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# *THE EFFECT OF NON-PHARMACOLOGICAL INTERVENTION ON VITAL SIGNS IN PREGNANT WOMEN WITH HYPERTENSION*

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**Abstract**

**Background**: Pregnancy induced Hypertension (PIH) is a significant cause of maternal and fetal death. Although, the intervention approach that takes into account physical and psychological conditions is not yet optimal. This study aims to determine the efforts of relaxation technique therapy on the difference in heart rate dan oxygen saturation level ($SpO_2$) in pregnant women with hypertension. **Method**: This study used a cross-over design. A total of 36 pregnant women with third trimester hypertension obtained by random sampling technique were given bed rest therapy for 5 days 1 x 20 minutes and given relaxation therapy for 5 days 1 x 20 minutes. Bedrest is a health treatment where the client lies in bed certain period of time and relaxation therapy is techniques involve tensing and relaxing muscles in sequence which is a psychological mechanism that connects the mind and body. Measurements using a pulse oximeter. Data were analyzed using the Friedman and Wilcoxon tests. **Results**: The results of the study showed a significant difference in relaxation technique therapy and bed rest therapy on reducing in normal heart rate ($P < 0.001$) and oxygen saturation levels ($SpO_2$) with $P < 0,05$. The average decrease in heart rate and increased oxygen saturation levels ($SpO_2$) was greater in the relaxation technique therapy group and the confounding variables have no effect on either. **Conclusion**: Relaxation techniques can reduce heart rate and increased $SpO_2$ to optimal in pregnant women with hypertension. Relaxation techniques can be a complementary therapy in midwifery care for pregnant women with hypertension.

Keyword : Relaxation, heart rate, increased oxygen saturation levels ($SpO_2$), pregnancy induced hypertension.

## INTRODUCTION

Pregnancy induced hypertension (PIH) is a condition where systolic blood pressure is ≥ 140 mmHg and diastolic ≥ 90 mmHg with measurements at least twice with a difference of 4 hours in pregnant women. Pregnancy complications due to hypertension account for 5-10%, which is the main cause of maternal and infant morbidity and mortality, such as premature birth, Intrauterine Growth Restriction (IUGR), Intrauterine Fetal Death (IUFD), placental abruption, increasing the incidence of Sectio Cesarea (SC), kidney failure, heart failure and maternal death (Kementerian Kesehatan RI, 2014; Dimitrova N, Zamudio JR and Jong RM, 2017).

Pregnant women will often experience ambivalent feelings, namely feelings of sadness and happiness that occur alternately even at the same time. Anxiety is

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believed to be an uncomfortable feeling experienced by someone, especially pregnant women (Kneisl, WIlson and Trigoboff, 2012; Sujianti and Dhamayanti, 2012). Pregnancy in mothers with complications such as hypertension in pregnancy has a higher risk of experiencing stress such as depression and anxiety (Bastard J and Tiran D, 2009). During stress exposure, the entire stress regulation system, namely the hypothalamic-pituitary-adrenal cortex system and the sympathetic nervous system-adrenal medulla system, are activated. Anxiety will result in changes in vital signs, such as increased blood pressure, heart rate, and respiratory rate. With increased sympathetic activity, it can cause at least a 15-20% increase in heart rate (Calimag-Loyola APP and Lerma E V, 2019).

Management of anxiety related to optimizing vital signs is limited to pharmacological therapy such as administration of blood pressure lowering drugs. However, this therapy has side effects such as dizziness, flushing, headache, nausea, peripheral edema, and transient hypotension. Non-pharmacological management such as relaxation techniques can be an alternative complementary therapy to optimalisasi heart rate dan kadar saturasi oksigen ($SpO_2$) in pregnant women with hypertension (Ward PJ, Clarke WR and Linden RW, 2009).

Efforts to overcome anxiety in pregnant women with hypertension have been carried out, such as providing dhikr therapy, murottal therapy, green color therapy, five-finger hypnosis, Cognitive Behavioral Therapy (CBT), psychological education, classical Turkish music therapy (Asghari, Faramarzi and Mohammmadi, 2016; Toker and Kömürcü, 2017; Widiastuti *et al.*, 2018; Abazarnejad *et al.*, 2019; Mamlukah *et al.*, 2019). However, these efforts are less able to be done independently by the client and have not considered the physical and psychological aspects as a whole.

