that incorporates physical postures, breathing exercises, and meditation techniques to promote physical, mental, and emotional well-being (Scroggins et al., 2016; Kaur & Bhat, 2019; Reina et al., 2020). Adapted yoga programmes include modified postures, visual adjustments, and specialised assistance to enhance participation and engagement for people with disabilities. Programmes are designed specifically to meet their unique needs and skills (Scroggins et al., 2016; Rayes et al., 2022).

Adapted yoga interventions have shown promise in improving various aspects of physical functioning in individuals with disabilities (Garg et al., 2013; Mohanty et al., 2016; Kaur & Bhat, 2019). Research has demonstrated the possible advantages of adapted yoga practices for people with intellectual disabilities, including improvements in flexibility, balance, muscle strength, relaxation, and overall quality of life (Pise et al., 2017; WASET, 2023; Rayes et al., 2022). However, the majority of studies in this area have focused on adults or mixed-age populations, with limited research specifically addressing the impact of adapted yoga training on physical functioning in students with mild ID.

Therefore, this study seeks to address this gap by examining the effects of adapted yoga training on physical functioning outcomes among students with mild ID. By examining the feasibility, acceptability, and efficacy of adapted yoga interventions within a school-based setting, we aim to generate empirical evidence to inform the development and implementation of effective adapted yoga programs for this population.

Materials and Methods

Participants

Purpose of this study is to find out the impact of adapted yoga on physical function of students with mild ID. For this 40 mild students with ID between the ages of 11 to 15 years were chosen from the Special Schools from Coimbatore, Tamil Nadu state. This age range was likely selected based on developmental factors and the potential for consistent participation in the study.

Table 1. Mean, Standard Deviation and t Test result of Age, Height and Weight of Experimental and Control Group

No	Variables	Mean \pm SD		Sig
		Experimental group	Control Group	
1	Age	13.4 \pm 1.04	13.65 \pm 1.22	0.412
2	Height	153.1 \pm 5.09	152.60 \pm 4.81	0.743
3	Weight	47.8 \pm 6.36	49.05 \pm 6.20	0.423

Criterion Measures

Table 2. Selected Physical Performance variables, Test and measuring unit

No	Variable	Test	Measuring Unit
1	Cardiorespiratory endurance	Treadmill Run/walk test	Distance in meters
2	Muscular Strength and endurance	Isometric puss up test	Seconds
		Sit-to-Stand test	Centimetres
3	Flexibility	Plank test	Seconds
		Sit-and-reach test	Centimetres
4	Body Composition	Body fat analyser (Omron Karada Scan Body Composition Monitor HBF-375)	Body fat percentage
5	Balance	The one-leg stance test	Seconds

Design

Quasi-experimental design was applied for this study with two groups, an experimental group and a control group. The experimental group consisted of students who participated in 8-weeks adapted yoga training program, while the control group consisted of students who did not receive any special intervention beyond their regular activities. This design allowed for comparisons to be made between the two groups, with the experimental group serving as the treatment group and the control group providing a baseline for comparison.

Testing Procedure

Cardiorespiratory endurance was assessed using treadmill run test, The students walks on a treadmill to exhaustion, at a constant walking speed while gradient/slope is increased every one or two minutes. The assistant starts the stopwatch at the beginning of the test and stops it when the subject is unable to continue.

The isometric push-up test assessed the strength and endurance of the upper body. In a straight line, participants stretched their arms under their shoulders, and testers assessed how long they held this posture.

Lower body strength and endurance were evaluated by sit-to-stand test. The task required participants to cross their arms while sitting on a chair and count how many times they could get up in 30 seconds.

The plank test addressed strength and endurance of core muscles. Participants placed themselves on their forearms and toes in a straight-bodied position. If they felt any discomfort or were unable to keep the position, they released the hold.

Flexibility in the hamstrings and lower back was assessed using the sit and reach test. The sit-and-reach box was utilised by the participants (DSI, DANESH SALAR Ltd). They slowly extended their arms as far forward as they could while sitting with their knees flat on the floor. They held this position for two seconds. Every participant made three tries, and the results showed a correct measurement.

OMRON's Fat Loss Monitor with Scale estimated body fat percentage through the Bioelectrical Impedance (BI) Method. This method relies on the fact that muscles, blood vessels, and bones, which have high water content, conduct electricity easily, whereas body fat, which has little electrical conductivity, impedes the flow of electricity.

