ORIGINAL ARTICLE

Effect of brain GYM exercises on balance in preschool children: a randomized controlled trail

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Abstract

Objectives: To investigate the effect of Brain Gym exercise on preschool children's balance achievement.

Method: The randomised controlled trial was conducted at EL-Moasis kindergarten from May to September 2021, and comprised preschool children of either gender aged 4-6 years who were randomised into intervention group A which received Brain Gym exercise for 15-30 minutes per day, three times a week, for eight consecutive weeks, and control group B which received the usual kindergarten activities. Balance was assessed by One Leg Standing Test and Functional Reach Test. Data was analysed using SPSS 20.

Results: Of the 30 subjects, 15(50%) were in each of the 2 groups. There were 13(43.3%) boys and 17(56.7%) girls with overall mean age 4.99±0.67 years. However, the study completed had 27(90%) subjects. Overall, there were 26(%) right-handed subjects. Post-intervention, there was significant intra-group improvements ($p<0.05$), but there were no significant inter-group differences ($p>0.05$).

Conclusion: No significant benefits were seen in the balance of preschool children exposed to Brain Gym exercise.

RCT registration: The RCT was registered retrospectively at The Pan African Clinical Trials Registry (PACTR) (Trial #: PACTR202208886771106 Date of Approval: 15/08/2022). Link: https://pactr.samrc.ac.za/Search.aspx

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Introduction

The quality of the sociochemical environment influences children's motor, cognitive, and socioemotional development, and, therefore, consideration must be given to each child's needs and interests in order to enrich children's abilities.[1]

The term Brain Gym (BG) typically refers to a specific set of movements and processes that aim at improving concentration, focus, memory and physical coordination. This intervention requires the participants to perform a variety of motions in order to help the body recall earlier stage actions and synchronise the hands, eyes, ears and the rest of the body.[2,3]

BG integrates the left and right sides of the brain, removing learning difficulties, emotional strain and psychological stress, and allowing people to improve their learning experiences. There are three major categories of BG exercises; midline movements, energy exercises, and lengthening activities. Midline movements concentrate on two-sided (left-right) movement across the body's midline. Energy exercises serve to re-establish neuronal connections between the body and the brain. Lengthening activities help to express and process information in the brain.[2,3]

Body balance is about keeping the centre of gravity within the base of support established by the feet, and it can be static when the person is in a static position, or dynamic when the person is moving.[4] Obtaining and maintaining equilibrium during anti-gravitational tasks serves as a foundation for carrying out other secondary tasks. These are utilised to propel ourselves across space or to control our surroundings. Normal activities of daily living (ADLs), such as walking, running and stair climbing, necessitate dynamic body equilibrium.[5] The ability to maintain certain posture is referred to as the static balance of the human body.[6]

The physical ability of typical children may be negatively affected by many improper surrounding environments. As such, sedentary behaviour and poor levels of physical exercise are believed to contribute to the obesity pandemic among preschool children.[7] When compared to healthy-weight children, overweight children performed worse in gross motor abilities (coordination and fitness), manual dexterity, and intelligence quotient (IQ).[8] In addition, the persistence of the coronavirus disease-2019 (COVID-19) pandemic led to professional recommendations that prevented preschool children from playing with their friends as they did before the lockdowns.[9] Healthcare

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providers should reinforce guidelines for home and school enrichment.[10] Children who are at risk of experiencing developmental delays may benefit from early intervention or educational facilities. Early childhood care professionals should advise the concerned parents on the proper type and degree of stimulation based on their child's age.[11]

There have been a few empirical studies related to BG, with most of them showing that BG has a positive influence on children, but most such studies were not controlled trials.[12] Randomised controlled trials (RCTs) balances participant characteristics, both observable and unobserved, enabling any variations in result to be attributed to the research intervention. This is not achievable with any other type of research.[13] The current RCT was planned to investigate the effect of BG exercises on balance in preschool children.

Subjects and Methods

The randomised controlled trial was conducted at EL-Moasis kindergarten in Kafrelsheikh, Egypt from May to September 2021. The study was approved ethics review board of the Faculty of Physical Therapy at Cairo University, Egypt, the sample size was calculated using G-Power software[14] based on earlier findings[15] for a bi-directional alpha of 0.05 and statistical power 90%. To account for possible dropouts, the sample was inflated by 20%.

The sample was raised from among preschool children in Kafrelsheikh, Egypt, focussing on children who were a source of discomfort to their parents and teachers due to their inclination to move uncoordinatedly during free play and frequently clashed with objects.

In simple random sampling technique, The children were examined by using the Paediatric Balance Scale (PBS)[16] to exclude children who could complete all the PBS items. This was followed by a brief interview with each caregiver to collect socio-demographic data, such as child's age, education level and child's handedness, to exclude those with any neuropsychiatric diagnosis. Also excluded were those with visual or hearing impairment, those taking any type of medicines because that may cause confusion or make the child less aware, and those doing regular physical activity at home.

The final sample comprised preschool children of either gender aged 4-6 years with PBS score 31-53 who were physically normal and, as per parents' report, developing normally, and had the ability to understand the assessor's instructions.