Progressive Muscle Relaxation (PMR) is a technique of tensing and relaxing muscles sequentially which is a psychological mechanism that connects the mind and body. PMR is done by tensing the muscles for 5 seconds and relaxing for 5-10 seconds on the forehead, eyes, mouth, jaw, neck, chest, shoulders, back, biceps, hands, thighs, calves and toes which is done for 20-30 minutes (Jose R and D'Almeida V, 2013). In a relaxed state, the body will rest and activate the parasympathetic nervous system. The parasympathetic nervous system also

produces Ach as a neurotransmitter which is then inactivated by acetylcholine which inhibits or reduces the rate of chemical reactions. So that there is a decrease in heart rate and $SpO_2$ will increase (Chu *et al.*, 2024). PMR is very important to do because this relaxation technique is quite easy, does not require imagination, involves mind-body therapy and is an alternative to overcome anxiety in pregnant women with hypertension, but until now it has not been proven. This study aims to determine the difference in heart rate and oxygen saturation levels ($SpO_2$) in pregnant women with hypertension after being given relaxation techniques.

## METHOD

The research location was at the Magelang Regency Health Center, Cetral Java Indonesia. The design of this study was a quasi-experimental study with a cross-over study design. The subjects were pregnant women third trimester with hypertension.. The sampling technique was simple random sampling, 36 respondents were obtained. The sample inclusion criteria included: blood pressure ≥ 140/90 mmHg, maternal age 20-35 years, gestational age 28-36 weeks, have no other health complications (musculoskeletal disorders, bleeding, seizures, respiratory diseases), having anxiety problems and living in the research area, confounding variables (age, gestational age, and physical activity) have been controlled. Respondents were given 20 minutes of bed rest therapy every day on the first day to the 5th day, on the 6th day a washout or rest was carried out, then on the 7th to 11th day relaxation therapy was given, namely Progressive Muscle Relaxation (PMR) therapy for 20 minutes. The heart rate and oxygen saturation levels ($SpO_2$) measurement instrument used pulse oximetry. The heart rate and $SpO_2$ was measured every day, the first to the 5th day and the 7th to the 11th day. Data analysis used the parametric paired t-test Friedman + post hoc Wilcoxon test.

## RESULT AND DISCUSSION

The characteristics of respondents in this study consist of education, income, occupation, parity can be seen in Table 1.

**Table 1 Frequency Distribution of Respondent Characteristics based on Education, Parity, Income, and Occupation.**

| Characteristics | | Frequency (n) | Presentation (%) |
|---|---|---|---|
| Education | | | |
| | Elementary School | 16 | 44,5 |
| | Junior High School | 17 | 47,2 |
| | Senior High School | 3 | 8,3 |
| Parity | | | |
| | Primigravida | 10 | 27,8 |
| | Multigravida | 26 | 72,2 |
| Income | | | |
| | < UMR | 21 | 58,3 |
| | ≥ UMR | 15 | 41,7 |
| Occupation | | | |
| | Working mom | 10 | 27,8 |
| | Housewife | 26 | 72,2 |

The results of the analysis of the distribution of respondent characteristics in the table show that most respondents have junior high school education as many as 17 people (47.2%), then based on parity it can be seen that some respondents are multigravida as many as 26 people (72.2%), the majority of respondents have family incomes less than the minimum wage as many as 21 people (58.3%) and according to occupation, most respondents are unemployed as many as 26 people (72.2%).

The characteristics of respondents based on age, gestational age, physical activity and BMI of respondents are shown in Table 2.

