

CHAPTER IV RESEARCH METHODS

A. Types of Research and Research Design

This type of research is quantitative using a quasi-experimental design with *pre-test* and *post-test*. This study consisted of two groups, namely the intervention group and the control group. Both of them were first taken initial measurements (*pre-test*). In the intervention group, exercises were given in the form of *cawthorne-cooksey exercises* and *proprioceptive exercises*, then follow-up measurements (*post-tests*) were carried out. The results of this *post-test* were then compared with the results in the control group who were given an intervention in the form of *balance exercises*. The *pre-test* is used to assess the initial balance of the elderly who are at risk of falling. The research design is described systematically with the model below:

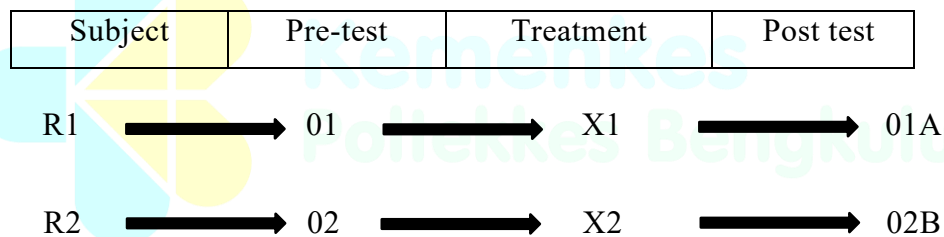


Chart 4. 1 Research model

Description:

- R1 : Respondents in the intervention group
- R2 : Respondents in the control group
- 01 : Balance measurement before intervention in the intervention group
- 02 : Balance measurement before intervention in the control group
- X1 : Intervention group treatment before being given *cawthorne-cooksey-exercises* and *proprioceptive exercises*

- X2 : Treatment of the control group before being given *balance exercises*
 01A : Balance measurement after intervention in the intervention group
 02B : Balance measurements after intervention in the control group

B. Research Variables

1. Independent Variables

The independent variables in this study were *cawthorne-cooksey exercises* and *proprioceptive exercises*.

2. Dependent Variable

The dependent variable in this study is the improvement of the balance of the elderly.

C. Research Location and Time

1. Location

The place of this research was carried out in the working area of the Kuala Lempuing Health Center, Bengkulu City.

2. Time

The research time was carried out from February 1 - March 10, 2026.

D. Population and Sample

1. Population

Population is all objects and research subjects that have certain characteristics or characteristics so that they are worthy of research and used as a basis for drawing conclusions (Suriani et al., 2023). The population in this study is the elderly aged ≥ 60 years with balance disorders, in the working area of the Kuala Lempuing Health Center in 2026 with an estimate based on the number of elderly people who experience balance disorders in 2024 with a total of 311 elderly people in the working area of the Kuala Lempuing Health Center.

2. Sample

A sample is a part of a population that is deliberately chosen by the researcher to be used as an object of observation. It is smaller in number than

the population and is used as a representative of that population (Mushofa et al., 2024).

The calculation of the number of samples in this study is based on the formula of two *means difference*, in particular:

$$n = \frac{\sigma^2 (Z_{1-\alpha} + Z_{1-\beta})^2}{(\mu^\alpha - \mu^o)^2}$$

Description:

n : Number of samples

Z_{1-α} : Normal standard deviation for α (standard deviation α = 1.96)

Z_{1-β} : Normal standard deviation for β (standard deviation β = 1.28)

μ^o : Mean value before intervention obtained from the literature

μ^α : Mean value after intervention obtained from the literature

σ : Standard deviation/standard deviation

Based on research conducted by Boonkerd, et al (2025), in 70 elderly people in Pathum Thani, Thailand, who underwent a program *Balance Training* To improve balance, a mean value before the intervention is obtained (μ^o = 51.09), mean value after intervention (μ^a =), as well as the difference in standard deviation (σ = 1.06) measured using 51,81 *Mountain Balance Scale* (BBS). The average difference in the reported balance score increase was 0.72 points.

