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Masters Program in Public Health, Universitas Sebelas Maret

Meta-Analysis

Meta-Analysis the Effectiveness of Speech Therapy on Phonation Improvement in People Diagnosed with Parkinsons Disease

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ABSTRACT

Background: Parkinson's disease (PD) is a complex, progressive neurodegenerative disease characterized by tremor, rigidity, slow movement, and postural instability. Phonation disturbances are the most frequently observed speech characteristics in PD patients. The purpose of this study was to estimate the effectiveness of speech therapy interventions for phonation improvement in people with a diagnosis of Parkinson's disease.
Subjects and Method: This study is a meta-analysis of a number of Randomized Controlled Trial study designs. The articles used in this study were obtained from several databases including PubMed, Google Scholar, and Springer Link. Article search was carried out by considering the eligibility criteria defined using the PICO model. The population in the study were people with a diagnosis of Parkinson's disease with intervention in the form of speech therapy intervention, comparison, namely no speech therapy intervention, outcome in the form of phonation. The keywords to search for articles are as follows: "Intervention Speech Therapy" OR "Speech Therapy" OR "Phonation" OR "Voice" OR "Parkinson Disease" AND "Randomized Controlled Trial" OR "RCT". The articles included in this study are full text articles with a Randomized Controlled Trial (RCT) study design. Articles are collected using PRISMA flow diagrams. Articles were analyzed using the Review Manager 5.3 application.
Results: A total of 7 articles were reviewed in this study from the United States, North America, and Austria. The total sample size in this study was 213 subjects. A meta-analysis showed that speech therapy was effective for improving phonation in people with a diagnosis of Parkinson's disease (SMD = 2.52; 95% CI = 1.79 to 3.24; p<0.001).
Conclusion: Speech therapy is effective for improving phonation in people with a diagnosis of Parkinson's disease.

Keywords: speech therapy, phonation, voice, parkinson disease.

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BACKGROUND

Parkinson's disease (PD) is a complex, progressive neurodegenerative disease characterized by tremors, rigidity, slow movements, and postural instability (Kouli et al., 2018). PD is the second most common neurodegenerative disease after Alzheimer's disease with a prevalence of approximately 0.5–1% among ages 65–69 years, increasing to 1–3% among persons aged 80 years and

over. It is estimated that the prevalence and incidence of PD will increase by more than 30% by 2030 (Kouli et al., 2018). Phonation disorders are the most frequently observed speech characteristics in PD patients (Dashtipour et al., 2018).

According to Saffarian (2019) 70% to 90% of patients with PD exhibit some type of speech disorder. The majority of people with PD have speech dysfunction which negatively affects communication (Church, 2021).

Speech therapy presents a variety of therapeutic methods to improve communication in PD patients. One method in the treatment of voice disorders in PD is known as the Lee Silver-man Voice Treatment (LSVT). The aim of this method focuses on improving vocal loudness as well as one of the most widely used speech interventions in hypokinetic dysarthria associated with PD (Pu et al., 2021).

SUBJECTS AND METHOD

1. Study Design

This research is a systematic review and meta-analysis. The articles used in this study were obtained from several databases including PubMed, Google Scholar, and Springer Link. The keywords to search for articles are as follows: “Intervention Speech Therapy” OR “Speech Therapy” AND “Phonation” OR “Voice” AND “Parkinson Disease” AND “Randomized Controlled Trial” OR “RCT”.

2. Steps of Meta-Analysis

Meta analysis was carried out in 5 steps as follows:

1) Formulate research questions in PICO (Population, Intervention, Comparison and Outcome).
2) Searching for articles from various databases including Google Scholar and PubMed.
3) Screening and conducting assessments in primary studies.
4) Perform data extraction and enter effect estimates from each primary study into the RevMan 5.3 application.
5) Interpret the results of the research analysis and draw conclusions.

3. Inclusion Criteria

The articles included in this study are full paper articles with a Randomized Controlled Trial (RCT) study design, the relationship size used is the mean standard deviation, in Indonesian and English. The intervention given is speech therapy, the subject of research is people with a diagnosis of Parkinson's disease.