The test of one-leg stance evaluated static balance. The participants maintained the posture for as long as possible while standing on one leg, hands on hips, and eyes open. After testing both legs, the average time was noted in seconds.

Training Program

The experimental group engaged in an 8-week adapted yoga training program tailored explicitly for individuals with mild ID. Led by qualified instructors experienced in working with special needs populations, the sessions

were meticulously crafted to accommodate the unique requirements of the participants. The content and structure of the program were adapted to ensure accessibility and safety, focusing on gentle and modified yoga poses as well as breathing exercises suitable for individuals with ID. Throughout the duration of the program, attendance records and participation logs were likely maintained to track the engagement and adherence of participants, facilitating ongoing assessment and adjustment as needed to optimize the effectiveness of the training regimen.

Total weeks	– 8
Days per Week	– 5
Session per day	– 1
Duration of the session	– 45 to 60 minutes

Statistical Analysis

As the participants were randomly selected and allocated to the experimental and control groups, it was possible to justify the use of these two groups in this study using two statistical analyses. With regard to the variables, the Kolmogrov-Smirnov test revealed that the difference in scores was normally distributed. SPSS version 20.0 was used to conduct all statistical analyses.

The paired sample t test was used to statistically evaluate the pre- and post-test data in order to determine the significance of the mean differences. A significance level of 0.05 was used in order to test the hypotheses.

Table 3. Eight week of Adapted yoga training schedule for Experimental group

Weeks	Yoga	Name and Pose	Number of repetition	Duration in Minutes	Total Duration
1 & 2	Asana	Tadasana, Trikonasana, Vajrasana, Sukhasana, Bhujangasana, Salabhasana, Pawanmuktasana, Ardha Halasana	8	330	600 Minutes
	Pranayama	Anuloma villoma, kapalapathi, bhramari pranayama, bhatrika	2	180	
	Meditation	Mindfulness Meditation, Guided Imagery and Visualization, Focused Attention Meditation	1	90	
3 & 4	Asana	Vrikshasana, Utkatasana, Paschimottanasana, Marjariasana, Dhanurasana, Makarasana, Setubandhasana, arvangasana.	12	330	600 Minutes
	Pranayama	Anuloma villoma, kapalapathi, bhramari pranayama, bhatrika	2	180	
	Meditation	Mindfulness Meditation, Guided Imagery and Visualization, Focused Attention Meditation	1	90	
5 & 6	Asana	Natarajasana, Ardha Chakrasana, Gomukhasana, Ushtrasana, Astanga namaskara Chakrasana, Halasana	12	300	600 Minutes
	Pranayama	Anuloma villoma, kapalapathi, bhramari pranayama, bhatrika	3	210	
	Meditation	Mindfulness Meditation, Guided Imagery and Visualization, Focused Attention Meditation	1	90	
7 & 8	Asana	Padahastanasana, Adhomukha Shwanasana, Vakrasana, Shashakasana, Dhanurasana, Makarasana, Pawanmuktasana, Ardha Halasana	12	300	600 Minutes
	Pranayama	Anuloma villoma, kapalapathi, bhramari pranayama, bhatrika	3	210	
	Meditation	Mindfulness Meditation, Guided Imagery and Visualization, Focused Attention Meditation	1	90	

Results

Table 4. Mean, Standard Deviation and t Test result of Age, Height and Weight of Experimental and Control Group

No	Variables	Experimental group Mean ± SD			Control Group Mean ± SD		
		Pre test	Post test	Sig	Pre test	Post test	Sig
1	Cardiorespiratory endurance	21.15 ± 6.10	22.05 ± 5.34	0.070	20.10 ± 5.58	20.35 ± 5.07	0.398
2	Isometric puss up test	21.95 ± 4.93	23.15 ± 4.94	0.004	22.25 ± 5.16	22.60 ± 5.48	0.130
3	Sit-to-Stand test	13.35 ± 3.86	14.8 ± 3.50	0.001	14.00 ± 2.82	14.25 ± 2.55	0.204
4	Plank test	14.12 ± 6.31	15.04 ± 5.71	0.002	13.82 ± 4.75	14.23 ± 4.54	0.065
5	Flexibility	18.34 ± 7.06	20.46 ± 6.77	0.000	17.61 ± 7.07	18.20 ± 6.88	0.017
6	Body Composition	16.40 ± 3.54	16.65 ± 3.16	0.234	16.45 ± 2.08	16.85 ± 2.32	0.028
7	Balance	9.54 ± 3.00	11.27 ± 2.83	0.000	9.66 ± 3.33	9.97 ± 3.06	0.144