**Table 2 Distribution of Respondents Based on Age, Gestational Age, Physical Activity, and BMI.**

| Variabel | n | Mean | SD | Min | Max | 95%CI |
|---|---|---|---|---|---|---|
| Age | 36 | 28,06 | 4,57 | 20 | 35 | 26,51-29,60 |
| Gestational age | 36 | 31,45 | 2,42 | 28 | 36 | 30,63-32,27 |
| Physic Activity | 36 | 184,9 | 62,8 | 96,82 | 362,5 | 163,6-206,1 |
| BMI | 36 | 26,36 | 3,17 | 21,5 | 34 | 25,28-27,43 |

Table 2 shows that the mean age is 28.06 with a standard deviation of 4.57. The average estimated results at a 95% confidence level are around 26.51 years to 29.6 years. The lowest age is 20 years and the highest age is 35 years. The

gestational age of the respondents shows a mean of 31.45 with the lowest gestational age of 28 weeks and the highest gestational age of 36 weeks. The average physical activity of the respondents is 184.9 MET/week with a standard deviation of 62.8. The lowest BMI of the respondents is 21.5 kg/m2 and the highest BMI is 25 kg/m2.

The results of the comparative analysis of heart rate frequency in hypertensive pregnant women before and after treatment can be seen in Table 3.

**Table 3 Results of Comparative Analysis of Heart Rate Frequency Before and After Treatment**.

| Heart Rate Frequency | Group | | | |
|---|---|---|---|---|
| | Intervention | | Control | |
| | Median(min-max) | P-value | Median(min-max) | P-value |
| Pre-Test (n=36),bpm | 101 (90-120) | 0,000 | 101 (90-120) | 0,010 |
| Post-Test day-1 | 99,5 (85-117) | | 100 (85-120) | |
| Post-Test day-2 | 99,5 (85-115) | | 101 (90-117) | |
| Post-Test day-3 | 98 (85-110) | | 100 (87-120) | |
| Post-Test day-4 | 93 (81-106) | | 100 (89-118) | |
| Post-Test day-5 | 90 (80-101) | | 100 (85-118) | |

*Friedman

Table 3 shows that the results of the Friedman test obtained a p-value <0.05 in the intervention group and the control group, which means that there were at least two different heart rate measurements before and after relaxation technique therapy and bed rest therapy.

The results of the comparative analysis of pulse rate frequency in the control group and intervention group according to time can be seen in table 4.

**Table 4 Results of Comparative Analysis of Pulse Rate Frequency by Time.**

| Heart Rate Frequency | Group | |
|---|---|---|
| | Intervention | Control |
| | P-value | P-value |
| *Pre-Test* vs *Post-Test* day-1 | 0,000 | 0,070 |
| *Pre-Test* vs *Post-Test* day-2 | 0,000 | 0,099 |
| *Pre-Test* vs *Post-Test* day -3 | 0,000 | 0,084 |
| *Pre-Test* vs *Post-Test* day -4 | 0,000 | 0,001 |
| *Pre-Test* vs *Post-Test* day -5 | 0,000 | 0,000 |

*Post Hoc Wilcoxon

Table 4 shows that the results of the Wilcoxon Post Hoc Test in the group obtained pulse frequency before therapy vs day 1 to day 5 has a p-value of 0.000 so it can be concluded that the difference in pulse frequency starts on the first day, while in the control group it shows that the difference in pulse frequency occurs on days 4 and 5.

The results of the study on the heart rate of pregnant women given to the relaxation group and the bed rest group are shown in Table .

**Table 5 Differences in Mean Heart Rate in the Intervention and Control Groups.**

| Variable and Group (n=36) | Intervention | Control | p value |
|---|---|---|---|
| | Mean±SD | Mean±SD | |
| Pre-Test | 102,2±7,69 | 102,47±8,12 | 0,000 |
| Post-Test 1 | 100,11±8,5 | 101,81±8,09 | |
| Post-Test 2 | 98,25 ± 7,2 | 101,69 ± 7,87 | |
| Post-Test 3 | 95,89 ± 6,9 | 101,61±8,06 | |
| Post-Test 4 | 92,47±5,9 | 101,17±7,6 | |
| Post-Test 5 | 89,42±6,0 | 100,7±8,0 | |
| Difference | 12,81±5,84 | 1,72±2,386 | |
| p value | 0,000 | 0,010 | |

*wilcoxon

Based on table 5, it can be seen in the intervention group, changes in heart rate from day to day in each observation tended to decrease. The mean difference was 12.81 with a standard deviation of 5.84. While in the control group, the mean difference was 1.72 with a standard deviation of 2.386. The p-value obtained was 0.000 <0.05, which means there was a significant difference in heart rate in the intervention group given relaxation technique therapy and the control group given bed rest therapy.

