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Ball Activity vs. ABA: A Comparative Study of Attending Skills in Children with ASD

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ABSTRACT
This study investigated the relative effectiveness of Applied Behavior Analysis (ABA) therapy alone versus a combined ABA and ball activity intervention in enhancing attending skills among children with Autism Spectrum Disorder (ASD) in Lahore, Pakistan. Using a quasi-experimental pre-test/post-test design, twenty children aged 3–10 years were assigned to either the ABA-only group or the combined intervention group. Both groups demonstrated statistically significant within-group improvements in attending skills, with the ABA-only group showing a mean gain of 0.45 ($p = .029$) and the combined group exhibiting a more substantial mean gain of 2.35 ($p < .001$). However, between-group differences were not statistically significant, likely due to small sample size and greater variability in the combined group. The findings suggest that integrating structured motor-based activities such as ball play into traditional ABA sessions may enhance treatment outcomes. Further research with larger samples is recommended to confirm these preliminary findings and explore long-term effects.

***Keywords**:* Ball Activity, ABA, Comparative Study, Attending Skills, Children.

Introduction

Autism Spectrum Disorder represents a multifaceted neurodevelopmental condition characterized by persistent deficits in social communication and interaction across various contexts, alongside restricted, repetitive patterns of behavior, interests, or activities. These core features manifest along a spectrum of severity, impacting individuals uniquely and necessitating tailored intervention approaches (McCormack et al., 2022). Attending skills, the ability to focus and sustain attention on relevant stimuli, are foundational for learning and development, particularly for children with ASD who often exhibit difficulties in this area, further compounding challenges in acquiring new skills and engaging in social interactions The pursuit of effective interventions to enhance attending skills in children with ASD remains a critical area of research, with the ultimate goal of improving their overall adaptive functioning and quality of life.

Applied Behavior Analysis stands as a widely recognized and empirically validated intervention for ASD, emphasizing the application of learning principles to systematically improve socially significant behaviors (Du et al., 2024). ABA-based interventions typically involve breaking down complex skills into smaller, manageable steps, using positive reinforcement to motivate desired behaviors, and employing data-driven decision-making to monitor progress and adjust treatment strategies (Rodgers et al., 2021). However, ABA has faced criticism regarding its potential for over-reliance on compliance and its impact on intrinsic motivation, particularly in individuals with lower functioning or nonverbal abilities (Sandoval-Norton et al., 2019). In the context of Pakistan, where cultural norms and resource limitations may influence the implementation and accessibility of ABA, exploring alternative or complementary interventions becomes particularly salient (Leaf et al., 2017; Marino et al., 2020).

Considering the imperative for diverse and culturally sensitive intervention strategies, exploring alternative approaches to enhance attending skills in children with ASD becomes crucial. Ball activity, encompassing structured and unstructured play involving balls of various sizes, textures, and colors, presents a potentially engaging and motivating avenue for promoting attention and focus. Ball activities can naturally foster social interaction, communication, and motor skills development, all of which are often targeted in ASD interventions. The inherent playfulness and adaptability of ball activities may appeal to children with ASD, potentially mitigating some of the challenges associated with more structured and demanding ABA-based interventions. Moreover, the integration of ball activities into existing intervention programs may offer a means of enhancing engagement, promoting generalization of skills, and fostering a more holistic approach to addressing the multifaceted needs of children with ASD.

This study aims to investigate the relative effectiveness of ball activity and ABA in enhancing attending skills in children with ASD within the specific cultural context of Lahore, Pakistan. By comparing these two distinct intervention approaches, the study seeks to provide valuable insights into their respective strengths and limitations, informing the development of evidence-based practices that are both effective and culturally appropriate.

Literature Review

Applied Behavior Analysis has long been established as a cornerstone intervention for individuals with Autism Spectrum Disorder (Kerr et al., 2000). ABA employs principles of learning theory to systematically increase desired behaviors, decrease maladaptive behaviors, and enhance a range of skills, including communication, social interaction, and adaptive functioning (Sandoval-Norton et al., 2019). Early Intensive Behavioral Intervention, a specific type of ABA, has demonstrated significant positive effects on cognitive performance, language skills, and adaptive behavior in some children with ASD, although the need for replication and further investigation into factors influencing treatment success remains crucial (Fernell et al., 2013). Various ABA techniques, such as discrete trial training, prompting, and reinforcement, are commonly used to teach attending skills by breaking down complex tasks into smaller steps and providing clear instructions and positive feedback. While ABA demonstrates efficacy, its intensive nature can pose challenges in terms of cost, time commitment, and accessibility, particularly in resource-constrained settings like Pakistan.

