CHAPTER IV
RESEARCH METHOD

A. Research Type and Design

This research is a quantitative study using a quasi-experimental design with a pre-posttest intervention and control group in post-stroke patients, aiming to determine the effect of Proprioceptive Neuromuscular Facilitation (PNF) and Hand Ball Grasping Exercise on upper extremity muscle strength.

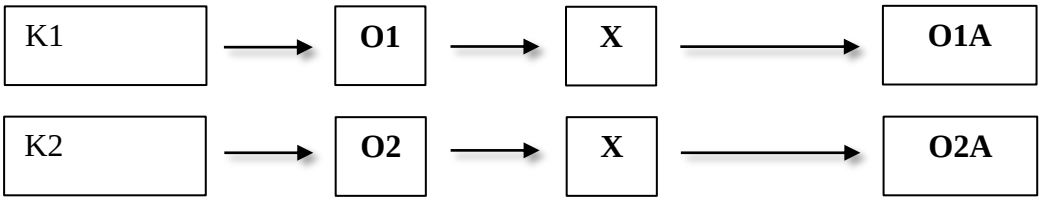

Chart 4.1 Research Design1

Legend:

K1 = Respondents in the intervention group

K2 = Respondents in the control group

O1 = Initial measurement of upper extremity muscle strength in the Intervention Group

O2 = Initial measurement of upper extremity muscle strength in the Control Group

X1 = Given PNF Therapy and Hand Ball Grasping Exercise

X2 = Given Dumbbell Exercise.

O1A = Final measurement of upper extremity muscle strength in the Intervention Group O2A = Final measurement of upper extremity muscle strength in the Control Group

B. Research Variables

a) The dependent variable in this study is Upper Extremity Muscle Strength

b) The independent variable in this study is Proprioceptive Neuromuscular Facilitation (PNF) and Hand Ball Grasping Exercise.

C. Research Location and Time

1. Research Location

   This research was conducted in the working area of Puskesmas Sawah Lebar, Bengkulu City.

2. Research Time

   This research was conducted from February 1 to April 1, 2026

D. Population and Sample

1. Population

   A population is the entire set of objects or subjects with the same characteristics that are the target of research (Subhaktiyasa, 2024). The population in this study was stroke patients in the working area of Puskesmas Sawah Lebar, Bengkulu City, in 2026, estimated based on the number of stroke patients in 2025, which was 75 people.

2. Sample

   A sample is a portion of the population selected based on certain criteria set by the researcher to be analyzed in the research (Subhaktiyasa, 2024). The sample in this study consisted of some post-stroke patients with muscle weakness disorders in the area of Puskesmas Sawah Lebar.

   The sample size calculation in this study uses the two-mean difference formula:

$$n = \frac{\sigma^2(Z_1 - \alpha + Z_1 - \beta)^2}{(\mu^0 - \mu^a)^2}$$

Description:

n	=	Sample size
$Z_1 - \alpha$	=	Standard normal deviation for α (standard deviation α = 1.96).
$Z_1 - \beta$	=	Standard normal deviation for β (standard deviation β = 1.28)
μ^0	=	Mean before intervention obtained from the literature

μ^{α} = Mean after intervention obtained from the literature

σ = Standard deviation

DO = Drop Out

Tongpangmeren et al. (2023), in 30 post-stroke patients in India who received the Proprioceptive Neuromuscular Facilitation (PNF) and Hand Ball Exercise intervention to improve hand function in post-stroke patients, obtained a mean value before intervention (μ^{0}= 29.02), a mean value after intervention (μ^{α}= 30.02), a pre-test standard deviation value, and a post-test standard deviation value.$\sigma = (12{,}8)\sigma = (11{,}2)$

a. Determining the sample

$$n = \frac{\sigma^2(Z_1 - \alpha + Z_1 - \beta)^2}{(\mu^0 - \mu^{\alpha})^2}$$

$$n = \frac{1{,}6^2(1{,}96 + 1{,}28)^2}{(29{,}02 - 30{,}02)^2}$$

$$n = \frac{2{,}56\ (3{,}24)^2}{(1)^2}$$

$$n = \frac{2{,}56\ X\ 10{,}497}{1}$$

$$n = \frac{26{,}872}{1}$$

$$n = 26{,}872$$

$$n = 27$$

To anticipate the occurrence of dropout, the researcher anticipated this by adding to the sample size using the formula:

b. Drop out

$$N' = \frac{n}{(1-f)}$$

$$N' = \frac{27}{(1-0{,}1)}$$

$$N' = = 30 \times 10\% = 3\frac{27}{0{,}9}$$

Total sample = 27 + 3 = 30 participants

So, from the calculation it was found that the minimum sample size for each group was 30 participants, so the total sample needed was 60 participants.