After taking written informed consent form all the parents, the subjects were randomised into intervention group A and control group B. Each enrolled child was assigned an identity number. Sealed envelopes were used to randomly allocate a subject to one of the two groups.

Group A received BG exercise for 15-30 minutes per day, three times a week, for eight consecutive weeks in addition to the traditional educational and physical kindergarten activities, while group B received just the usual kindergarten activities that included a 30-minute session of simple exercises in the morning and another 30-minute session in the physical education class.

BG movements were chosen to represent one movement activity from each category: midline movement (cross crawl, lazy 8, neck rolls, belly breathing); lengthening activities (the owl, arm activation); and energy exercises (brain buttons, energy yawn) as well as deepening attitude (hook up).[2,3]

The movement activity continued until the subject stopped moving, requested to stop, or 30 seconds had passed. The 30s marker was chosen as it is the shortest period advised for BG activities[2,3]. The BG sessions were held in a confined room away from other children's eyes, trying to ensure that the population was blinded. The researchers also visited all the children in group B and give them candy and chocolate at the end of each session.

Dynamic balance was assessed using the Functional Reach Test (FRT), which is a valid, useful and consistent measure of dynamic balance in children. It is the greatest distance a human can stretch forward from a standing position without losing balance, taking a step, or collapsing onto the floor or along the sidewall. Each child was given three attempts. The data for each kid was derived from the average of the three attempts.[17]

Static standing was assessed by One-Leg Standing (OLS) test, in which assessments are made with both eyes open (EO) and eyes closed (EC). The subjects were barefoot and stood 2 feet away from any wall, with hands on their hips. They were told to raise one foot. The experiment was repeated for the EO and EC conditions. On each foot, subjects were assessed twice. On each foot and under each situation, the best performance was recorded. The timing of OLS test in typically developing children aged 4-9 years has shown to have moderate to high interrater and test-retest reliability.[18]

Data was analysed using SPSS 20. Data was expressed, as appropriate, through mean and standard deviation (SD), median and interquartile range (IQR), or frequencies and percentages. Kolmogorov-Smirnov test was used to examine numerical data for normal assumption. Sample t-test for independent variables comparing normally distributed data, and Mann Whitney U test for independent

variables comparing not-normal data were used for inter-group comparisons. For intra-group comparisons, paired t test was used for normally distributed data and Wilcoxon signed rank test for paired (matched) samples when data was not normally distributed. When comparing categorical data, chi-square test was used. When the anticipated frequency was <5, exact test was applied, instead. Two-tailed p<0.05 was considered statistically significant.

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Results

Of the 96 children screened, 30(31.25%) were enrolled; 15(50%) in each of the 2 groups (Figure).

There were 13(43.3%) boys and 17(56.7%) girls with overall mean age 4.99±0.67 years. However, the study was completed by 27(90%) subjects. Age, gender, handedness or PBS scores were not significantly different between the groups (Table 1).

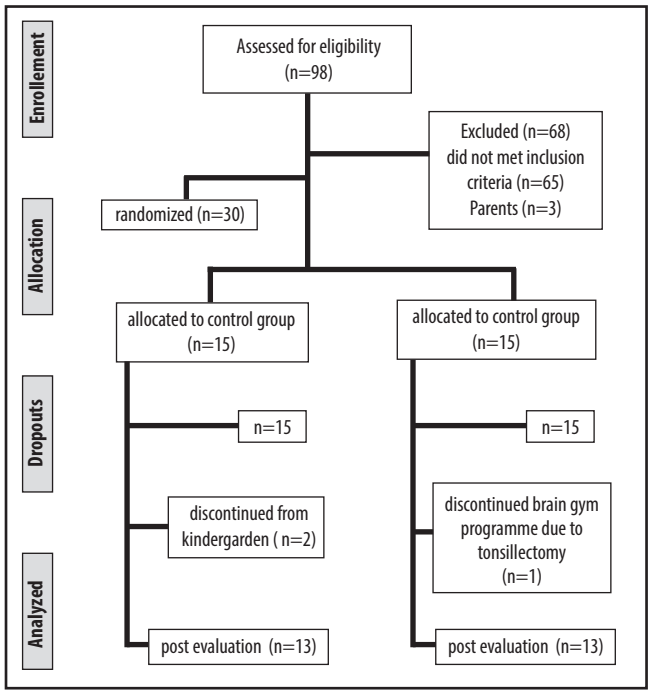

Figure: Study flow chart.

Post-intervention, there was significant intra-group improvements (p<0.05), but there was no significant inter-group difference (p>0.05) (Table 2).

Table-1: Demographic characteristics

	Controls	Intervention	total	P value
Allocated number	15	15	30	
Mean Age\years:	4.95±.62	5.03±.74	4.99(.67)	0.742
Gender male \female	7/8	6\9	13\17	0.713
Mean PBS	52±1.604	51.87±1.922	51.93±1.741	0.838
Handedness RT: LF	12:3	14:1	RT=86.7%	0.598

PBS: Paediatric balance scale, RT: Right, LT: Left.