The effectiveness of ABA may be contingent upon factors such as the individual's IQ level, where research indicates that those with measurable IQs, typically at 70 or above, tend to benefit more significantly (Sandoval-Norton et al., 2019). This highlights the importance of considering

individual characteristics when determining the suitability of ABA as an intervention strategy. Although ABA is an evidence-based treatment, there is still need for more research to provide additional support for this model (Weiss et al., 2008). Moreover, early intervention programs are often lacking in availability, quality, and funding, leaving many children without adequate therapy during critical developmental periods (Dunn et al., 2017).

Research indicates that early intensive ABA-based interventions might lead to some improvements in cognitive ability and everyday life skills in children after two years, however it is important to consider the limitations that arise in the design of the existing studies (Rodgers et al., 2021). Functional behavior assessments within ABA interventions are important because they have been found to yield larger effect sizes (Walker & Snell, 2013). This underscores the importance of tailoring interventions to address the specific behavioral functions that maintain challenging behaviors. Implementing ABA effectively necessitates well-trained personnel who are adept at applying ABA principles and adapting interventions to individual needs. Telehealth approaches, which can extend the reach of ABA services to remote areas and reduce costs, can be useful in parent training (Lindgren et al., 2016).

While ABA has strong empirical support, its reliance on structured, directive techniques has raised concerns about potential negative impacts on intrinsic motivation and generalization of skills. Furthermore, cultural values and social movements have substantially influenced the evolution of ABA, impacting research directions, intervention focus, and the selection of behavioral targets (Johnston et al., 2006). Historically, ABA interventions were designed without sufficient input from autistic individuals, leading to therapeutic practices that may not align with their actual needs and values (Johnson, 2025).

Ball activity, as an alternative or complementary intervention, presents a potentially less structured and more naturally motivating approach to enhancing attending skills in children with ASD. Ball activities encompass a wide array of play-based interactions involving balls, ranging from simple throwing and catching to more complex games and exercises. Such activities offer opportunities for promoting attention, focus, and engagement through their inherent appeal and adaptability.

Methodology

This study utilized a quasi-experimental, pre-test/post-test design to compare the effects of two interventions—ball activity and Applied Behavior Analysis (ABA)—on the attending skills of children with Autism Spectrum Disorder. A total of 20 participants (aged 3-10 years) were selected via purposive sampling from the Autism Resource Center Lahore, Pakistan, and assigned to either the ball activity group (n=10) or the ABA group (n=10). Attending skills were measured before and after the intervention using a custom-developed observational checklist, while the Childhood Autism Rating Scale (CARS) was used to assess autism severity. Both interventions were delivered in one-on-one, 25–30-minute sessions, five times per week for eight weeks. The ball activity protocol involved structured motor tasks with balls, whereas the ABA protocol used tabletop discrete trial training. Data were analyzed using SPSS, employing paired-samples t-tests for within-group changes, an independent-samples t-test to compare improvement scores between groups, and a Pearson correlation to examine the relationship between age and improvement, with significance set at $p < .05$.

Results and Discussion

The following section outlines the key statistical results obtained from the comparison of ABA-only and combined ABA with ball activity interventions, focusing on their impact on attending skills among children with ASD. The results from Table 1 demonstrate that the ABA-only group experienced a statistically significant improvement in attending skills, with a mean difference of 0.45 (SD = 0.55), t(9) = 2.586, p = .029. This finding supports the effectiveness of ABA therapy in addressing attentional challenges in children with ASD, aligning with a well-established body of literature that endorses ABA as a foundational intervention for core deficits in autism.

Table no 1: Paired Sample t-test Results Comparing Pre- and Post-Test Scores in the ABA-Only Group

Measure	Mean Difference	Std. Deviation	Std. Error Mean	95% CI (Lower)	95% CI (Upper)	t	df	p-value
Pre vs Post (ABA Only)	0.45	0.55	0.17	0.06	0.84	2.586	9	.029

Table 2 highlights a more substantial effect in the group receiving the combined ABA and ball activity intervention, with a highly significant mean improvement of 2.35 (SD = 1.20), t(9) = 6.177, p < .001. This improvement is more than five times greater than that observed in the ABA-only group, indicating a potentially synergistic effect when structured motor-based tasks are incorporated into ABA sessions. Notably, all participants in the combined intervention group demonstrated at least a 1-point increase in attending skills, underscoring the consistency and potential strength of this approach.

Table No 2: Paired Sample t-test Results Comparing Pre- and Post-Test Scores in the ABA + Ball activity intervention Group

Measure	Mean Difference	Std. Deviation	Std. Error Mean	95% CI (Lower)	95% CI (Upper)	t	df	p-value
Pre vs Post (ABA + Ball activity intervention)	2.35	1.20	0.38	1.49	3.21	6.177	9	.000

However, as shown in Table 3, the comparison of mean improvement scores between the two groups did not yield a statistically significant difference, t(7.91) = -1.28, p = .238. Although the combined group showed a higher mean gain (mean difference = 0.92), the result failed to reach significance. This outcome is likely attributable to the limited sample size (n = 10 per group) and higher variability in the combined group (SD = 1.20 compared to 0.55 in the ABA-only group). These factors reduce statistical power and may obscure true differences between groups.