4. Exclusion Criteria

The articles published in this study were articles that had been meta-analyzed. Research with non-randomized controlled trial (RCT) studies, and does not include the mean standard deviation.

5. Operational Definition of Variables

Speech therapy intervention is a professional health service in the field of voice
Phonation is the process of speaking when the vocal cords in the throat vibrate and produce sound.

6. Study Instruments

The instrument used in this study was a critical appraisal tool randomized controlled trial (RCT).

7. Data Analysis

Data processing was carried out by the Review Manager (RevMan 5.3) by calculateing the effect size and heterogeneity to determine the combined research model and form the final meta-analysis results.

RESULTS

Figure 1. The process of searching for articles by searching through the journal database which includes: PubMed, ScienceDirect and Google Scholar. A total of 7 articles were reviewed in this study.

Figure 2 shows the area where the articles were taken according to the criteria. Articles obtained from 2 continents namely America and Europe. As well as from 3 countries namely the United States, North America, and Austria.

Table 1 shows the assessment of the quality of primary articles from a randomized controlled trial (RCT) carried out using a checklist of critical appraisal tools randomized controlled trial (RCT) published by CEBM University of Oxford. Based on the answers from the article quality assessment, the highest total score was 12.

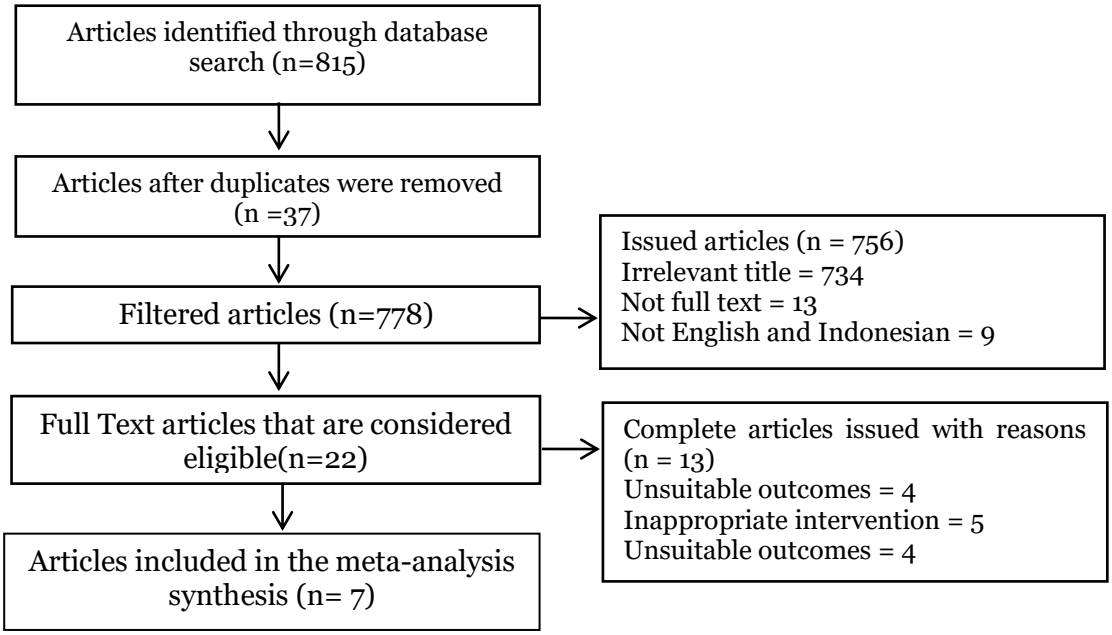

Figure 1. PRISMA flowchart diagram of Speech Therapy on Phonation Improvement in People Diagnosed with Parkinsons Disease

Figure 2. Map of the distribution of research of Speech Therapy on Phonation Improvement in People Diagnosed with Parkinsons Disease

Tabel 1. Critical appraisal checklist for randomized controlled trial dari critical appraisal skills programme (CASP)