Oxygen Saturation Level ($SpO_2$) measurements were carried out every day for five days, so that there were five measurements in each group which aimed to determine the effect of PMR and bed rest on changes in Oxygen Saturation Level ($SPO_2$). The results of the comparative analysis of Oxygen Saturation Level ($SpO_2$) in hypertensive pregnant women before and after treatment can be seen in Table 6.

**Table 6 Results of Comparative Analysis of Level ($SpO_2$) Before and After Treatment.**

| SpO2 | Group | | | |
|---|---|---|---|---|
| | Intervention | | Control | |
| | Median(min-max) | *P-value* | Median(min-max) | *P-value* |
| Pre-Test (n=36), % | 98 (97-99) | 0,000 | 98 (97-99) | 0,561 |
| Post-Test day-1 | 98 (98-99) | | 98 (97-99) | |
| Post-Test day-2 | 98,5 (98-99) | | 98 (97-99) | |
| Post-Test day-3 | 99 (98-99) | | 98 (97-99) | |
| Post-Test day-4 | 99 (98-99) | | 98 (97-99) | |
| Post-Test day-5 | 99 (98-99) | | 98 (97-99) | |

*Friedman

Table 6 shows that the results of the Friedman test obtained a p-value < 0.05 in the intervention group, which means that there were at least two different measurements of oxygen saturation levels ($SpO_2$), while in the control group a p-value > 0.05 was obtained, which means there was no difference in oxygen saturation levels ($SpO_2$) before and after the intervention.

**Tabel 7 Results of Comparative Analysis of Oxygen Saturation Levels ($SPO_2$) by Time.**

| SpO2 (%) | Group | |
|---|---|---|
| | Intervention | Control |
| | P-value* | P-value* |
| Pre-Test vs Post-Test day-1 | 0,480 | 0,564 |
| Pre-Test vs Post-Test day-2 | 0,109 | 0,655 |
| Pre-Test vs Post-Test day -3 | 0,021 | 0,655 |
| Pre-Test vs Post-Test day-4 | 0,005 | 0,414 |
| Pre-Test vs Post-Test day -5 | 0,005 | 0,739 |

*Post Hoc Wilcoxon

Based on table 7, it shows that statistically and clinically, the oxygen saturation level ($SpO_2$) before PMR therapy is different from the oxygen saturation level ($SpO_2$) after three days, four days, and five days of therapy with a p-value < 005.

The results of the study on the oxygen saturation levels ($SpO_2$) of pregnant women given to the relaxation group and the bed rest group are shown in Tabel 8.

**Table 8 Results of Comparative Analysis of Oxygen Saturation Levels (SpO2) in the Intervention Group and Control Group.**

*Wilcoxon

Table 8 shows that the intervention group has a median oxygen saturation level ($SpO_2$) that tends to increase in observations from the first to the fifth day of post-test. While in the control group, the median remains at 98 from the first to the fifth day of post-test. The p-value shows that the amount is 0.008 <0.05, so it can be concluded that there is a difference in oxygen saturation levels ($SpO_2$) in the intervention group and the control group.

Results of the analysis of the relationship between confounding variables with pulse rate and oxygen saturation levels are shown in Table 9.

**Table 9 Relationship between Confounding Variables with Pulse Rate, and Oxygen Saturation Levels ($SpO_2$).**

| | Variabel | Heart Rate | SpO2 |
|---|---|---|---|
| P-value | **Age** | 0,163 | 0,168 |
| | **Pregnancy Age** | 0,746 | 0,399 |
| | **Physical Activity** | 0,725 | 0,355 |

**Spearman Test*

The results of statistical tests showed in table 9 is no significant relationship between confounding variables (age, gestational age, and physical activity) with pulse rate, or oxygen saturation levels with P > 0.05.

