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Dance Movement-Based Intervention Reduces Stereotypical Behavior in Children with Autism Spectrum Disorder

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Abstract: Autistic individuals are commonly characterized by stereotypical behaviors, which affect their daily life, particularly social aspects. The study aimed to assess the effectiveness of dance movement-based intervention in reducing stereotypical behavior among autistic children. The study used an experimental-based approach, which recruited 30 autistic children purposively between 9 and 15 years old, diagnosed with autism spectrum disorder- level 1 (ASD [1]) or autism spectrum disorder- level 2 (ASD [2]) from one autism center in Jordan. The intervention sessions were fifteen sessions and lasted 60 minutes. The dance movement and music were selected cautiously by professional therapists. The observation was the study tool for collecting data performed by both author and care providers. The results approved the effectiveness of the suggested intervention in reducing stereotypical behavior. The children presenting ASD (1) showed significantly less stereotypical behavior than those presenting ASD (2). The result also showed that the difference was significant and obvious from the first three sessions, but the best reduction was in the fourth session. However, the results refuted any difference in reduction of stereotypical behavior attributed to gender or age group of participants.

Keywords: *Autism, dance movements, physical exercises, stereotypical behavior.*

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Introduction

Stereotypical behavior is one of the most common characteristics of individuals presenting with autism spectrum disorder (ASD) (Bremer et al., 2016). Stereotypic behavior is exhibiting a narrower range of interests or activities (Polak et al., 2019). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), stereotypic behavior is a range of purposeless and repetitive motor actions (e.g., hand flapping or hitting) that are commonly predominant and prevalent among neurodevelopmental disorders such as ASD (The American Psychiatric Association [APA], 2013). These purposeless rituals and monotonous routine actions negatively impact children's daily life and induce major difficulties in learning and adaptation (Patriquin et al., 2017; Uljarevic et al., 2020). Furthermore, individuals presenting stereotypic behavior experience affiliate stigma, social isolation, and public rejecting attitudes and are more likely to be bullied (Lu et al., 2021). Many efforts consequently evoke the various types of treatment and early interventions to reduce by frequency or nature of these meaningless repetitive behaviors among these children (Bremer et al., 2016). In this study, stereotypical behavior is defined as negative monotonous, repetitive actions that children presented with ASD exhibits, such as verbal expressions and physical movements.

The manual (DSM-5) classified ASD into three main levels based on ASD severity. The current study considers only the first two-level of categorization. The mild, severe level is level 1, entitled 'requiring support,' where children in this level present social communication deficits, including initiating social interactions and showing decreased interest in social interactions, and they present rituals and repetitive behaviors that interrupt their functioning. We will use ASD (1) across the paper to indicate level 1 ASD. The moderate-severe level is level 2, entitled "requiring substantial support, we will use ASD (2) to indicate level 2 ASD across the paper. Children diagnosed with ASD (2) present deficits in verbal and nonverbal social communication skills, and rituals and repetitive behaviors frequently appear to be obvious and interfere with functioning in all contexts (APA, 2013). In this study, we only consider these two-level since level 3 requires individualized arranged sessions rather than group-based sessions, as the current study was, attributed

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to their severe symptoms. However, improving physical performance and managing inappropriate and disruptive behaviors such as stereotypical behaviors exhibited by individuals presenting ASD involve extensive efforts and time to work with these conditions, particularly those presenting a severe and profound level of development disabilities (Bachman & Sluyter, 1988; Patriquin et al., 2017). Accordingly, it is crucial to develop and implement various techniques related to behavioral intervention in a context such as the physical activities-based intervention of the substantial increment of autistic individuals, particularly children (Fauziyah et al., 2019; Polak et al., 2019). According to a recent statistical report by World Health Organization (WHO), the estimated prevalence of autism among children is 1/160 as an average global figure (2019). However, recent reports cited higher rates (Chiarotti and Venerosi (2020). This huge increment of ASD numbers in the whole world increases the relevance of the practical contribution of this study to assess this large population of individuals presenting developmental disorders.