Author (Years)	Criteria of Questions												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Spielman et al (2018)	1	1	1	1	1	0	1	1	1	1	0	1	10
Halpern et al (2012)	1	1	1	0	1	0	1	1	1	1	0	1	9
Fox et al (2001)	1	1	1	0	1	0	1	1	1	1	0	1	9
Sapir et al (2001)	1	1	1	1	1	0	1	1	1	1	0	1	10
O'Brien et al (1996)	1	1	1	1	1	0	1	1	1	1	0	1	10
Ramig et al (1995)	1	1	1	1	1	0	1	1	1	1	0	1	10
Johnson and Pring (1990)	1	1	1	1	1	0	1	1	1	1	0	1	10

Description of the question criteria:

1 = Does the research address a clearly focused statement or problem?
2 = Are the RCT research methods appropriate for answering the research questions?
3 = Were there enough subjects in the study to establish that the findings were not made by chance?
4 = Were subjects randomly allocated to the experimental and control groups? If not, could this introduce bias?
5 = Were inclusion or exclusion criteria used?
6 = Were the two groups comparable at study entry?
7 = Were objective and unbiased outcome criteria used?
8 = Were objective and validated measurement methods used to measure the results? If not, were the results assessed by someone who was not aware of the group assignment (i.e. was the assessment blinded)?
9 = Is the effect size practically relevant?
10 = How precise is the estimated effect? Are there confidence intervals?
11 = Could there be confounding factors that have not been taken into account?
12 = Are the results applicable to your research?

Description of the answer score:

1 = Yes
0 = No

Table 2. Table PICO summary of the article effectiveness of speech therap on phonation improvement in people diagnosed with parkinsons disease

Author (Year)	Country	Sample	P	I	C	O
Spielman et al. (2018).	USA	Intervention: 22 Control: 22	People with a diagnosis of Parkinson 's disease	Speech therapy intervention using the LSVT LOUD and LSVT ARTIC methods	No speech therapy intervention was given using the LSVT LOUD and LSVT ARTIC methods	Phonation repair
Halpern et al. (2012).	USA	Intervention: 8 Control: 8	People with a diagnosis of Parkinson 's disease	Speech therapy intervention using the LSVT method	Not given speech therapy intervention with the method	Phonation repair

Author (Year)	Country	Sample	P	I	C	O
Sapir et al. (2001).	North America	Intervention: 21 Control: 12	People with a diagnosis of Parkinson 's disease	Speech therapy intervention using the LSVT method on vocal loudness [sound pressure level (SPL)]	LSVT	Phonation repair
Fox et al. (2001).	USA	Intervention: 13 Control: 15	People with a diagnosis of Parkinson 's disease	Speech therapy intervention using the LSVT method	No speech therapy intervention was given using the LSVT method on vocal loudness [sound pressure level (SPL)]	Phonation repair
O'Brien et al. (1996).	USA	Intervention: 22 Control: 13	People with a diagnosis of Parkinson 's disease	Speech therapy intervention using the LSVT method	No speech therapy intervention was given with the LSVT method	Phonation repair
Ramig et al. (1995).	USA	Intervention: 26 Control: 19	People with a diagnosis of Parkinson 's disease	Speech therapy intervention using the LSVT respiration (R) or voice and respiration method	No speech therapy intervention was given with the LSVT method	Phonation repair
Johnson and Pring. (1990).	Austria	Intervention: 6 Control: 6	People with a diagnosis of Parkinson 's disease	Speech therapy intervention using the LSVT method	No speech therapy intervention was given using the LSVT respiration (R) or voice and respiration method	Phonation repair

Table 3. Effect estimates (Mean SD) from the primary studies included in the meta-analysis

Author (Year)	Speech Therapy		Non-Speech Therapy	
	Mean	SD	Mean	SD
Fox et al (2001)	82.4	3.9	70.5	4.4
Halpern et al (2012)	85.0	2.4	70.4	5.4
Johnson and Pring (1990)	100.2	10.9	90.0	18.2
O'Brien et al (1996)	82.47	3.62	67.83	4.94
Ramig et al (1995)	81.2	4.65	68.01	4.31
Sapir et al (2001)	82.36	3.92	68.69	4.79
Spielman et al (2018)	84.3	4.95	76.1	4.37

