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Motor and Social Responses of Down Syndrome Children in Adaptive Tennis Training

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ABSTRACT (9 pt)

This study aims to explore the involvement of children with Down Syndrome in adaptive tennis training sessions through a descriptive qualitative approach. The method used is direct participatory observation during the training program for two weeks, with a frequency of twice a week. The subjects of the study consisted of children aged 6 to 14 years. Data were collected through structured observation sheets, field notes, video documentation, and light interviews with coaches and parents. The focus of observation was directed at two main aspects, namely motor aspects (coordination, balance, strength, agility, and response to instructions) and social aspects (interaction with coaches and peers, emotional expression, and participation in groups). The observation instrument was developed based on motor development literature such as Life Span Motor Development (Haywood, 2014) and Understanding Motor Development (Gallahue, 2012), with an assessment scale. The results of the study indicate that adaptive tennis training can facilitate the improvement of gross motor skills and social abilities of children with Down Syndrome. This study recommends the use of a similar model in adaptive tennis training activities in clubs, schools and communities.

INTRODUCTION

Children with Down Syndrome tend to experience obstacles in motor development and social interaction (Oktafiolita et al., 2024). Muscle hypotonia, delayed coordination, and difficulty in following instructions often become challenges in physical learning (Alsakhawi & Elshafey, 2019). Therefore, an inclusive and tailored sports approach is needed to suit the characteristics of the child (Lopes Schabbach, 2024). Adaptive tennis is one form of sport that has potential because it combines basic movements, hand-eye coordination, and social interaction. Unfortunately, academic studies that directly observe the effects of adaptive tennis on children with Down Syndrome are still very limited (Shahzad, 2023). This study aims to provide empirical evidence through a direct observation approach to motor and social changes during training. Motor development in children with Down Syndrome is influenced by different neuromuscular structures, causing delays in basic movements (Malak et al., 2015).

Tennis as one of the adaptive sports has great potential in supporting the motor, cognitive, and social aspects of children with Down Syndrome. Activities in tennis games such as hand-eye coordination, balance, and basic movements of walking, running, and hitting the ball can stimulate the development of children's fine and gross motor skills. In addition, learning tennis also trains concentration, the ability to follow instructions, and builds self-confidence and social interaction through fun and structured activities. Adaptive sports have been shown to improve the fitness and social interaction of children with special needs (Alsakhawi & Elshafey, 2019). Adaptive tennis can be modified with slow balls, light rackets, and visual instructions to increase children's participation (Alesi & Pepi, 2017).

More than just a physical activity, tennis can be a holistic learning medium for children with Down Syndrome. (Alesi & Pepi, 2017). Through an inclusive and play-based pedagogical approach, children not only gain the benefits of physical fitness, but also learning experiences that build character, discipline, and independence (Bran Girón et al., 2022). Thus, it is important for educational institutions, sports coaches, and parents to understand and develop a planned and sustainable adaptive tennis program as part of educational and rehabilitative interventions for children with Down Syndrome (Kumar & Sharma, 2024).

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In this context, there is a need for a specific approach in motor and social training that is tailored to the abilities, learning rhythms, and communication styles of children with Down Syndrome (J. Ayesha & Chetan, 2024). This approach requires flexible, patient methods, and is supported by a safe and supportive environment, so that children can develop optimally without stress or risk of injury (Shevchenko, 2022). Without this adjustment, the physical training and social learning provided have the potential to be less effective (Rodríguez-Grande et al., 2022).

However, until now there is still very little direct observation-based research exploring the application of adaptive tennis in the context of education and training for children with Down Syndrome in Indonesia (Vandoni et al., 2023a). The limitations of literature and field documentation are obstacles in developing programs that are truly contextual, effective, and applicable (Çimen & Alp, 2024). Therefore, an in-depth empirical study is needed through an observational approach to produce recommendations for best practices in adaptive tennis training that are appropriate to the needs of children with Down Syndrome in the country (Vandoni et al., 2023b).

Based on this urgency, this study aims to observe and describe the motor responses of Down Syndrome children when participating in adaptive tennis learning, as a basis for understanding the extent to which physical activity can support the development of their motor skills. In addition, this study will also identify social interactions that arise during training sessions, in order to assess the social impact of children's involvement in an inclusive sports learning environment. The results of this observation are expected to provide recommendations for pedagogical approaches based on observation findings, so that adaptive tennis training can be designed more effectively, contextually, and responsive to the special needs of children with Down Syndrome.

RESEARCH METHOD

This study used a descriptive qualitative approach with direct participant observation methods to obtain a real picture of the involvement of children with Down Syndrome in adaptive tennis training sessions. The subjects of the study consisted of children aged 8 to 14 years who routinely participate in adaptive tennis training. Data were collected through observation sheets, field notes, video documentation, and light interviews with coaches and parents to strengthen observational findings. The focus of observation is divided into two main aspects, namely motoric and social aspects. In the motoric aspect, researchers observed the child's coordination, balance, strength, agility, and response to the coach's instructions. Meanwhile, in the social aspect, what was observed included the child's interaction with the coach and peers, the emotional expressions displayed, and their participation in group activities. This approach is expected to provide a holistic picture of the effectiveness of adaptive tennis learning for children with Down Syndrome.