3. Sampling Technique

The sampling technique in this study used purposive sampling. Purposive sampling is a sample determination technique that uses certain established considerations (Sugiyono, 2007). The reason for using purposive sampling is that, according to Sugiyono (2007), not the entire population meets the research criteria, so the sample was determined based on inclusion and exclusion criteria in order to align with the research objectives and increase the validity of the results. The criteria in this study are as follows:

a. Inclusion Criteria

1) Willing to become a research respondent.
2) The family agrees and commits to participating in the activities until completion.
3) Residing in the area of Bengkulu City.
4) Recurrent post-stroke patients with muscle strength of 3-4 based on MMT measurement.
5) Respondent age 30-75 years.
6) Respondents with stable hemodynamics (blood flow, heart function, and blood vessel condition assessed through blood pressure, pulse, and cardiac output parameters to ensure blood circulation and oxygen supply to organs are in a stable state).
7) Respondents have good orientation.
8) Respondents do not have any serious illness that could interfere with the exercise to be performed, such as vertigo, COPD, heart disease, rheumatoid arthritis, musculoskeletal disorders, etc.

b. Exclusion Criteria

1) Respondents who withdraw (drop out) if the respondent experiences a health problem that interferes with the intervention process.
2) Respondents who are unable to complete the intervention within the specified time.

E. Data Collection

1. Data Source

a. Primary Data

1) Data was collected directly by the researcher from respondents experiencing hemiparesis who were undergoing post-stroke disease management at Puskesmas Sawah Lebar, Bengkulu City.
2) The researcher will explain to prospective respondents the research plan, including the purpose, benefits, and duration of the study, and will explain the inclusion criteria for prospective respondents desired by the researcher.
3) The researcher has measured the muscle strength of prospective respondents; if the prospective respondent meets the requirements and inclusion criteria set by the researcher, they will be planned as a respondent.
4) Next, respondents who meet the inclusion criteria will be given an informed consent statement by the researcher to become a respondent. If the prospective respondent refuses, the researcher will cancel their participation as a research respondent.
5) After obtaining the respondent's consent, the researcher will arrange a time for the intervention.
6) Next, the researcher will divide the total respondents into 2 groups, a control group and an intervention group, using the total sampling technique.
7) The researcher will measure upper extremity muscle strength before PNF and Hand Ball Grasping Exercise are performed; the

measurement results will then be recorded on the observation sheet, and upper extremity muscle strength will also be measured before Hand Ball Grasping Exercise and PNF are performed in the control group.

8) The results of the recorded data will then be processed using the SPSS version 27 application program.

b. Secondary Data

Data was obtained from medical records or the register of post-stroke patients treated at Puskesmas Sawah Besar, Bengkulu City, in 2025.

2. Data Collection Tools and Instruments

a. Data Collection Form

The data collection form is a questionnaire containing demographic data to obtain patient data including name, age, education, and frequency of stroke attacks, as well as an observation sheet for measuring respondents' pre- and post-intervention upper extremity muscle strength.

b. Rubber Ball

A textured rubber ball, which is more effective at increasing muscle strength, with a diameter of 6 cm, used in resistance exercise.

c. DumbbellA dumbbell or weight disc, sometimes called a hand weight, is a type of free weight lifting device used in resistance exercise with a weight of 0.5 kg

d. Stopwatch

Used to measure the duration of the intervention.

e. Standard Operating Procedure (SOP) for PNF Therapy and Hand Ball Grasping Exercise

A guide for the researcher in training respondents' upper extremity muscle strength.

f. Manual Muscle Testing (MMT) Scale Measurement Sheet

Uses an MMT (Manual Muscle Testing) scale measurement sheet format with a value range of 0-5 to measure upper extremity muscle strength before and after treatment.