a. Search n

$$\begin{aligned} n &= \frac{\sigma^2 (Z_{1-\alpha} + Z_{1-\beta})^2}{(\mu^\alpha - \mu^o)^2} \\ n &= 1,06^2 \frac{(1,96 + 1,28)^2}{(51,81 - 51,09)^2} \\ n &= 1,124 \frac{(3,24)^2}{(0,72)^2} \\ n &= \frac{1,124 \cdot 10,498}{0,518} \end{aligned}$$

$$n = \frac{11,8}{0,518}$$

$$n = 22,78 \approx 23$$

b. Looking for *a drop out*

Value (*n*) with *a 10%* drop out

$$n' = n / (1 - f)$$

$$n' = 23 / (1 - 0.1)$$

$$n' = 23 / 0.9$$

$$n' = 25,556 \approx 26 \text{ people}$$

Total sample = 26 people, but the researcher set the number of samples as 30 people.

This study consisted of two groups, namely the intervention group and the control group, each group consisting of 30 participants. With a total of 60 participants in this study.

3. Sampling techniques

Non-probability sampling is a sampling technique that does not provide an equal opportunity for every member of the population to be selected as a sample. The selection of respondents was carried out based on certain considerations that were adjusted to the research objectives, such as the characteristics of inclusion criteria, or the ease of reaching respondents (Wahab & Junaedi, 2022). One of the sampling techniques in this study uses *purposive sampling*, in this method, the researcher assigns the sample directly based on certain considerations. In this case, the selected sample was elderly with balance disorders.

The sampling technique used is *purposive sampling* based on the following inclusion and exclusion criteria:

a. Inclusion criteria

- 1) Willing to be a research respondent
- 2) Elderly aged ≥ 60 years old
- 3) Have good hearing and vision functions
- 4) Elderly people who can stand and walk with or without aids

- 5) Elderly people who have a balance disorder with the *Berg Balance Scale* are at moderate risk of falling with a value of 21-40
- 6) Cooperative elderly
- 7) Elderly people who have normal blood pressure
- b. Exclusion criteria
 - 1) Elderly people who suddenly experience an increase in blood pressure while the study is ongoing
 - 2) Elderly who cannot continue their research have a maximum of 3-2 meetings
 - 3) Elderly people who were suddenly sick/hospitalized during the study

E. Data Collection

1. Data Source

a. Primary Data

Primary data is data that researchers collect directly from the source during the implementation of the research (Shawn & Shawn, 2024). In this study, data related to balance disorders in the elderly were obtained through observation techniques using instruments *Mountain Balance Scale* (BBS).

b. Secondary Data

Secondary data is data collected by researchers through intermediary or indirect sources (Shawn & Shawn, 2024). In this study, the secondary data used comes from the Kuala Lempuing Health Center, Bengkulu City in 2025. The data taken includes the number of elderly people aged 60 years and older at the Kuala Lempuing Health Center, Bengkulu City in 2025.

2. Data Collection Tools

Data collection in this study was carried out with a *balance measurement checklist* sheet with the *Berg Balance Scale* (BBS) instrument as a balance measurement tool modified with *google form*.

3. Test Data Collection Tools

Studies conducted by Miyata, et al (2022), indicates the instrument *Mountain Balance Scale* (BBS) proven to be valid and reliable. This is proven through analysis *Rasch* that indicates the value of *Person Separation Reliability* (PSR) of 0.96 and *Cronbach's alpha* of 0.97, which indicates a very good level of reliability. Thus, BBS can be applied as a valid and consistent instrument in assessing balance in the elderly (Miyata et al., 2022).

4. Data Collection Procedure

The data collection approach in this study is carried out through several stages.