The main instrument in this study was a structured observation sheet developed based on gross and social motor development indicators, with reference to scientific literature such as Life Span Motor Development. (Haywood, 2014) and Understanding Motor Development by (Gallahue, 2012). This observation sheet is designed to assess three main aspects, namely: (1) Gross Motor, which includes activities such as running, jumping, and hitting a ball; (2) Response to Instructions, namely the child's ability to understand and follow the coach's commands; and (3) Social Interaction, which includes greeting behavior, working together with peers, and the ability to wait for one's turn. Each indicator in the observation sheet is assessed using a four-level scale (0–3), with the following details: a score of 0 means that the activity is not done at all, a score of 1 means that the child can do the activity with full assistance, a score of 2 means that the child can do activity with partial assistance, and a score of 3 indicates that the activity is done independently. Examples of indicators observed include: "Able to hit the ball with a racket" for the motor aspect, "Following the coach's commands" for the instruction aspect, and "Waiting for one's turn to play" for the social aspect. This instrument is designed to capture responses that arise naturally during training sessions, in order to support the accuracy and validity of field data.

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Program duration is two weeks, with frequency twice per week. Session structure includes warm-up, basic tennis movement exercises, games, and cooling down. Observations were conducted by two observers using structured observation sheets.

RESULTS AND DISCUSSION

Table 1. Indicator Statistics

Aspect	Indicator	Average	Minimum	Maximum	SD
Gross motor skills	Able to run smoothly	1.54	1	2	0.52
	Able to hold the racket and ball smoothly	1	1	1	0
	Able to hit the ball smoothly	1	1	1	0
Instructions	Follow the coach's orders	1.45	1	2	0.52
	Understanding verbal instructions	1	1	1	0
	Understanding visual instructions	1.54	1	2	0.52
Social interaction	Greeting a coach or a friend	0	0	0	0
	Collaborating with peers	0	0	0	0
	Waiting for their turn to play	1	1	1	0
	Exchanging opinions with friends	0	0	0	0

There are three main indicators in the gross motor aspects, namely ability to run, hold the racket and the ball, and hit the ball. The results show that the indicator of "able to run smoothly" has an average score of 1.54 (SD = 0.52), with a minimum value of 1 and a maximum of 2. This shows that most children can run with partial assistance, and some are even able to do it more independently.

The three indicators observed in this aspect are the ability to follow the trainer's commands, understand verbal instructions, and understand visual instructions. The highest average score was achieved in the indicator "understanding visual instructions" with a score of 1.54 (SD = 0.52), followed by "following the trainer's commands" with a score of 1.45 (SD = 0.52). In contrast, "understanding verbal instructions" only obtained an average score of 1.00 with a standard deviation of 0, which means that all children need full assistance in understanding verbal commands.

Social interaction was the aspect with the lowest achievement in this study. Four of the five indicators (greeting, cooperating, exchanging opinions, and waiting for turn) showed an average score of 0, meaning that none of child showed these behaviors during the training session. Only the indicator "waiting for turn to play" recorded an average score of 1.00, indicating that children were able to wait for their turn with full assistance.

Table 2. Rubric Assessment Results

Respondents	Aspect			Total score	Average score
	Gross motor skills	Instructions	Social interaction		
MS	3	4	1	8	0.8
MJ	4	4	1	9	0.9
RA	3	4	1	8	0.8

KN	4	4	1	9	0.9
DM	4	4	1	9	0.9
A.J.	4	4	1	9	0.9
MK	3	4	1	8	0.8
AR	3	4	1	8	0.8
A-Z	4	4	1	9	0.9
BR	3	4	1	8	0.8
RAA	4	4	1	9	0.9

Most of children obtained score 3 or 4 from this aspect, indicating that although not yet fully independent, children have been able to perform gross motor activities such as running, holding a racket, and hitting a ball with partial assistance. A total of 5 children (MJ, KN, DM, AJ, AZ, RAA) received a maximum score of 4, meaning they showed higher development in motor skills than other respondents.

All respondents obtained score 4 in this aspect, indicating that all children were consistently able to follow and understand instructions, even in the context of partial assistance or in the form of visual instructions. This result confirms previous findings that providing visual instructions is more effective for children with Down Syndrome than verbal instructions.

All respondents gained score 1 on the social interaction aspect. This shows that the social activities that emerge were very minimal; limited to the behavior of waiting for turns to play, and even it was still done with assistance. There was not social behaviour of greeting, working together, or talking to peers emerged spontaneously. This is an important note that interventions on the social aspect need to be designed more intensive and specific.