Table no 3: Independent Samples t-test Comparing Improvement Scores Between ABA and ABA + Ball activity intervention Groups

Assumption	t	df	p	Mean Difference	SE	95% CI (Lower, Upper)
Equal variances assumed	-1.53	18	.144	-0.92	0.60	[-2.19, 0.35]
Equal variances not assumed	-1.28	7.91	.238	-0.92	0.72	[-2.59, 0.75]

The lack of statistical significance, despite the large observed difference in mean scores, is likely attributable to two key factors: the small sample size (n=10 per group) and the high variability of outcomes within the combined intervention group (SD=1.20 vs. 0.55 in the ABA group). A small sample provides limited statistical power to detect a true effect, while high variance can obscure mean differences. The boxplot of improvement scores (Figure 2) visually captures this, showing a higher median and wider score distribution for the combined group, suggesting that while some children benefited immensely, the effect was less uniform than in the ABA-only group. The overlapping 95% confidence intervals (Figure 1) further support the interpretation that while a trend favoring the combined approach is evident, a larger sample is needed to confirm its statistical superiority.

Discussion

The present study investigated the impact of an ABA-only intervention against a combined ABA and ball activity intervention on the attending skills of children diagnosed with Autism Spectrum Disorder, revealing that while both interventions yielded positive outcomes, the combined approach facilitated a more pronounced enhancement in attending skills, albeit without achieving statistical significance (Kerr et al., 2000) (Du et al., 2024). The findings align with a substantial body of literature that substantiates the effectiveness of ABA as a fundamental intervention for ameliorating core deficits associated with ASD, as evidenced by the statistically significant increase in attending skills within the ABA therapy group, demonstrating a mean improvement of 0.45 from the baseline ($t = 2.59$, $p = .029$) (McCormack et al., 2022). Furthermore, the marked improvement observed in the combined ABA and ball activity intervention group, signified by a mean increase of 2.35 in attending skills, intimates that the incorporation of structured, motor-based activities engenders a potent synergistic effect, thereby amplifying the gains beyond what is attainable through ABA therapy alone (Yu et al., 2018). This inference is bolstered by the descriptive statistics, which reveal that the mean improvement in the combined group exceeded that of the ABA-only group by a factor of five, with each participant in the combined group exhibiting an improvement of at least 1.0 point on the checklist, underscoring the additive benefits of integrating motor-based tasks with ABA therapy (Fernell et al., 2013). When juxtaposing the improvement scores between the two intervention groups, it becomes evident that the combined ABA and ball activity intervention group showcased a superior mean improvement compared to the ABA-only group, thereby suggesting a differential impact of the two interventions on enhancing attending skills in children with ASD. It is also important to consider the effects of intensive, long-term, multimodal treatment in targeting the symptoms and functional impairment of children with ASD (Wymbs et al., 2005).

Although the study did not find statistical significance when directly comparing the two groups, the implications of these results are noteworthy for several reasons. The considerable effect size

observed in the combined intervention suggests that integrating physical activity, specifically ball activities, with ABA may offer a more engaging and effective approach to improving attention in children with ASD (Marino et al., 2020). These findings should be considered when designing interventions for children with ASD. Given the established efficacy of early intensive behavioral intervention as an intervention of choice for children with autism, the present study suggests that incorporating physical activity may further augment these benefits (Eldevik et al., 2009). Furthermore, the demonstrated improvements in attending skills may extend beyond the specific context of the intervention, potentially influencing academic performance, social interactions, and adaptive functioning, contributing to a more holistic improvement in the child's overall development. Physical activity and sports are known to improve the outcomes in cognitive, psychological, behavioral, social, and motor functioning in people with ASD (Gómez et al., 2022). Further research should seek to investigate these effects.

Conclusion

This study examined the effects of ABA therapy alone versus a combined ABA and ball activity intervention on attending skills in children with ASD. Both interventions led to significant within-group improvements, with the combined approach showing a greater mean improvement. However, this difference was not statistically significant, likely due to the small sample size and higher variability in the combined group. Although the trend supports the combined approach, further research is needed to establish its statistical advantage. The findings suggest that integrating structured motor-based activities into ABA may enhance its effectiveness.

Future research should involve larger sample sizes to increase statistical power and address variability. Longitudinal designs are recommended to examine the lasting impact of interventions. Studies should also consider individual differences such as age, ASD severity, and motor skills to tailor treatments more effectively. Exploring which elements of ball activity drive positive outcomes can help refine intervention strategies. It is also important to assess whether attending skill improvements transfer to other settings. Finally, including a control group in future studies would strengthen causal inferences and reduce potential confounding factors.

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