The results of the statistical test showed that there was a significant difference in heart rate in the group given PMR therapy and the bed rest group with a P value of 0.000 <0.05. After conducting the Post Hoc Wilcoxon test, it was found that the difference in heart rate in the intervention group, namely the one given relaxation therapy, occurred starting on the first day after the intervention with a p-value of 0.000 <0.05.

| SpO2 | Group | | P-value |
|---|---|---|---|
| | Intervention | Control | |
| | Mean±SD | Mean±SD | |
| Pre-test | 98,33 ± 0,63 | 98,33 ± 0,63 | 0,008 |
| Post-test 1 | 98,39 ± 0,49 | 98,31 ± 0,64 | |
| Post-test 2 | 98,50 ± 0,50 | 98,31 ± 0,62 | |
| Post-test 3 | 98,58 ± 0,50 | 98,36 ± 0,59 | |
| Post-test 4 | 98,64 ± 0,48 | 98,39 ± 0,59 | |
| Post-test 5 | 98,64 ± 0,48 | 98,36 ± 0,63 | |

After being given PMR therapy, the results based on the Friedman Test showed a change in oxygen saturation levels ($SpO_2$) with a P value of 0.000. The Wilcoxon Post Hoc test showed that changes in oxygen saturation levels (SPO2) occurred starting from the third day statistically with a P value of 0.021 (<0.05).

Based on the results of statistical tests, it was shown that there was a difference in oxygen saturation levels between the intervention group, namely those given PMR therapy and the control group given bed rest therapy with a P value of 0.008 <0.05.

Heart rate is influenced by the sympathetic nerves that stimulate the adrenal medulla to release the hormones adrenaline (epinephrine) and noradrenaline (norepinephrine). Epinephrine and norepinephrine will increase the rate of decrease in the pacemaker potential so that the time required to reach the threshold is faster, thus the rate of decrease in the SA node resting potential is also fast which will cause the heart rate to increase. Meanwhile, pregnant women with hypertension have a higher risk of anxiety, so the effect of sympathetic nerve exposure is higher (Ward PJ, Clarke WR and Linden RW, 2009).

In a state of anxiety, the hypothalamus stimulates the cortex and amygdala to influence the pneumotaxis center in the pons, chemoreceptors and lung receptors in the medulla which can cause changes in the respiratory pattern, namely increased respiratory rate. When the respiratory rate increases, hyperventilation will occur, hyperventilation normally cannot increase O2 content. While oxygen transport throughout the body requires inadequate respiratory system function from the exchange of O2 and CO2 will affect the oxygen saturation level to decrease (Ward, Clarke and Linden, 2009).

This study revealed that pregnant women with hypertension in the Magelang Regency Health Center area before being given therapy had a heart rate faster than normal (tachycardia) and there is an increase in oxygen saturation levels ($SpO_2$) to optimal levels. Namely, in the intervention group the average heart rate was 102.2 and in the control group 102.47. Before being given relaxation therapy, the heart rate of pregnant women with hypertension was tachycardia. After being given relaxation therapy, the heart rate decreased to a normal heart rate. Likewise, SpO2 showed an increase of 1% after PMR therapy. This study involved 36 pregnant women with hypertension. Control of confounding variables such as maternal age, gestational age, and physical activity has been carried out. The limited number of respondents in the study can make the results of the study to be generalized to a wider population also limited.

This study is in line with research conducted by Urech on pregnant women in the third trimester who underwent PMR therapy once for 30 minutes which

showed a decrease in heart rate of P < .001 compared to the control group (Pan L, Zhang J and Li L, 2012).

Nickel in his research conducted on pregnant women with asthma after being given PMR therapy for 10 minutes was able to significantly reduce the heart rate (P < 0.001) compared to the control group (Nickel C, Lahmann C and Muehlbacher M, 2016).

Other studies revealed that there was a statistically significant difference in PMR therapy on reducing the heart rate with P < 0.05 (Trisnowiyanto, Kesehatan and Surakarta, 2015; Sahin and Basak, 2020). So it can be concluded that PMR is effective in reducing the heart rate in pregnant women with hypertension.