Table 3. Frequency of Individual Scores

Aspect	Indicator	Score 0	Score 1	Score 2	Score 3
Gross motor skills	Able to run smoothly	0	5	6	0
	Able to hold the racket and ball smoothly	0	11	0	0
	Able to hit the ball smoothly	0	11	0	0
Instructions	Follow the coach's orders	0	6	5	0
	Understanding verbal instructions	0	11	0	0
	Understanding visual instructions	0	5	6	0
Social interaction	Greeting a coach or a friend	11	0	0	0
	Collaborating with peers	11	0	0	0
	Waiting for their turn to play	0	11	0	0
	Exchanging opinions with friends	11	0	0	0

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1. Gross Motor Aspects
   - ✓ Able to walk smoothly: 5 children obtained score 1 (with full assistance), and 6 children scored 2 (with partial assistance). There was no child completely independent (score 3) or completely unable (score 0). Interpretation: The ability to walk shows sufficient development, but still needs assistance. This is an early good indicator of basic motor development.
   - ✓ Able to hold the racket and the ball smoothly & able to hit the ball smoothly:
     All 11 children scored 1, indicating that they were only able to do it with full assistance. None were able to do it independently or even with partial assistance. Interpretation: Manipulative skills are still very low, indicating the need for repeated practice and adapted aids (such as light rackets and soft balls).

2. Instruction Aspect
   - ✓ Follow order of trainer: 6 children scored 1 (with full assistance), while 5 children scored 2 (partial assistance). Interpretation: Children are starting to be able to follow instructions, although they still need assistance. The distribution of scores 1 and 2 indicates variations in the ability to understand instructions.
   - ✓ Understanding verbal instructions: All children scored 1. There was no child could understand independently or partially. Interpretation: Children with Down Syndrome have difficulty in understanding verbal instructions, so the learning approach cannot rely solely on verbal communication.
   - ✓ Understanding visual instructions: 5 children scored 1 and 6 children scored 2. Interpretation: Children are more responsive to visual stimuli, which reinforce the importance of using pictures, demonstrations, and gestures in learning.

3. Social Interaction Aspects
   - ✓ Greeting trainer/friend, working together, and exchanging ideas: All children scored 0, meaning that there was not social behaviour emerged spontaneously in this aspect.
   - ✓ Interpretation: Social interaction is the most lagging aspect. This may be due to communication barriers, discomfort in social interaction, or lack of previous social experience.
   - ✓ Waiting for turn to play: All children scored 1, meaning they were able to wait their turn with full assistance. Interpretation: This is the only form of social interaction that emerged, although it was not yet done independently. Waiting for a turn can be a first step in building self-control and more complex social interactions.

However, the ability to "hold the racket and the ball" and "hit the ball" both have the same mean score, which is 1.00 with a standard deviation of 0. This indicates that all children perform these activities with full assistance and there is not variation in ability between individuals. This finding reflects the presence of significant obstacles in manipulative skills, which are likely influenced by muscle hypotonia and lack of hand-eye coordination that are common in children with Down Syndrome.
These findings suggest that children with Down Syndrome are more responsive to visual stimuli than verbal, so a learning approach based on demonstrations, pictures, and visual instructions will be more effective in helping them understand and follow activities.
The low score on this social aspect reflects that the social skills of children with Down Syndrome, especially in the context of interaction with coaches and peers, are still very limited. This can be caused by delays in the development of social communication and their lack of experience in group social situations. Therefore, a pedagogical approach is needed that explicitly trains social interaction in a safe, fun, and structured atmosphere.
Based on these statistical results, there are several important implications that can be used as a reference in designing further adaptive training programs:

1. Focus on strengthening manipulative motor skills. Given that holding and hitting abilities are still very limited, training programs need to emphasize basic manipulative activities such as throwing, catching, and dribbling the ball using simple props and lightweight materials (e.g., foam balls and small rackets).
2. Optimize the use of visual instructions. High scores on the "understanding visual instructions" indicator confirm that the demonstrative approach and the use of visual aids (such as pictures, instruction boards, and gestures) should be a major part of the teaching method.
3. Integrate social training gradually. Social interaction needs to be built through cooperative play that requires cooperation, turn-taking, and simple communication. Strategies such as playing in pairs, greeting before and after practice, and role-playing can slowly build a child's confidence and social competence.
4. Use an individual and responsive approach. Because of the high variation in abilities in motor skills and understanding of instructions, coaches need to apply a differentiated approach to training, and give each child enough time to develop at their own pace.

CONCLUSION

Learning tennis adaptive influences positively to motor and social development of Down Syndrome children. This program can be integrated into an inclusive physical education curriculum. Direct observation is an important approach in assessing the effectiveness of adaptive sports interventions. Overall, the results of the study showed that adaptive tennis learning has a positive impact, especially in the development of motor aspects and visual understanding of children with Down Syndrome. However, social interaction is still a major challenge that requires more specific and sustainable interventions. Therefore, the training program sport tennis adaptive does not only need to be focused on physical activity alone, but also be designed as a contextual, fun, and inclusive social learning platform.

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