Moreover, the study contributes to increasing the attendance and inclusion rates of children presenting ASD in the physical education classes since those children have a rare and low attendance pace in physical education sessions due to various reasons related to children themselves or the coach of physical training (Hassani et al., 2020; Simpson et al., 2019). A second contribution of the study is providing an evidence-based treatment that is convenient for the financial status of autistic children's families, particularly in the earlier stage of diagnosis, since financial resources or intervention costs with lack of public-funded services are defined as one of the main burdens to include children within intervention programs (Bremer et al., 2016). Furthermore, in Jordan, there is a lack of presenting and carrying out investigation studies on the effectiveness of physical activities-based intervention for autistic children so far. This study contributes to enriching the local empirical evidence of physical activities-based treatment in Jordan.

Literature Review

Stereotypic behavior, as aforementioned, is one of the main features of autistic individuals, including a wide range of behaviors. There are two common classifications of this behavior across literature; 1) lower-order stereotypic behavior and higher-order stereotypic behavior, and 2) repetitive sensory-motor (RSM) behaviors and repetitive hand mannerisms and insistence on sameness (IS) behaviors (Joyce et al., 2017). Autistic children exhibit poor coordination between fine and gross skills (gross skills include big muscles, fine skills involve small muscles) and difficulties in balance, flexibility, and speed (Hassani et al., 2020). Hence, various previous therapies suggested physical activities-based interventions to reduce such types of behaviors and develop coordination skills of autistic children (Bremer et al., 2016).

Emerging clinical, psychological, and educational research suggests physical activity treatments for typically developing individuals to benefit their mental, physical, and psychological health (Gregora et al., 2018). For instance, participation in physical activities brings different benefits and advantages for children presenting with ASD, namely, developing routine and schedules, regulating motor movements, enhancing self-efficacy, increasing muscles strengths, enhancing overall fitness, developing mental health, and reducing anxiety, and social barriers (Bremer et al., 2016; Gregora et al., 2018; Howells et al., 2020; Yu et al., 2018). This study selects dance movements since they are easy to incorporate various physical activities within it, despite the chance to incorporate music and rhythm within the intervention. The tendencies of therapies are toward dance and movement therapy due to the manifested benefits to social and communication skills of autistic children (Morrison et al., 2021). A systematic review manifested that dance movement therapy is efficient in increasing body awareness and contributes to adjusting the behavior of normal to high-functioning ASD (DeJesus et al., 2020). In this study, we are only interested in the benefits of dance movements-based intervention to reduce stereotypic behavior since most research studies focused on communication and social skills and some psychological health aspects of autistic individuals. There is inadequate evidence in reducing stereotypic behavior because exploring intervention effectiveness is rarely done (Mishra & Chaube, 2020).

Meta-analysis research involved 22 articles from 124 retrieved articles on physical activities-based intervention (such as horseback, swimming, yoga, dance, and running) for autistic individuals and found that yoga and dance movements significantly reduced the behavioral symptom of sixteen autistic children aged between 5 to 12 years old (Bremer et al., 2016). The same study declared that only one out of 22 articles examined the dance movement intervention. Another case study reported the effectiveness in 5 autistic cases engaged in a dance movements training program consisting of 15 sessions. These results emphasized the effectiveness of training programs in reducing repetitive behaviors (Mishra & Chaube, 2020).

An old study examined aerobic dance movements for the reduction of stereotypical behaviors. It manifested that inappropriate repetitive behavior of two developmentally disabled adults (first was female aged 53 years old and the second was male aged 23 years old) was reduced as a result of the dance movement, with no significant difference between both attributed to their gender or age (Bachman & Sluyter, 1988). Also, Lakes et al. (2019) asserted no difference in children's responses to a movement and music-based intervention, which significantly reduced stereotypical behaviors by 8%.

Hence, there is an incentive to increase autistic participation in physical activities. The present study implements a dance moving-based intervention that incorporates components of aerobic activities, basic movement skills, speed,

balance, agility, fitness, and motivation development to benefit stereotypic behavior reduction among these children, particularly the younger age group.