Table-2: Intra-group and inter-group comparisons of balance improvement.

		control group	experimental group	Mean (Std) Difference	95% CI of the Difference		*p-value*
					Upper	Lower	
EC left	pre	2.38±1.261	2.57±1.089	0.333 ±0.412	1.188	0.521	0.431
	post	3.08±1.44	3.79 ±1.47)	0.709 ±0.562	1.867	0.449	0.219
	Mean (Std) Difference	0.692±0.480	1.214±0.699				
	p value	0.001 *	0.001 *				
EC Right	pre	3.38± 2.022	3.64±1.781	0.400 ±0.676	1.785	0.985	0.559
	post	3.77±1.92	4.71±2.12	0.945±0.782	2.556	0.666	0.238
	Mean (Std) Difference	0.385±0.506	1.071±0.616				
	p value	0.018 *	0.001 *				
EO Left	pre	7.08±2.753	6.86±3.739	0.000 ±1.151	2.357	2.357	1.000
	post	8.08±2.66	8.86±3.80	0.780 ±1.272	3.400	1.839	0.545
	Mean (Std) Difference	1.000±0.577	2.000±1.240	p value	0.001 *	0.001 *	
EO Right	pre	7.88±3.166	8.32±4.168	0.100 ±1.331	2.827	2.627	0.941
	post	10.15±3.21	11.29±4.08	1.132±1.422	4.060	1.796	0.433
	Mean (Std) Difference	1.385±0.650	2.964±1.599				
	p value	0.001 *	0.001*				
FRT	pre	8.73±1.666)	7.93 ±1.774	0.800±0.615	0.460	2.060	0.204
	post	9.27±1.81)	9.00±1.95	0.269 ±0.726	1.226	1.764	0.714
	Mean (Std) Difference	0.538±0.380	1.071±0.514				
	p value	0.001 *	0.001 *				

EC: Eyes closed, EO: Eyes opened, FRT: Functional reach test.

Discussion

According to the current study's findings, when compared to the baseline evaluation, there was a significant improvement in children's balance when exposed to BG exercise. However, when compared to the control group exposed to traditional physical and educational kindergarten activities, there were no significant differences. This is in contrast to earlier studies that recommended BG exercise for pre-school children because it improved abilities in children by increasing blood flow and oxygen to the brain.[19,20] The contradictory findings were perhaps due to different BG exercises and different populations, as one study[20] assessed the effect of BG in young rhythmic gymnasts. Also, children in the current study were attending regular physical education classes in kindergartens as well, which may affect balance positively. BG, however, is better because, among other things, it aligns capabilities and thinking at the same time.[21] If children are trained or stimulated in a boring manner, they will quickly become bored and will frequently ignore the educators.[22] By giving brain exercise on a regular basis in a non-boring manner, one may provide stimulation to the brain, improving the child's motor development.[21] Several studies on BG have been conducted in preschool and school-aged children. A study compared the effectiveness of BG in child-parent relationship therapy and discovered that BG was effective in reducing mental emotional problems in school-aged children.[23] Diana et al.[11] demonstrated that BG application was associated with an increase in appropriate fine motor development in 63.30% subjects, and a reduction in 10% in a quasi-experimental study.

Our bodies maintain equilibrium through a variety of mechanisms. The hip and ankle strategies are two of the most common ones. Our bodies employ the hip strategy when the support surface translates or when the disturbance to balance is greater. The ankle strategy is typically used to account for rotational or smaller disturbances. Only in simpler movements can a clear distinction be drawn between these two. As the difficulty of balance increases, two strategies appear to act in tandem, compensating for different sorts of disturbances or allowing the performance of increasingly demanding skills.[24] Reviews of studies suggest that children may derive improvement from physical activity participation.[25]

BG routines include 26 types of progressive activities that include three fitness characteristics: focus, centring and laterality. All BG activities can help to accelerate learning and integrate all of the areas involved.[12] BG practice improves the ability to coordinate both sides of the brain with each other, particularly in the visual, auditory and kinaesthetic domains. BG helps to balance stress associated with certain memories, situations, people, locations and abilities. When people are in stressful circumstances, it awakens the reflex to respond without thinking by neurologically re-patterning both academic and behavioural performance.[3] But a study[26] demonstrated that educators need to implement practices that have been validated by empirical research and not waste valuable time participating in BG as there is no quality empirical evidence supporting BG.

Parents, caregivers and teachers seek facilities and methods to help children improve their physical abilities. BG provides benefits in terms of logic, creativity and motor abilities.[11] The current study found no additional benefits of BG compared to traditional physical education activities in kindergartens, but there are perhaps other cognitive or psychological benefits that need other studies to explore.

Conclusion

BG exercises were found to have no beneficial effects on balance abilities when added to traditional kindergarten physical activity sessions. However, there was a significant effect when compared with baseline evaluation.

Limitations: The current study has limitations as it did not compare the effect of BG with lack of traditional physical activity as well. It would have been better to have an additional group in the study. Also, the study could not find a link between the number of BG sessions and the size effect on balancing performance. This will help in determining the best BG programme.

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Conflict of Interest: None.

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