Physiotherapy and Physical Rehabilitation Journal
Volume 2 Issue 2 Year 2023 Pages 25-34
E–ISSN 2830–7151
Web https://ojs.stikestelogorejo.ac.id/

Effectiveness of Neurodevelopmental Treatment to Improve Motor Function in Children with Developmental Disorders: Meta-Analysis

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Abstract
Background: Growth delay in children is one of the most common disorders in children. It is influenced by delays in gross motor and fine motor development. The prevalence of delayed development is estimated at 5-10 per cent of the world's child population and most children with delayed development have weaknesses in all stages of their abilities.The aim in providing treatment is to improve gross and fine motor muscle function which is one of the important roles in one until two child development.
Material and Methods: This was a systematic review and meta-analysis. The data was obtained though journal screened by Science Direct database, PubMed database, and Google Schoolar database with selecting articles published in 2013-2023. The keywords used were ("Neurodevelopmental Treatment") AND ("Child" OR "Children") AND trunk exercise, AND "Randomized controlled Trial". Articles were colled by using PRISMA flow diagrams and analyzed using the revman 5.3 application.
Result : Meta-analysis of 3 articles showed that NDT can increase motor function in children with developmental disorders by 0.49 times higher compared to other interventions or no intervention (SMD = 0.49; 95% CI = -0.88 to -0.10; p = 0.01).
Conclusion: Neurodevelopmental Therapy - Trunk Intervenion Improved GMFM-B and Trunk Control Scores. Therefore, Neurodevelopmental Therapy - Exercise can be applied as an arm focus for children with developmental delays who have difficulty controlling their arms.

Keywords: *Neurodevelopment, Trunk Exercise, Pediatric, Delay Development*

INTRODUCTION

Problems related to developmental delays are common in children, especially if children do not receive proper nutrition and vitamins to prevent developmental delays in children. Children go through two processes including growth and development. These processes have different purposes and roles in the process experienced by children growth is more dominant in children's height. Meanwhile, development is related to cognitive, motor and social development (Labaf et al., 2015).

Based on the results of Riskesdas (2018), it can be seen that among the 82,661 children under the age of five recommended in the country, the obesity rate is 19.6%, which includes 5, 7% malnutrition and 13.9% under nutrition. In Indonesia, 18 provinces have malnutrition problem more than 21.2% - 33.1%, including NTB, North Sumatra and Jambi (Inggriani et al., 2019). Based on WHO data in 2018 shows that growth problems are not only in malnutrition, but also the lack and excess of nutrients obtained for children can cause growth and development problems. The

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prevalence of malnourished toddlers was 7.3%, overweight was 5.9% and stunted toddlers were 21.9% (WHO, 2019).

Growing Child improvement effects from the interplay manner of heredity with environmental elements on the prenatal or post-natal stage. Prenatal or post-natal stage. Growth and improvement co-occur. Human boom and improvement are characterized and decided with the aid of using the manner we extrade in size, form and adulthood relative to the passage of time. adulthood relative to the passage of time (Soetjiningsih, 2013).

The achievement of optimal child development depends on a person's biological potential as a result of the interaction between genetic factors and the biophysical-psychosocial environment (biological, physical, and psychosocial). The unique process and different outcomes characterise each child (Enny Fitriahadi, 2020).

The existence of developmental delays in children can be caused by several things, one of which is the motor function that must be passed during the growth and development of children. motor functions in children are divided into two, namely gross motor and fine motor (Mardeyanti et al., 2021). Some of the causes of delayed fine motor development in children include genetics, nutrition, prenatal health conditions, stimulation, family environment, beliefs, and culture (Pamungkas et al., 2021).

Trunk control is important for child development as it provides stability and movement of the head and extremities. Better trunk control allows you to achieve a higher level of development. Good trunk control allows constant movement of the head and hands, so the child can easily grasp the toy and hold it firmly. Constant head movement creates constant eye movement, which improves eye development and perception, allowing for a wider range of play activities (Park et al., 2023).

Some of these stages overlap with the next stage and there is a large variety, in terms of timing and acquisition, between different children. A child with developmental delay will greatly benefit from neurodevelopmental therapy (NDT) to assist with stimulating them to help achieve the missing milestones. The brain is continually changing and can develop and adapt greatly with stimulation (Zanon et al., 2018). Neurodevelopmental therapy works on the principle that the brain can be moulded and infantile brains responds quickly, therefore the sooner a child with delay begins to receive appropriate stimulation the better (Arndt et al., 2008).

Neurodevelopmental therapy helps the child to reach their gross motor milestones but can also monitor if problems with the feeding, communication, sensory or fine motor systems arise later and refer where needed. Treatment is always family orientated and family members or significant others are very integral to goal setting, sessions and carry over to home activities (Lee et al., 2017).