The current study investigates whether the dance movement-based intervention can reduce stereotyped behavior of children presenting ASD. However, the literature review of dance movement does not address age and gender variables in the effectiveness of dance movement treatment for children with ASD. Thus, the study addresses these variables for investigation. Accordingly, the study attempts to answer the following questions:

- Does the dance movement bring positive change in the stereotypical behavior of children diagnosed with ASD?
- Is there any reduction of the stereotypical behaviors of children with ASD during the session's intervention?
- Did children with ASD (1) exhibit the highest reduction than those with ASD (2)?
- Is there a statistically significant difference in the intervention outcomes according to gender and age?
- After how many sessions does the stereotypical behavior enhancement substantially adhere?
- Are there statistically significant differences in the stereotypical behaviors in the follow-up measurements according to continuous practice?

Methodology

Research Design

The study used an experimental-based approach with one group design consisting of three measurement phases. The baseline measurement was conducted a month before the intervention, in which participants were observed during normal classroom routine; the author registered and observed baseline data. In the second phase, the intervention was conducted. The author and care providers were responsible for collecting data during the intervention and the post-intervention measurement. The last phase was the follow-up phase, in which care providers reported the follow-up data during the month post-intervention. They also reported if the participant was engaged in similar dance movement training or classrooms during the follow-up observation.

Sample and Data Collection

According to the mental and psychological reports, children and adolescents aged between 11 to 21 years old are more likely to develop new skills and movement patterns (Gregora et al., 2018). Furthermore, Bremer et al. (2016) disclosed a gap in research conducted on early childhood and adolescents aged 12-16. Hence, the study targets autistic children aged between 8 to 15 years old with an average age of 11. The participants were selected purposively from one large autism center in Amman according to children's educational and medical profiles obtained from the educational center. The author obtained authorized consent from the central administration and children's families to access their children's profiles. The selection basis was the mental and psychological eligibility of children to participate in the session and the diagnostic level of autism according to DSM-5 levels. Only ASD (1) and ASD (2) were recruited for participation. Children presenting ASD (3) were excluded from interventions since they require individualized arranged sessions rather than group-based sessions attributed to their severe symptoms. Thirty autistic children were selected for the treatment.

The majority of participants were presenting ASD (1) (N=18), and only 12 participants were presenting ASD (2). Moreover, the highest participation rate favored autistic male children (N=18).

Intervention

A well-known and trained physical therapist implemented and coached the participation with a cooperative inclusion from the author and care providers. Care providers were involved in both observing, regulating, and facilitating children's participation. The main purpose of the inclusion of care providers in the trial was to reduce the weird feeling of participants and to train the care providers to evaluate, observe, and record participants' stereotypic behavior since they gauge the frequent stereotypic behavior among participants in the follow-up readings after the one-month post the end of the last session.

The intervention activities were held and performed in the center's gymnasium hall, which is approximately 7x9 meters and is well equipped for conducting activities and observations. The hall is equipped with mainly six sensory cameras. The author used camera recordings to trace and register participants' stereotypic behaviors.

Music and rhythm in the intervention sessions were selected cautiously as per recommendations of occupational and psychological therapists visiting the autism center. Furthermore, the author presented this music to care providers of all autistic children participating in the trial to ensure convenience for them. Examples of music and rhythm used in sessions were: buckle my shoe, do your ears hang low, Bingo, and like. Moreover, the duration of each session was also

determined according to therapists' recommendations (N=7); the average session duration according to their recommendation was 55.6 minutes. The intervention session's duration was 60 minutes.

Each session incorporated five main arrangements; opening, check-in, body warm-up, dance movement with music, and closing. Each session includes various dance and movement activities such as shuffle dance, mimic dance, jumping dance, slow and fast dance, break dance, mirroring, synchronization dance, rhythm dance, head nodding, rocking body, and like. Each session included only ten autistic children with the attendance of their care providers during the session, especially those who are center-based accommodation. Accordingly, participants were divided into three main groups. Each group had certain intervention days. The total number of sessions was fifteen. The participants were divided into three groups to facilitate session conducting. There was no certain theoretical or practical basis for participants' division. It was randomly divided and assigned to each group. All groups had similar frequency, content, and duration of sessions.