Discussion

This research sought to assess how adapted yoga affects the physical health of students with ID. The primary finding revealed that participating in eight weeks of adapted yoga notably improved physical health among the students mild ID. But there were no notable changes seen in terms of body composition or cardiorespiratory endurance. Whereas literature supports the beneficial impact of yoga on the physical fitness of the general population, there is limited evidence regarding the effects of adapted yoga specifically on the physical health of students with ID. The current investigation and these results are in agreement the Yoga-based programmes had a favourable influence on kids with ID's motor abilities, demonstrating modest to substantial increases in measured outcomes (Khalsa & Butzer, 2016; Reina et al., 2020; Hart et al., 2022).

Furthermore, after an eight-week yoga intervention, there were no significant differences in cardiorespiratory endurance. On the other hand, following exercise-based interventions, a recent study found that young individuals with ID had improved cardiovascular function (Büssing et al., 2012). Information regarding yoga's impact on cardiorespiratory endurance in students with ID, remains limited. An investigation found that prepubescent children who practiced yoga for 12 weeks had improved aerobic capacity (Veneri et al., 2018). These results may be explained by the beneficial effects of breathing exercises and yoga poses on factors including cardiac output, oxygen delivery capacity, and capillary density. The nature, duration, and intensity of physical activity play crucial roles in enhancing the cardiorespiratory system (Hawkins et al., 2012; Mishra et al., 2018; Satish et al., 2018). Marked enhancements in cardiorespiratory endurance have been noted with aerobic regimens like aquatic sports or cycling (Marandi et al., 2023). Additionally, investigations focusing on exercises targeting respiratory muscle strengthening have reported increased cardiorespiratory endurance post-yoga interventions (Pastula et al., 2012). Although our research revealed a slight rise in cardiorespiratory endurance, students with ID were unable to participate in high-intensity activities due to physical constraints. Such activities are essential for increasing aerobic capacity. Subsequent investigations may explore extended periods of yoga intervention in order to

thoroughly assess its possible impacts on cardiorespiratory endurance.

Physical well-being, which encompasses strength, endurance, power, and flexibility, plays a pivotal role in overall health (Yang et al., 2022). Students with ID typically exhibit lower levels of physical well-being compared to their peers without disabilities (Kim & Yi, 2018). Movement challenges such as poor balance and coordination can impede their participation in exercises aimed at enhancing muscle groups and overall fitness (Hsu et al., 2021). Moreover, poor muscle tone is a problem among some kids, which makes prolonged physical activity challenging. In addition to causing a propensity for solitary pursuits, cognitive and social challenges can limit possibilities for physical activity (Xu et al., 2020).

After eight weeks of adapted yoga training, the study found that there were considerable improvements in the strength and endurance of the upper, lower, and core muscles. These findings are in line with meta-analyses showing that exercise therapies increase the muscle strength and endurance of the ID population. Although outcomes have varied, yoga has been demonstrated to be effective in improving muscle fitness in those without ID. Studies on toddlers and teenagers with ID have shown improvements in leg strength and hand grip (Hawkins et al., 2012; Sun et al., 2022). Inconsistencies in findings could come from variations in methods of measuring related to ID. The effects noted in this study might be related to neuromuscular changes made possible by isometric contraction yoga postures, which improve the connections between the muscles and nerves (Folletto et al., 2016). Childhood is a critical time for neuromuscular development, and bodyweight exercise maximises muscular fitness throughout this phase (Mohanty et al., 2016).

When it comes to flexibility, people with ID usually score poorly (Serwacki & Cook-Cottone, 2012). In line with other earlier studies, our study did find that practicing yoga training increased flexibility. Yoga's combination of static and dynamic stretching exercises could extend the limbs' elastic connective tissue, improving range of motion (Gothe & McAuley, 2015; Reina et al., 2020). These positive findings highlight the potential benefits of adapted yoga training for people with ID in terms of increasing flexibility and muscle strength and endurance.