The provision of neurodevelopment treatment and trunk control exercise has the aim of improving functional motor in children with developmental disorders. this exercise focuses on training gross motor and fine motor in children and training children's postural control using trunk control

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exercise. giving trunk control exercise trains to strengthen the muscles of the trunk to train gross motor function in children. Based on this statement, researchers are interested in conducting research related to this matter using meta-analysis and systematic review.

METHODS

1. Study Design

The study design used in this study was a systematic review and meta-analysis, using the PRISMA flow chart guidelines. The data was obtained though journal screened by Science Direct database, PubMed database, and Google Schoolar database with selecting articles published in 2008-2023. The keywords used were ("Neurodevelopmental Treatment") AND ("Child" AND "Children") AND trunk exercise, AND "Randomized controlled Trial".

2. Inclusion Criteria

The inclusion criteria used in this study were based on full paper articles using a randomized controlled trial (RCT) research method, the size of the relationship used was following the Mean SD, for the interventions given were neurodevelopment treatment and trunk control excersie , with research subjects aged < 8 years, , with diagnosis of developmental delay or developmental disability due delayes one or more motor milestones by a pediatrician or rehabilitation physician at gross motor function classification system (GMFCS) nn physician, at Gross Motor Function Classification System (GMFCS) level >II.

3. Exclusion criteria

In this study, the exclusion criteria were based on published articles other than English and Indonesian, a diagnosis of CP at GMFCS level I or independent walking, musculoskeletal deformations that can affect posture control, and having undergone orthopedic surgery within the last six months.

4. Operational definition

Formulation of research conducted using PICO. The population is children with diagnosis of developmental delay or developmental disability due delayes one or more motor milestones by a pediatrician or rehabilitation physician at gross motor function classification system (GMFCS) nn physician, at Gross Motor Function Classification System (GMFCS) level >II. The intervention used neurodevelopment treatment and trunk control excersie was an increase in functional motoric at gross and fine motor in children.

Neurodevelopment treatment is an advanced "hands-on" therapeutic approach that helps guide the individual to more efficient functional abilities. It utilizes principles of motor development, motor control, motor learning, and other supporting scientific principles to improve basic body functions. Engaging and motivating (NDT Association, n.d.).

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Trunk exercise is an exercise that can be given to children with developmental disabilities with the focus on strengthening the core stability in the child's body. The improvement of core stability helps strengthen children in development, especially in gross motor functions that have the function of lifting the head, rolling over, crawling, sitting and several other gross motor functions (Ko et al., 2016)**.**

The Gross Motor Function Classification System (GMFCS) is a five-level evidence-based tool that measures gross motor function of children with developmental disabilities. The gross motor functions emphasised in the GMFCS are sitting, walking, some other gross motor-related movements.

5. Research Instruments

The research device uses filtering to look the first-rate of research articles the usage of the critical Appraisal skill software (CASP).

6. Data analysis

Data analysis in this study used the review manager application (RevMan 5.3). Data were analyzed based on variations between studies by determining the use of fixed effect analysis models. This study uses I2 to quantify dispersion. The results of the analysis obtained are data in the form of effect size values of study heterogeneity, where the results of the research that have been analyzed are then interpreted in the form of forest plots and funnel plots.

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RESULT AND DISCUSSION

Result

Research based on primary studies related to the effectiveness of the combination of neurodevelopment treatment and trunk control exercise in improving gross and fine motor function in children aged one to two years obtained in articles. Articles obtained include those from the Asian continent and the European continent. Then the respondents of each article obtained the results of less than 50 participants.

Searching for articles using a database has been described in the PRISMA flowchart. While the quality assessment in this study used the clinical appraisal skill programme (CASP). After the quality assessment, five articles were included in the quantitative synthesis process of meta-analysis using RevMan 5.3.

There were 3 review articles that qualified as sources for the meta-analysis of the effectiveness of the combination of neurodevelopmental training and trunk control exercise to improve motor function in one- to two-year-old children from the Asian and European continents consisting of Australia, the United Kingdom, and Brazil that obtained meta-analysis results translated in the form of forest plots and funnel plots.