Assessment tool

Observation is the main assessment tool in the study. Observation aims to count the occurrence of stereotypical behavior of each participant during the session. The author and care providers recorded any stereotypical behaviors exhibited by participants, including repetitive movement unrelated to dance movements and off-task behavior such as loss of attention or disruption. Vocalization monotonous behaviors were not counted since it is difficult to recognize each participant's verbal expressions from the recording sessions.

All care providers were trained and consensus on the criteria and techniques of counting stereotypic behaviors. Care providers' training was conducted in one session 3 hours duration before the beginning of the intervention. The agreement of observation recorders of stereotypical behavior between author and care providers during the training session was above 80%. The author and care providers gauged and registered observation of stereotypical behavior from camera recordings for each session at its end. Care providers provided daily basis reading of stereotypical behavior of each participant during the month post-intervention.

Findings / Results

1. Does the dance movement bring positive change in the stereotypical behavior of children diagnosed with ASD?

Table 1. Paired Sample t-test

Source	Mean	N	Std. Deviation	Mean differences	t	Df	Sig.
Pre	98.93	30	14.03	21.30	11.010	29	0.00*
Post	77.63	30	8.28				

*: significant at level of (0.05)

The study used Paired Sample t-test to show if the dance movement brought a positive change in stereotypical behavior of children diagnosed with ASD between pre and post measurements. The standard deviation of (14.03) and the Mean value for the children post-intervention was (77.63) with the standard deviation of (8.28) with the mean difference (21.30) in enhancement.

Is there any reduction of the stereotypical behaviors of children with ASD during session intervention?

The result of this question contains three steps; step one is a comparison between the pre-test and post-test, then step two is a comparison between post-test and follow-up1, while step three is a comparison between follow-up one and follow-up two as follows:

Table 2. Paired Sample t-test for the Three Steps

Steps	Source	Mean	N	Std. Deviation	Mean differences	t	Df	Sig.
Step one	Pre	98.93	30	14.03	21.30	11.010	29	0.00*
	Post	77.63	30	8.28				
Step two	Post	77.63	30	8.28	-5.23	-5.631	29	0.00*
	During intervention	82.87	30	7.46				
Step Three	During intervention	82.87	30	7.46	5.43	4.422	29	0.00*
	Follow-up	77.43	30	9.04				

*: significant at level of (0.05)

The results showed statistically significant differences between the pre and post-measurement, and the result confirmed good enhancement in the stereotypical behaviors of children with ASD. The mean of pre-measurement was (98.93) with the standard deviation of (14.03) and the mean value of post-measurement was (77.63) with the standard

deviation of (8.28), with the mean difference of (21.30) reduction. The (t) value = (11.010) and it is significant at level of (0.05).

The results also showed statistically significant differences between the post-measurement and after the first three sessions. However, the result had risen for ASD children with stereotypical behaviors. The mean of post-measurement was (77.63) with std. deviation of (8.28) and the mean behavior after the first three sessions were (82.87) with the standard deviation of (7.46), with the mean difference of (-5.23) decreased (t) value = (-5.631).

Finally, the results showed statistically significant differences between the first three sessions and follow-up measurement, and the result confirmed good enhancement in the stereotypical behaviors of children with ASD. The mean of behavior during the intervention was (82.87) with the standard deviation of (7.46) and the mean value of follow-up post the one-month measurement was (77.43) with std. deviation of (9.04), with mean difference = (5.43) reduction. The t value = (4.422) and it is significant at level of (0.05).

Did children with ASD (1) exhibit the highest reduction than those with ASD (2)?