Students with ID have been shown to have motor weaknesses, balance problems, and unstable posture. Several studies have highlighted balance as a crucial aspect of motor fitness and have documented the positive benefits of exercise treatments on people with ID's ability to walk and stand balanced (Azar et al., 2023). Notably, a recent meta-analysis revealed a significant beneficial impact after yogic intervention meant to improve balance in children and adolescents with ID (Jylänki et al., 2022). Furthermore, a growing body of research indicates that yoga improves this component of motor fitness in people with ID (Reina et al., 2020).

In a comparable manner, our research on students with ID showed significant improvements in static balance after receiving adapted yoga instruction. On the other hand, after a creative yoga intervention, a research found no difference in balance, which it attributed to differences in the yoga programme and the balance subtest performed (Jeter et al., 2014). Adapted yoga has been shown to improve balance by stimulating the proprioceptive, vestibular, and visual systems, all of which support sensory integration (Kaur et al., 2021). Additionally, better posture control and balance are probably influenced by the enhanced muscle fitness that comes with yoga. Attention-focused yoga poses have the potential to improve postural control (Kaur & Bhat, 2019). Ultimately, students with ID benefit from adapted yoga training as an effective intervention for improving their balance, which may also improve their motor fitness and general physical well-being.

Conclusions

This study highlights the potential of adapted yoga programs as an intervention for improving physical functioning in students with mild intellectual disability. These findings suggest that adapted yoga can be a valuable and accessible intervention to enhance physical functioning in this population.

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Conflict of interest

There are no conflicts of interest, the authors assure.

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Визначення впливу адаптованого тренування з йоги на фізичне функціонування учнів з порушенням інтелектуального розвитку помірного ступеня

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів

Реферат. Стаття: 8 с., 4 табл., 47 джерел.

Історія питання. Особи з порушенням інтелектуального розвитку (ПІР) помірного ступеня часто зазнають труднощів у фізичному функціонуванні, що впливає на їхнє загальне самопочуття та якість життя. Традиційні програми фізичних вправ не завжди можуть бути доступним або ефективним засобом для цієї категорії осіб через різні обмеження. Адаптовані програми з занять йогою розглядаються як перспективна альтернатива, що пропонує індивідуальні інтервенції, спрямовані на забезпечення особливих потреб осіб з порушенням інтелектуального розвитку.

Мета дослідження. Метою дослідження було подолання вказаної проблеми шляхом вивчення впливу структурованої, модифікованої програми з йоги на фактори, пов'язані з фізичним функціонуванням.

Матеріали та методи. Загалом було відібрано 40 учнів з порушеннями інтелектуального розвитку помірного ступеня у віці від 11 до 15 років із спеціальних шкіл у місті Коїмбатор, штат Таміл-Наду. Дослідження проводилося за квазі-експериментальною схемою. Учасники дослідження були розділені на експериментальну групу, яка проходила 8-тижневу адаптовану програму з занять йогою, і контрольну групу, яка дотримувалася звичайного режиму занять. Параметри фізичної функції оцінювали шляхом проведення стандартизованих тестів, що вимірюють кардіореспіраторну витривалість, м'язову силу та витривалість, гнучкість, композицію тіла та рівновагу. Адаптована програма з йоги, яку проводили кваліфіковані інструктори, складалася з 8 тижнів занять по 5 днів на тиждень, кожне з яких тривало від 45 до 60 хвилин. За допомогою статистичних методів аналізу було підтверджено нормальний розподіл даних і застосовано t-критерії парних вибірок для оцінки відмінностей до і після проведення дослідження з використанням програмного забезпечення SPSS версії 20.0 із встановленим рівнем значущості 0,05.

Результати. Після 8 тижнів проходження адаптованих тренувань з йоги спостерігалось значне покращення показників сили верхньої частини тіла ($p < 0,04$), нижньої частини тіла ($p < 0,001$), зміцнення м'язів кору ($p < 0,002$), гнучкості

($p < 0,001$) та статичної рівноваги ($p < 0,00$). Однак не було зафіксовано достовірної різниці у показниках вмісту жиру в організмі та кардіореспіраторної витривалості між адаптованими тренуваннями з йоги.

Висновки. У цьому дослідженні висвітлено потенціал адаптованих програм занять з йоги як інтервенції для покращення фізичного функціонування учнів з ППР помірною ступеня. Отримані результати вказують на важливість та доступність впровадження занять з адаптованої йоги з метою поліпшення фізичного функціонування даної категорії осіб.

Ключові слова: порушення інтелектуального розвитку, адаптована йога, фізичне функціонування, м'язова сила, витривалість.

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