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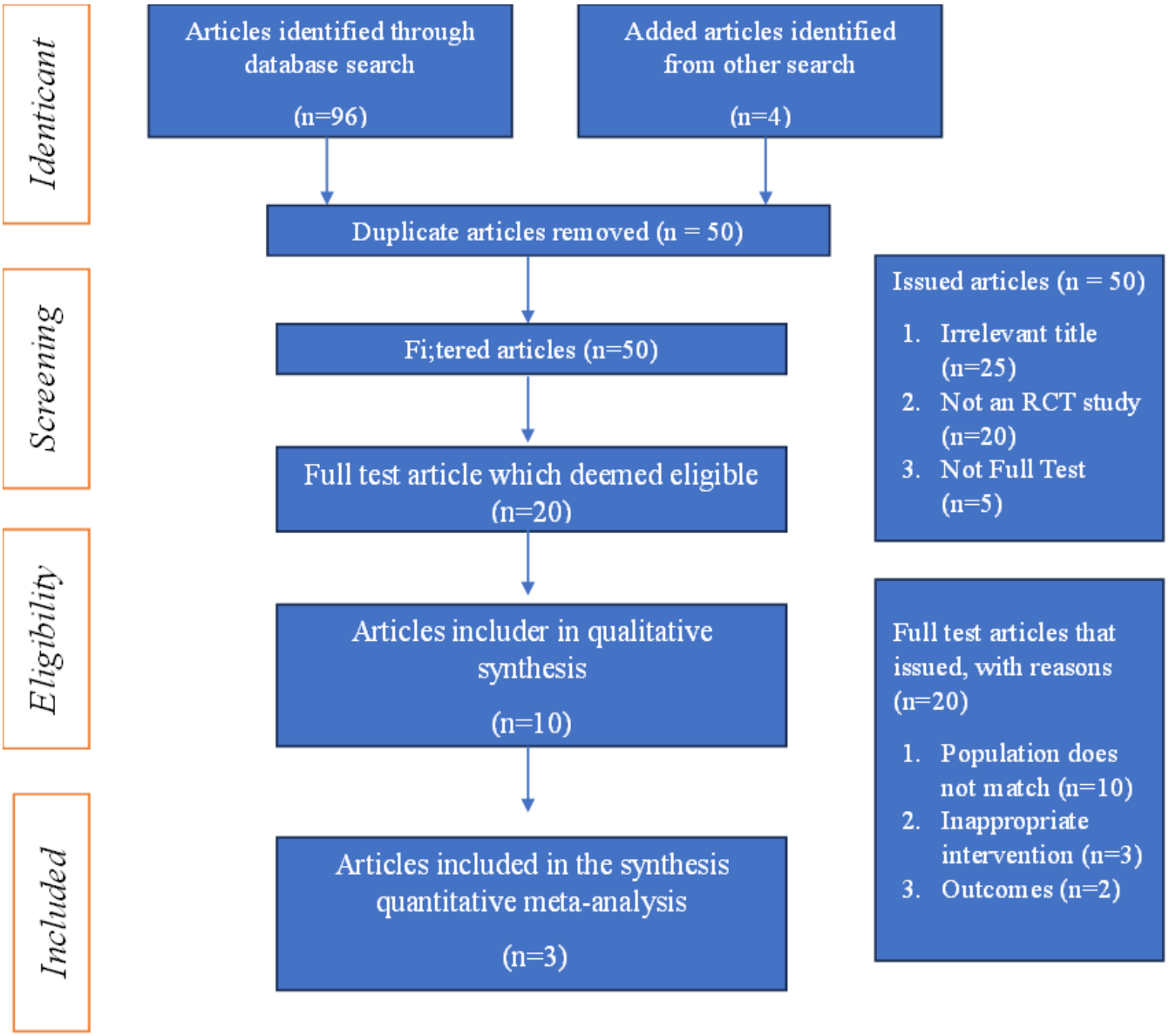

Figure 1. PRISMA Diagram Flow

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a. Forest Plot

Interpretation results obtained from the meta-analysis process through the forest plot explained that as many as 3 articles reported NDT can increase motor function in children with developmental disorders compared to other interventions given (figure 2). The results obtained, there is high experimental heterogeneity (I2 = 0%), so the data is homogeneous. Using the fixed effect model in analyzing the data in the forest plot, it can be concluded that giving NDT can increase motor function in children with developmental disorders by 0.49 times compared to other interventions. This is also supported by the results of statistical calculations which are significant (SMD = 0.49; 95% CI = -0.88 to -0.10; p = 0.01).