- a. Data on respondent characteristics were obtained using interview methods and observation sheets.
- b. Interventions were carried out based on standard procedures/SOPs in the form of *Cawthorne-Cooksey Exercises* and *Proprioceptive Exercises*.
- c. Respondents' balance measurements were made using a *modified Berg Balance Scale* (BBS) observation sheet using *Google Forms*

F. Data Processing

According to Kamaruddin and Yanis (2023), data processing is a series of activities to collect and organize data from each research variable so that the data is in a form that is ready to be analyzed and evaluated. Here is how data is processed in quantitative research:

1. Editing

Editing is the initial stage in data processing, where researchers check the completeness of the data collected in the field. At this stage, the data is reviewed, selected, and corrected, including ensuring the completeness of the number and filling out the questionnaire. This inspection process is carried out first so that the data is more structured and facilitates the next processing step.

2. Coding

Coding is a data processing stage where respondents' answers are grouped by assigning certain codes or numbers, making it easier for researchers to process and analyze data systematically.

3. *Entry Data*

Data entry or data tabulation is the stage of entering the answer code into the columns that have been prepared beforehand. This process demands high precision to prevent input errors or duplication of data, so that the processing results remain accurate.

4. *Processing*

The processing stage includes data processing using a computer program, so that information is obtained that is ready for further analysis.

5. *Cleaning*

Data cleansing is done by double-checking the data that has been entered, aiming to make sure all encoding, typing, or other errors are correct so that the data is ready for analysis.

G. Data Analysis

1. Univariate Analysis

Univariate data analysis was conducted to describe the general characteristics of respondents in the study. In numerical data such as age, *pre-test* and *post-test* scores, descriptive statistical analysis was used including mean score, median, maximum score, minimum value, standard deviation, and *95% confidence interval* from the mean. Meanwhile, categorical data such as gender and physical activity were analyzed using frequency and percentage distributions. Furthermore, the results of the analysis of each variable are presented in the form of a table according to the findings obtained.

2. Bivariate Analysis

The bivariate analysis in this study began through two stages of testing, namely the equivalence test and the normality test using *the Shapiro wilk* method. To see the difference in *pre-post* balance values within the group, *the Wilcoxon Signed-Rank* test was used because the data was not normally distributed. Meanwhile, to see the effect of *Cawthorne-Cooksey exercises* and *proprioceptive exercises*, as well as *balance exercises* therapy on balance

in the elderly at risk of falling, the *Mann-Whitney test* was used because the data were not normally distributed

Table 4. 1 Bivariate Test

Yes	Variable	Non-Parametric Test
1.	Value of pre-post <i>balance differences</i> in groups	<i>Wilcoxon Signed-Rank Test</i>
2.	Value of pre-post <i>balance differences</i> between groups	<i>Mann-Whitney Test</i>