1. Forest Plot

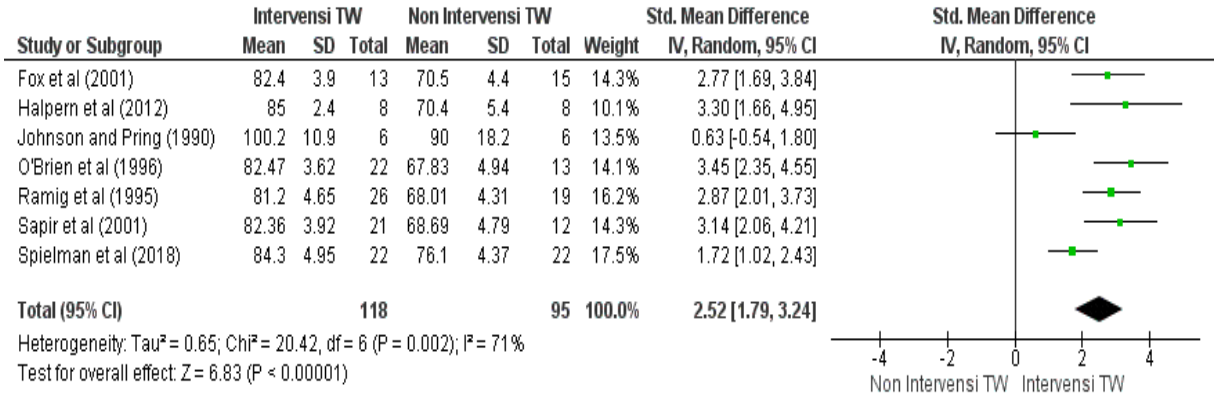

Figure 3. Forest plot of the effectiveness of speech therapy interventions on phonation improvement in people with a diagnosis of Parkinson's disease

Based on the results of the forest plot in Figure 3, it shows that the effect of speech therapy intervention on phonation improvement in people with a diagnosis of Parkinson's disease is 2.52 units and is statistically significant (Standardized Mean Difference = 2.52; 95% CI 1.79 to 3.24; p< 0.001). High heterogeneity of effects (I2= 71%; p= 0.002). So that the distribution of data is stated to be heterogeneous (random effect model).

2. Funnel Plot

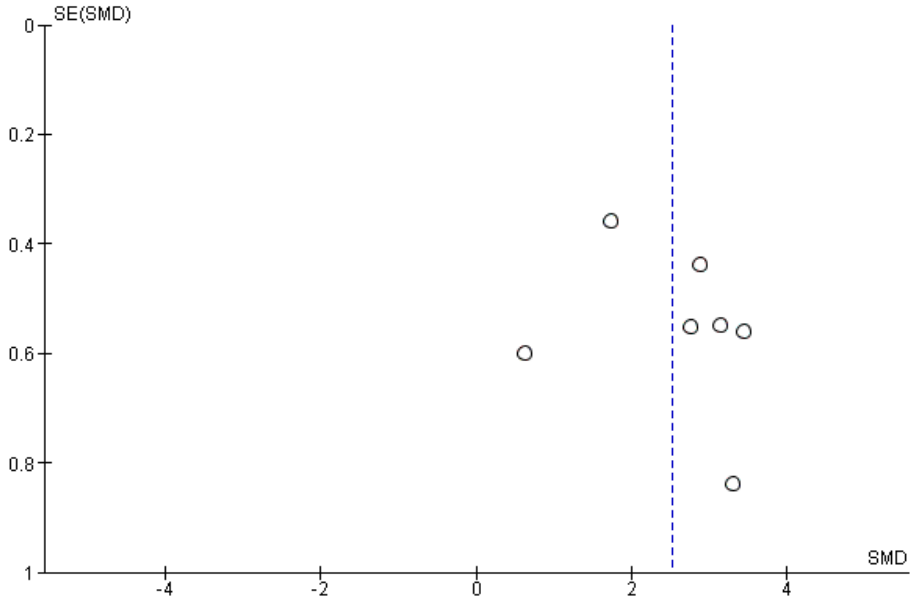

Figure 4. Funnel plot of the effectiveness of speech therapy interventions on phonation improvement in people with a diagnosis of Parkinson's disease

The funnel plot in Figure 4 shows the distribution of effect estimates between studies with a standard error of less than 0.5, which is more to the right than to the left of the vertical line of the average effect estimate. So it was identified that there was publication bias.