The study used Independent Sample T-test to show the statistically significant differences in the level of stereotypical behaviors between the children with ASD level (1) and level (2), as shown in Table (3)

Table 3. Independent Sample t-test

	Level	N	Mean	Std. Deviation	t-value	Df	Sig.
Stereotypical behaviors (Post)	Level (1)	18	74.28	7.16	-3.096	28	0.004*
	Level (2)	12	82.67	7.44			

*: Significant at level of 0.05

The result showed statistically significant differences in the level of stereotypical behaviors among children with ASD according to the level. The mean value of the level (1) was (74.28) with the standard deviation of (7.16), and the mean value of the level (2) was (82.67) with the standard deviation of (7.44). (t) value was (-3.096), and it is more than (t) tabulated = (1.96) with the significant level at (0.05), which indicates the variance was in favor of level (1), as shown in Figure (1) above.

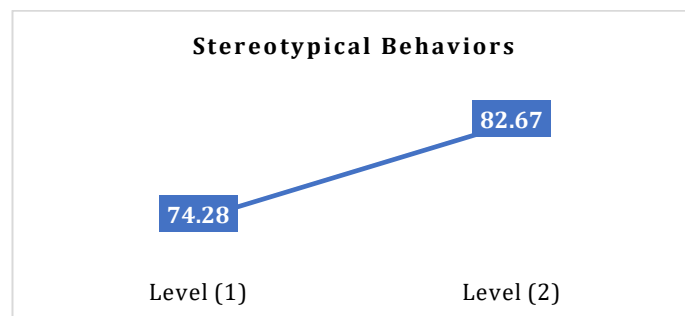


Figure 1. Stereotypical Behavior Readings between Children with ASD (1) and ASD (2)

Is there a statistically significant difference in the intervention outcomes according to gender and age?

To answer this question, the study used mean, std. deviation and two-way ANOVA test to show the statistically significant differences in the result of intervention according to the gender and age as following tests:

Table 4. Descriptive Analysis

Dependent Variable: Post measurement				
gender	age	Mean	Std. Deviation	N
male	8-11 year	77.08	8.52	12
	12- above	78.50	10.50	6
	Total	77.56	8.94	18
female	8-11 year	76.67	7.55	6
	12- above	78.83	8.11	6
	Total	77.75	7.56	12
Total	8-11 year	76.94	7.99	18
	12- above	78.67	8.95	12
	Total	77.63	8.28	30

The results of Table 4 showed apparent differences in the means values of the intervention level on the post-test (Final) related to the enhancement of stereotypical behaviors among a sample of children with autism spectrum disorder ASD according to gender and age. To identify the significance of the differences, two-way ANOVA was used, as shown in Table 5. The results in Table (5) showed no statistically significant differences in the level of reduction of stereotypical behavior during the post (final) intervention according to gender and age. (F) values were (0.001, 0.290), and it is not significant at a level of (0.05). The variance was found between mean values, but it was not significant.

Table 5. Two Way ANOVA Test

Dependent Variable: Post					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
gender	.063	1	.063	.001	.977
age	21.147	1	21.147	.290	.594
Error	1965.548	27	72.798		
Total	182795.000	30			
Corrected Total	1986.967	29			

After how many sessions does the stereotypical behavior enhancement substantially adhere?

To answer this question, the study used the descriptive analysis to show the main session, which substantially affected the stereotypical behavior enhancement. The descriptive analysis showed that the pre-measurement for stereotypical behavior recorded a mean value of (98.93) when the minimum value was (75.00) and the maximum value was (135.00) among children with autism spectrum disorder ASD. After that, the intervention sessions started; the mean value during the first three sessions was (95.23) and the minimum value was (75.00) to a maximum of (120.00). Then, the mean value during the second three sessions was (91.33). The minimum value began to enhance with (73.00), and the maximum value also began to enhance with (118.00). The result showed good enhancement, and the mean value during the third three sessions was (86.30) with a minimum value of (70.00) to (100.00) as a range. In the fourth three sessions, the mean value was (82.37), and the values ranged between (65.00 – 95.00). Finally, the average of the fourth three sessions was (88.81), less than the pre-measurement value = (of 98.93). This indicates that the intervention was effective and confirms that the study used paired sample t-test, as shown in Table (6).