3. Data Collection Instrument Testing

In this study, validity and reliability testing was not performed again, because Manual Muscle Testing (MMT) is a standardized instrument; according to the results of research by Hermawan & Wihardja (2020), an α value of >0.63 to 0.98 was obtained for individual muscle groups and α > 0.57 to 1.0 for the total MMT score. It is declared valid if the MMT validity value shows r = 0.768 (>0.05).

4. Data Collection Procedure

The researcher collected data through interviews and observation. In addition, the researcher also used a questionnaire containing demographic data that could be filled out by the respondent or their family. After conducting interviews and observations, the researcher asked the respondent or family to fill out the questionnaire sheet

F. Data Processing

1. Editing

The data collected from respondents is checked for completeness of the instrument, which includes the clarity, uniformity, and consistency of the data.

2. Coding

A code, also known as coding, will be applied to the data that has been collected and checked.

3. Sorting

Data grouped based on coding will be separated for inclusion in the intervention or control group.

4. Entry and Processing

The survey results will be entered into the SPSS version 27 program and divided into numerical and categorical data.

5. Cleaning

   After all data has been entered, data cleaning is performed to ensure whether there are errors and whether the coding is correct or not.

G. Data Analysis

1. Univariate Analysis (Descriptive Analysis)

   Univariate analysis on numerical data such as age and muscle strength is used to show analysis results in the form of Mean, Standard Deviation (SD), Median, Max-Min, and 95% CI For Mean values. Meanwhile, categorical data such as gender, education, and type of stroke are shown as percentage or frequency distribution values.

2. Bivariate Analysis

   In this study of Proprioceptive Neuromuscular Facilitation (PNF) and Hand Ball Grasping Exercise, bivariate analysis was used to determine whether there was an effect of Proprioceptive Neuromuscular Facilitation (PNF) and Hand Ball Grasping Exercise therapy on increasing upper extremity muscle strength in post-stroke patients. It began with testing the equivalence of the two data groups, and a normality test was performed using the Shapiro-Wilk Test if the sample size was smaller (<50) and the Kolmogorov-Smirnov test if the sample size was larger (>50). The Dependent T-Test was used if the data were normally distributed, while the Wilcoxon test was used if the data were not normally distributed. Next, to determine the effect of Proprioceptive Neuromuscular Facilitation (PNF) and Hand Ball Grasping Exercise on increasing upper extremity muscle strength in post-stroke patients, the Independent T-Test was used if the data were normally distributed and the Mann-Whitney test was used if the data were not normal. Conclusions from the Mann-Whitney U test were drawn using α 0.05, or a 95% confidence level.