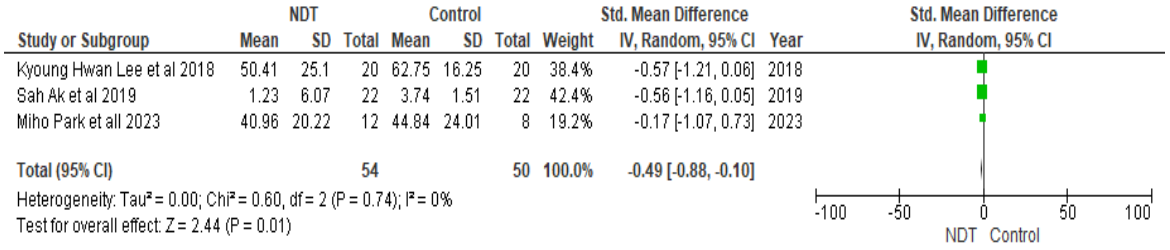

Figure 2. Forest Plot

b. Funnel Plot

a funnel plot is a plot that plots the estimated effect size of each study against an estimate of its precision, which is usually the standard error. The results of the funnel plot on NDT based on the elaboration of Figure 3, which is to increase motor function in children with developmental disorders, shows perfect results with no bias which is marked by the distribution in each plot which has a standard error value of 0.0.

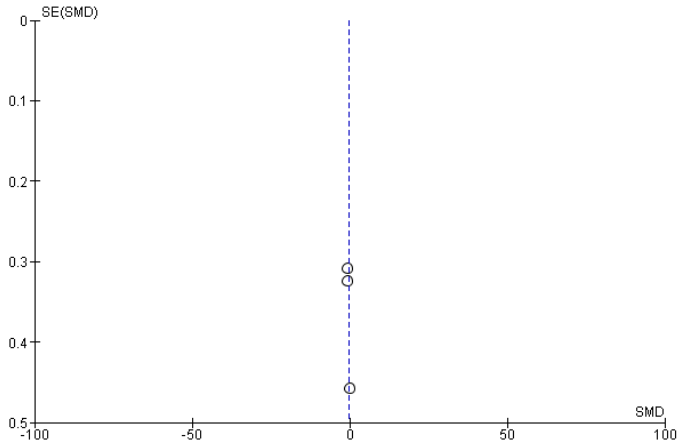

Figure 3. Funnel Plot

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Discussion

Children aged one to two years are at risk of developmental disorders during their growth and development. Developmental disorders that often occur include motor function disorders that are often encountered, especially when measured using the gross motor function classification system (GMFCS) by looking at child development using milestones (Ko et al., 2016).

The decline in development that is passed in children aged one to two years, is influenced by several factors, one of which is the stimulus provided and stimulation to train motor functions. In addition, the provision of trunk exercise also has the aim of strengthening the muscles in the trunk which also focuses on training core stabilisation in children, especially those with developmental disorders Sah, A. K., Balaji, G. K., & Agrahara, S. (2019).

Several studies have been conducted stating that neurodevelopment treatment (NDT) has been shown to improve trunk strength, and in this study, children with DD who received NDT-TCE were able to improve their trunk control potentially due to increased muscle strength, tone, and proper co-activation of flexors and extensors. NDT-TCE, which increases trunk strength and induces activation of trunk muscles, has been shown to improve motor function and stability, as well as gross motor function. Previous studies have suggested that NDT-based trunk-focused interventions for CP improve GMFM scores, TIS trunk control-related assessment tools and TCM scores, and postural alignment (Tekin et all, 2018).

A previous study has shown the administration of NDT and trunk exercise four times a week for 4 weeks, followed by a rest phase for 8 weeks, resulted in a significant improvement in GMFM, while NDT four times a week for 6 weeks followed by a rest phase for 6 weeks also resulted in an improvement in GMFM, it is one of the limitations in this study that the length of the rest period does not affect changes in motor function, but the length of exercise will affect GMFM (Pham HP et all, 2016).

Therefore, after adjusting for age, the results before and after the intervention were compared. As a result, the NDT-TCE group significantly increased the GMFM B dimension and total score than the control group. In a prior study, children aged 18–23 months and 30–35 months scored the same in GMFM A and B dimensions, but at 30–35 months they scored higher in the C, D, and E dimensions. This is consistent with the higher pre-intervention scores of the control group who were older in this study. However, in this study, the experimental group that underwent NDT-TCE had an average age of 21.92 months and had more score changes than the control group with an average of 32.75 months. This suggests that NDT-TCE produces a faster change in scores, suggesting that NDT-TCE is an effective intervention (Park et al., 2023).

CONCLUSION

The provision of NDT-TCE can be applied as a trunk-focused intervention for children with DD who have difficulty controlling their trunk has very good results. Based on meta-analysis data, it was found that the p-value was very significant with a result of 0.05 which meant The NDT-TCE intervention specifically improved GMFM-B and trunk control scores.

ACKNOWLEDGEMENT

Researchers would like to thank all those who have helped preparation of this article and also thanks to the database providers PubMed, Science Direct, and Google Scholar.

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