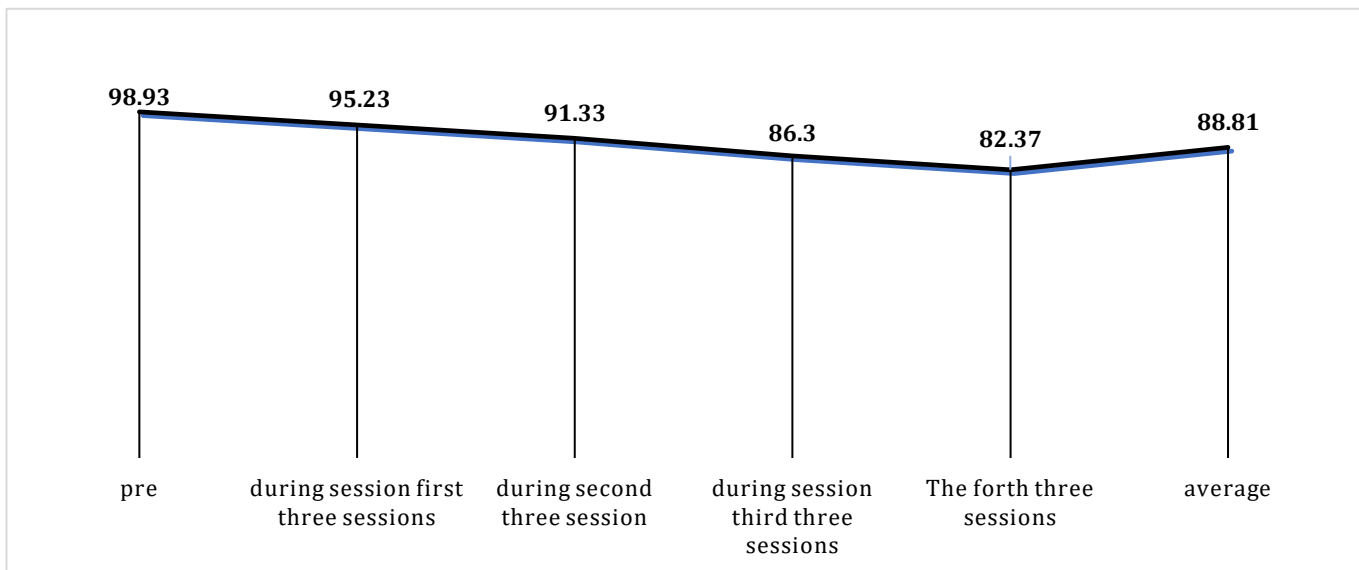


Figure 2. Stereotypical Behavior Readings during Intervention Sessions

From the above-mentioned figure, the reduction started from the first session, and the best reduction was in the fourth three sessions.

Table 6. Paired Sample t-test

Source	Mean	N	Std. Deviation	Mean differences	t	Df	Sig.
Pre	98.93	30.00	14.03	10.125	8.138	29	0.00*
average	88.81	30.00	8.66				

*: significant at level of (0.05)

The results showed statistically significant differences between the pre-test and the average value for the four sessions. The mean value for the pre-test was (98.93), the average value was (88.81), (t) value = (8.138), and it was more than (t) tabulated = (1.96), which is significant at a level of (0.05). This explains that the intervention was effective in enhancing stereotypical behaviors among children with autism spectrum disorder ASD.

According to continuous practicing, is there a statistically significant difference in the stereotypical behaviors in the follow-up group?

The study used Independent Sample T-test to show the statistically significant differences in the level of stereotypical behaviors according to the continuing practice, as shown in the Table (7)

Table 7. Independent Sample t-test

	Continuing practicing	N	Mean	Std. Deviation	t-value	Df	Sig.
Stereotypical Behaviours follow up	Yes	25	76.00	8.81	-2.045	28	0.050
	No	5	84.60	7.09			

*: Significant at level of 0.05

The result showed statistically significant differences in stereotypical behaviors among children with ASD according to continuous practice. The mean value for the children with ASD who continued practicing was (76.00) with std. deviation of (8.81), and the mean value for the children with ASD who did not continue practicing was (84.60) with std. deviation of (7.09). (t) value was (-2.045), which is more than (t) tabulated = (1.96), and it is significant at a level of (0.05) which indicates that the variance was in favor of the children with ASD who continued practicing.