H. Research Flow

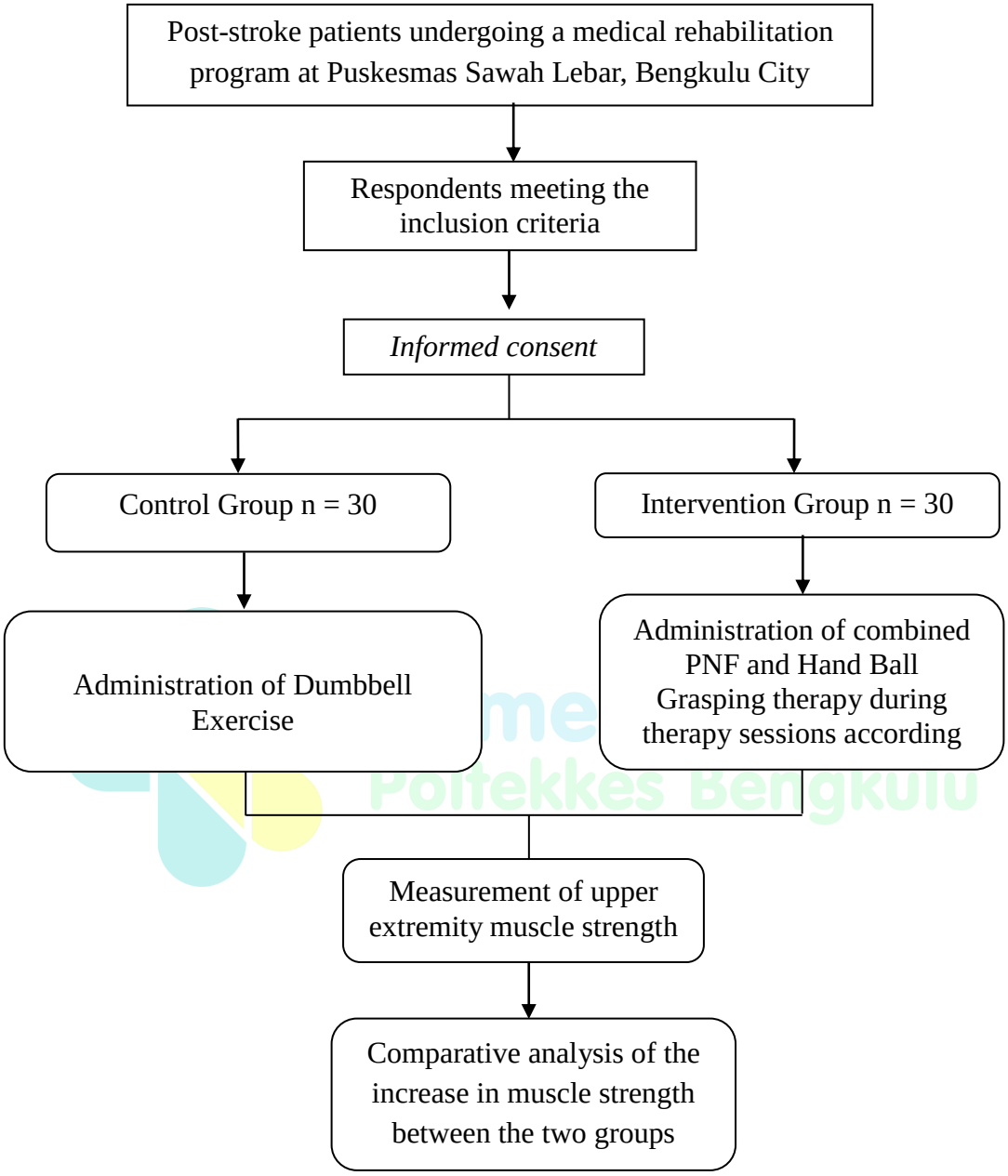

Chart 4.2 Research Flow2

I. Research Ethics

This research has gone through an ethical review process and was declared feasible by the Health Research Ethics Committee of Poltekkes Kemenkes Bengkulu with Ethical Clearance Certificate No. KEPK.BKL/097/01/2026, taking into account the following ethical principles:

1. The right to participate/not become a respondent

   In this study, respondents were given full freedom to decide whether or not to participate, without any coercion.

2. Anonymity

   Respondents' names are listed as initials on the observation sheet, and the researcher only uses a code number. Signatures are included on the written consent form.

3. Confidentiality

   All information obtained from respondents is guaranteed to be kept confidential and will not be disseminated or disclosed to others. The researcher stores this data as a soft file on the researcher's laptop, accessible only on the researcher's drive.

4. Justice

   The researcher treated respondents fairly from the beginning to the end of the study without discrimination, meaning all respondents received treatment.

5. Principle of beneficence

   Respondents who participated in this study gained benefits in the form of improved speaking ability during the therapy.

6. Non-Maleficence

   Ensures that this research does not cause discomfort, harm, or danger to respondents, either physically or psychologically.

J. Activity Schedule

No	Activity	Month											
		9	10	11	12	1	2	3	4	5	6	7	8
1	Completion of the Research Proposal	■	■										
2	Research Proposal Seminar Examination			■									
3	Thesis Proposal Revision and Approval			■	■								
4	Submission of Thesis Proposal to the Study Program				■								
5	Processing of Ethical Clearance					■	■						
6	Processing of Research Cover Letter and Permit						■						
7	Preliminary Survey							■					
8	Research Implementation and Data Collection								■	■			
9	Data Entry, Analysis, and Interpretation									■			
10	Preparation of Results Report Writing									■			
11	Thesis Examination									■			
12	Thesis Revision										■		
13	Thesis Approval with Examiners and Study Program Head											■	■
14	Submission of Thesis to the Study Program												■
15	Compiling the Manuscript											■	■
16	Submitting the Manuscript to a Scientific Journal												■
17	Submitting the Publication LOA to the Study Program												■
18	Submission of the Published Article to the Study Program												■

Chart 4.3 Activity Schedule