With relaxation therapy, the body will experience relaxation or experience a resting phase. At that time the body will activate the parasympathetic system. The parasympathetic nerves produce Ach as a neurotransmitter which is then inactivated by acetylcholine. This acetylcholine works on muscarinic cholinergic whose response is excitation or inhibitor which is a substance that inhibits or reduces the rate of chemical reactions. As a result, the rate of decrease in the pacemaker potential decreases which results in a longer time required to reach the threshold and a longer rate of decrease in the SA node resting potential so that there is a decrease in heart rate and heart rate will decrease (Ward PJ, Clarke WR and Linden RW, 2009).

Exercise can produce molecular, microscopic, and macroscopic changes that improve each of these variables and increase oxygen delivery to the trained muscles (Jonathan, Mark E and Opotowsky, 2019). The parasympathetic system can decrease the respiratory rate which causes more adequate oxygen transport so that the level of oxygen bound to hemoglobin (oxygen saturation) distributed throughout the body is more optimal (Calimag-Loyola APP and Lerma E V, 2019).

The results of the research that has been conducted are in line with the research conducted by Cahyati et al on 30 patients with chronic heart disease which proved that PMR therapy can increase oxygen saturation levels statistically significantly (P = 0.000 < 0.05) (Cahyati, Herliana and Februanti, 2020).

The results of other studies on PMR therapy can significantly increase oxygen saturation levels (P < 0.05), namely in research conducted by Dinaryanti et al on 19 lung cancer patients who were given PMR therapy for 5 days (Dinaryanti, 2019).

Based on the research results, it is known that the covariate variables contained in this study, namely age, gestational age, and physical activity, showed that there was no relationship with heart rate and oxygen saturation levels ($SpO_2$) with a P value > 0.05.

The results of the study are in line with Fadlilah's research which stated that there was no significant relationship between age and oxygen saturation levels ($SpO_2$) with P>0.05 (Fadlilah, Rahil and Lanni, 2020).

This is different from the theory that age can affect the pulse rate. The pulse rate will gradually settle to meet the oxygen needs as age goes by. In old age the pulse rate will decrease by 50% from the age of adolescence (Sandi, 2013). Because in this study the respondents' age was 20-35 years which does not include teenagers or the elderly.

The research results are not in line with the theory that states that physical activity is an indirect factor that affects oxygen saturation levels and heart rate in pregnant women because physical activity affects erythrocyte and hemoglobin levels (Ward, Clarke and Linden, 2009).

However, the results of this study are in line with the results of research conducted by Alza which showed that physical activity had no effect on anxiety in pregnant women in the third trimester (Alza, 2017). In addition, research conducted by Widhisusanti revealed that there was no relationship between physical activity and oxygen saturation levels (SpO2) with P>0.05 (Widhisusanti, 2016).

## CONCLUSION AND SUGGESTION

The results showed a significant difference in heart rate and oxygen saturation levels ($SpO_2$) between those given relaxation therapy and bed rest therapy, and the decrease in heart rate in the relaxation therapy group was greater than in the bed rest group (P <0.05). Variable confounding such as age, gestational age, and physical activity have not been shown to affect changes in heart rate and oxygen saturation levels (P > 0.05). So it can be concluded that relaxation techniques can make the heart rate and oxygen saturation levels (SpO2) in pregnant women with hypertension optimal.

For health workers, PMR can be an alternative complementary therapy in caring for pregnant women with hypertension. Further research is needed with the addition of variables and a longer research duration in order to obtain long-term effects of PMR therapy.

## DECLARATION

### Conflict of Interest

In this sub-section, the authors declare that there is no conflict of interest in this research. This ensures transparency and integrity in the research process.

### Authors' Contribution

I declare that all authors have approved the authorship sequence, the content of the paper, and the release of the paper for publication.

### Ethical Approval

Ethical clearance was obtained from the Health Research Ethics Commission of Dr. Moewardi Hospital number 050/I/HREC/2020.

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### Data Availability

The author encourages transparency and invites other researchers to verify and develop this research.

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