Discussion

The results revealed that dance-based movement is effective in reducing stereotypic behavior presented by autistic children and the continuous practicing of dance movement is also effective in sustaining the reduction of stereotypical behaviors. The reduction referred to dance movements since they help autistic children be aware of their bodies and self-sensing (DeJesus et al., 2020). As explained by (Bremer et al., 2016; Gregora et al., 2018; Howells et al., 2020; Yu et al., 2018), engagement in physical activities brings different benefits and advantages for children presenting with ASD, namely, developing routine and schedules, regulate motor movements, enhance self-efficacy, increase muscles strengths, enhance overall fitness, developmental health, reduce anxiety, and social barriers. Furthermore, dance exercises can activate the new growth of brain cells and facilitate training (Mishra & Chaube, 2020). These results coincide with previous research results such as (Bachman & Sluyter, 1988; Bremer et al., 2016; Gregora et al., 2018; Howells et al., 2020; Lakes et al., 2019; Yu et al., 2018).

The results approved that children presenting ASD (1) respond to intervention more efficiently and sustainably than those presenting ASD (2). The severity level of stereotypical behavior among ASD (2) is more severe than those among ASD (1) according to DSM-5 (APA, 2013), which explains the response differences between both groups. Meanwhile, previous research does not consider the severity level of ASD into account differences. The study also revealed no differences between participants' responses to intervention due to their age or gender. This agrees with the results reported by Mishra and Chaube (2020), Lakes et al. (2019), and Bachman and Sluyter (1988).

The reduction of stereotypic behavior significantly appeared during the fourth three sessions, which establishes that any intervention design less than twelve sessions cannot effectively manifest the benefits of intervention. However, more research and studies are required to validate this issue.

Conclusion

The study aimed to assess the effectiveness of dance movement-based intervention in reducing stereotypical behavior among autistic children. The study used an experimental-based approach that recruited 30 autistic children between 9 and 15 years purposively diagnosed with ASD (1) or ASD (2) from one autism center in Jordan. The results approved the effectiveness of the suggested intervention in reducing stereotypical behavior. The children presenting ASD (1) showed significantly less stereotypical behavior than those presenting ASD (2). The result also presented that difference was significant and obvious from the first three sessions, but the best reduction was in the fourth three sessions. However, the results refuted any difference in reduction of stereotypical behavior attributed to gender or age group of participants. The study provided additional empirical evidence on the effectiveness of the dance movement and music as an intervention program to reduce stereotypical behavior. Also, the results of the current study could be used to increase awareness and social involvement by using dancing movements and music. However, the current results support the differences in the effectiveness of the program due to the severity level of ASD.

Recommendations

Apart from the strength and contribution of this study, this study recruited participants from a unique autism center in Jordan and was limited to the (9 to 15) age group. Accordingly, further studies are encouraged to cover more and wider age groups from different target centers to report more nuanced comprehension of dance movement-based interventions and factors mediating the effectiveness of the intervention.

Future research is also recommended to survey participants' attitudes and perceptions toward the intervention and care providers. Moreover, this study did not examine intervention effectiveness between stereotypical behavior categories. Thus, it is required to further distinguish between different stereotypical behavior categories. Another measurement aspect can be conducted in such interventions related to the social and communication skill development of autistic participants.

Limitations

The current study was limited to a specific age range, particularly the (9 to 15) age group. Thus, it did not cover more and wider age groups from different target centers, which limited the comprehension of dance movement-based interventions and factors mediating the effectiveness of the intervention. Also, the study did not report participants' attitudes and perceptions toward the intervention and care providers. The study also tackles stereotypical behaviors in general without addressing the stereotypical behavior categories.

Authorship Contribution Statement

Ziadat: Writing. Alramamneh: Editing/reviewing, supervision. AL-Sabaylehr: Concept and design, data acquisition, data analysis/interpretation, technical or material support, supervision, final approval.

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