DISCUSSION

Speech therapy is a form of professional health services based on science and technology in the fields of language, speech, sound, rhythm/fluency (communication), and swallowing aimed at individuals, families and/or groups to improve health efforts caused by disturbances/anatomical, physiological, psychological and sociological abnormalities (Permenkes RI, 2014). The goal of speech therapy services is to optimize the individual's ability to communicate and swallow, thereby improving the quality of life (American Speech-Language-Hearing Association, 2016).

Parkinson's disease (PD) is a complex progressive neurodegenerative disease with characteristic motor symptoms such as tremor at rest, muscle and joint stiffness, slowness of movement and speech and postural instability (Kouli et al., 2018).

Currently, the diagnosis is based on clinical symptoms with diagnostic criteria requiring the presence of two of the following clinical features: tremor at rest, rigidity of muscles and joints (rigidity), slowness of movement and speech (bradykinesia) and postural instability (Kouli et al., 2018).

Speech therapy presents a variety of therapeutic methods to improve communication in PD patients. One method in the treatment of voice disorders in PD is known as the Lee Silverman Voice Treatment (LSVT). LSVT is one of the treatments for speech disorders associated with PD. LSVT is specifically designed to address voice and speech disorders due to PD (Mahler, 2015). The goal of this method focuses on improving vocal loudness as well as one of the most widely used speech interventions in hypokinetic dysarthria associated with PD (Pu et al., 2021).

Phonation is the term used for the process by which sound occurs. Phonation refers to the result of vocal cord vibrations. Conditions that need to be met to produce phonation include the vocal cords having to adduct and exhale to produce pressure on the larynx (Dashtipour et al., 2018).

This systematic review and meta-analysis research raises the theme of the effectiveness of speech therapy interventions in people with a diagnosis of Parkinson's disease, especially in terms of phonation improvement. This study discusses data on speech therapy interventions considered important because of their scarcity. The number of relevant research published and accessible is still small and also has data access problems (data duplication) (Murti, 2018).

The combined estimate of the effect of speech therapy intervention on phonation was processed using RevMan 5.3 with the continuous method. This method is used to analyze the effect size or standardized mean difference in bivariate data from two groups that have been controlled for confounding factors by randomization.

The results of systematic reviews and meta-analyses are presented in the form of forest plots and funnel plots. Forest plots provide an overview of the information from each study included in the meta-analysis, and estimates of the overall results (Murti, 2018). Forest plots show visually the large variation (heterogeneity) between study results (Murti, 2018).

Systematic review and meta-analysis in this study were conducted with the aim of increasing the generalizability of the findings and obtaining convincing conclusions from the results of various similar studies regarding the effectiveness of speech therapy interventions for phonation improvement in people with a diagnosis of Parkinson's disease based on statistical results (Standardized Mean Difference 2.52; CI 71% 1.79 to 3.24; $p<0.001$).

This research is supported by Choi (2011) showing the results of the LSVT program have been shown to produce consistent improvements in vocal loudness in PD-related voice disorders.

The overall effect on speech therapy intervention during phonation training was 6.07 dB (95% CI 0.10 to 12.24; p<0.001; REM, I2=90%). Xu's study (2020) showed that only participants who underwent LSVT training experienced significant improvements in vocal intensity. The frequency of exercise is 4 times a week for 4 weeks, sixteen training sessions a month and carried out for a minimum of 2 years.