H. Research Flow

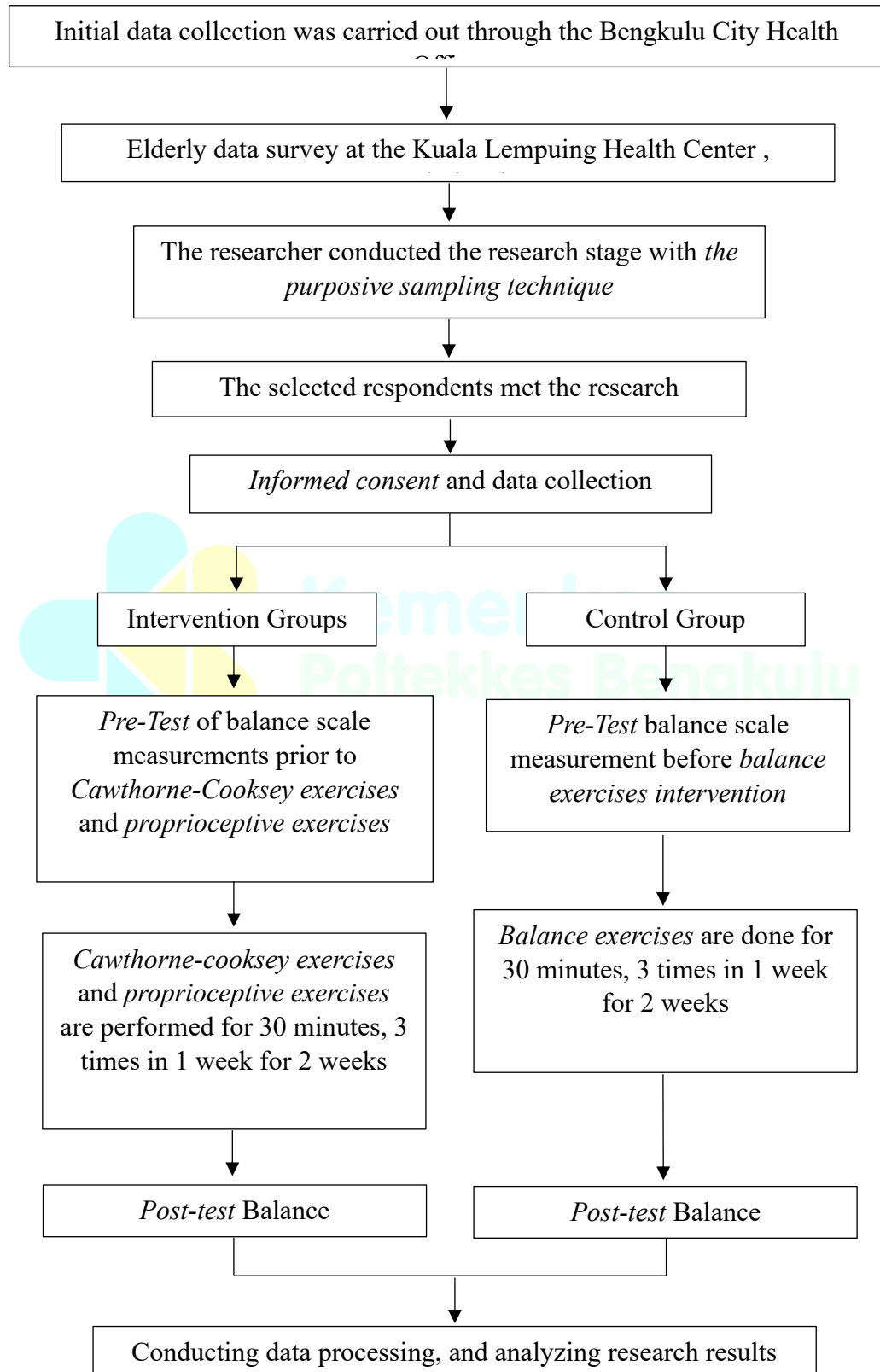


Chart 4. 2 Research flow

I. Research Ethics

According to Hansen, et al (2023), the researcher will consider ethical aspects and legal compliance to protect respondents from all forms of risk, including physical and psychological harm and discomfort. This research has passed an ethical review and was declared feasible by the Ethics Commission of the Bengkulu Ministry of Health (NO. KEPK. BKL/026/01/2026). *Etchical clearance* Consider the following aspects:

1. Right to participate/not be a respondent (*Self determinant*)

In this study, respondents were given full freedom to choose their participation or not, without coercion or pressure from any party.

2. *Anonymity*

The respondent's identity is not written directly in the results of the study, the respondent's name is written with initials and a number code, and the signature is listed on the written consent sheet.

3. Confidentiality

All data obtained from respondents is kept confidential and will not be disseminated. The data is stored in *soft file form* on the researchers' laptops and *personal drives*.

4. Justice

During the study, the researcher is obliged to guarantee the rights of the respondents fairly according to the agreement before the research begins.

5. The principle of *beneficence*

All respondents involved in this study found that it was useful to improve the balance that could be done independently/independently.

6. *Non-maleficence*

The researcher ensures that during the study, there will be no discomfort, pain, or things that harm the respondents physically or psychologically.

J. Activity Plan

Research activities will be carried out according to the following schedule:

Table 4. 2 Thesis Research Schedule

[illegible]