AUTHORS CONTRIBUTION

Anita is the principal researcher who selects topics, tracks and collects research data. Hanung Prasetya and Bhisma Murti played a role in analyzing the data and reviewing research documents.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

REFERENCES

American Speech-Language Hearing Association (2016). Scope of Practice in Speech-Language Pathology. https://-www.asha.org/policy/sp2016-00343/. Diakses Februari 2023.

Choi HS (2011). The Effect of Lee Silverman Voice Treatment (LSVT) on Parkinsonian Phonation: Nonlinear Dynamic, Perturbation, and Perceptual Analysis. Commun Sci Disord. 16(1):335-345.

Church FC (2021). Treatment Options for Motor and Non-Motor Symptoms of Parkinson's Disease. Biomolecules. 11(612):1-17.

Dashtipour K, Tafreshi A, Lee J, Crawley B (2018). Speech disorders in Parkinson's disease: pathophysiology, medical management and surgical approaches. Neurodegener Dis Manag. 8(5): 337–348.

Fox C, Ramig LO, Sapir S, dan Countryman S (2001). Changes in vocal loudness following intensive voice treatment (LSVT) in individuals with Parkinson's disease: A comparison with untreated patients and normal age-matched controls. J. Mov. Disord. 16(1): 79–83.

Halpern AE, Ramig LO, Matos EC, Petska JA, Spielman JL, Pogoda JM, Farland DH, et al. (2012). Innovative Technology for the Assisted Delivery of Intensive Voice Treatment (LSVT®LOUD) for Parkinson Disease. Am J Speech Lang Pathol. 21(4): 354-367.

Johnson JA, Pring TR (1990). Speech therapy and Parkinson's disease: A review and further data. IJLCD. 25(2): 183–194.

Kementerian Kesehatan RI (2014). Peraturan Menteri Kesehatan Republik Indonesia Nomor 81 Tahun 2014 tentang Standar Pelayanan Terapi Wicara. Jakarta: Kementerian Kesehatan RI.

Kouli A, Torsney KM, Kuan WL (2018). Parkinson's Disease: Etiology, Neuropathology, and Pathogenesis. Parkinson's Disease: Pathogenesis and Clinical Aspects. Brisbane (AU): Codon Publications.

Murti B (2018). Prinsip dan metode riset epidemiologi (5th ed) (Epidemiological research principles and methods). Surakarta: Program Studi Ilmu Kesehatan Masyarakat, Program Pascasarjana, Universitas Sebelas Maret.

O'Brien C, Ramig LO, Countryman S, Hoehn M, Thompson L (1996). Intensive speech treatment for patients with Parkinson's disease: Short- and long-term comparison of two techniques. J. Neurol. 47(6): 1496–1504.

Pu T, Huang M, Kong X, Wang M, Chen X, Feng X, Wei C, et al. (2021). Lee Silverman Voice Treatment to Improve Speech in Parkinson's Disease: A Systemic Review and Meta-Analysis. Hindawi. 21(1):1-10.

Ramig LO, Countryman S, Thompson LL, Horii Y (1995). Comparison of Two Forms of Intensive Speech Treatment for Parkinson Disease. J Speech Lang Hear. 38(6): 1232-1352.

Saffarian A, Shavaki YA, Shahidi GA, Hadavi S, Jafari Z (2019). Lee Silverman Voice Treatment (LSVT) Mitigates Voice Difficulties in Mild Parkinson's Disease. MJIRI. 33(5):1-6.

Sapir S, Ramig LO, Countryman S, Pawlas AA, O'Brien C, Hoehn M, Thompson LL (2001). Intensive voice treatment (LSVT(R)) for patients with Parkinson's disease: a 2 year follow up. JNNP. 71(4): 493–498.

Spielman J, Ramig LO, Halpern A, Fox C, Freeman K (2018). Speech treatment in Parkinson's disease: Randomized controlled trial (RCT). J. Mov. Disord. 33(11): 1777-1791.

Xu H, Bao Z, Liang D, Li M, Wei M, Ge X, Li J, et al (2020). Speech and Language Therapy for Voice Problems in Parkinson's Disease: A Meta-Analysis. J Neuropsychiatry Clin Neurosci. 32(4): 344–351.