Original Research Article

EFFECT OF PROGRESSIVE MUSCLE RELAXATION EXERCISE BASED ON ARDUINO UNO ON BLOOD SUGAR, CHOLESTEROL AND URID ACID LEVELS IN THE ELDERLY

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Abstract

Background: Elderly people often experience changes in cholesterol, uric acid, and blood sugar levels which tend to increase their disease.

Objectives: This study aims to determine the effect of progressive muscle relaxation training on blood sugar, choleterol and uric acid levels in the elderly in Medan Sunggal sub-district.

Methods: This research study used an pre-experimental one group pretest-postest with examination of blood sugar, cholesterol and uric acid levels before and after progressive muscle relaxation exercises. Respondents in the study were 39 elderly in environment II and III of Medan Sunggal District. Blood sugar, cholesterol and uric acid levels were measured before the first session and after the progressive muscle relaxation training session ended three times a week for 4 weeks. The implementation of progressive muscle relaxation therapy using a tool or standard operating procedure (SOP) with an instrument for measuring cholesterol, blood sugar and uric acid is a detection tool for the nesco multicheck-1 brand. Data analysis in this study using SPSS 26.

Results: These results were analyzed using the Wilcoxon test using SPSS 26. Data analysis found that the value of blood sugar levels of $1,000 > 0.05$ means that Ha is rejected, which means that there is no effect between blood sugar levels and progressive muscle relaxation exercises. Cholesterol value $0.157 > 0.05$ means that there is no effect of cholesterol levels with progressive muscle relaxation exercises. However, it is different from the value of uric acid levels of $0.046 < 0.05$, meaning that Ha is accepted where there is a significant effect between pre and post Arduino Uno-based progressive muscle relaxation exercises.

Conclusion: Progressive muscle relaxation exercises only affect uric acid levels and have no effect on cholesterol and blood sugar levels in the elderly. The implication of this study is that it is used for the elderly who experience impaired physical activity, joint pain and increased uric acid. The results of this study are expected to be able to improve the quality of life of the elderly well.

Keywords: Progressive Muscle Relaxation Exercises, The Elderly, Arduino Uno.

INTRODUCTION

The elderly population of the world's total population will experience an increase of 15% in 2025 and an increase of 25% in 2050. Asia and the Pacific will experience a rapid increase of 733 million in 2025. Indonesia is a developing country which has an elderly population of 9.77% (23.9%) in 2010 and is predicted to increase in 2020 around 11.34% (28.8 million people) (wati, 2012). The elderly experience changes in body composition, muscles, bones and joints, cardiovascular system, respiration and cognition. One of them is changes in blood sugar, cholesterol, and uric acid levels (Ambardini, 2020; Frihastuti, 2018; Saputro & Amalia, 2018). Factors that affect the increase in blood sugar, cholesterol and uric acid levels are excess weight, decreased cell function, and lack of physical activity. (Afnuhazi, 2019; Ira Mutiara Kusuma, M.Haffidudin, 2017; Natalia, n.d.). One of the efforts to prevent diseases that cause an increase in blood sugar, cholesterol and uric acid levels is to do muscle training (Anindyaputri, 2019). Research conducted by (Yunita, Jannah, Hidayah, & Utomo, 2019) showed that blood sugar levels in patients with diabetes mellitus type 2 decreased by doing walking exercises and progressive muscle relaxation. The combination of walking exercise and progressive muscle relaxation is able to stimulate glycogen synthesis by increasing the action of insulin and glucose transport GLUT4 and inhibiting stressors thereby strengthening a positive attitude towards stress stimuli which results in reduced hypothalamus. Aerobic exercise can reduce the ratio of total cholesterol to high density lipoprotein cholesterol in the elderly (Kelley, Kelley, & Tran, 2005). Research (Dewi, 2017) shows that the majority of respondents aged 56-65 years with a percentage of 46.7%, are female as much as 66.7% with a long time suffering from diabetes <10 years as much as 83.3% and the majority work as housewives doing progressive muscle training during 1 week. This exercise can reduce blood sugar levels he suffers (Meilani, Alfikrie, & Purnomo, 2020). Sports activities are also able to reduce the risk of uric acid 50% and 65% lower than the elderly who do not do activities (Williams, 2008). Losing weight through exercise and limiting calorie intake will reduce uric acid concentrations (Kakutani-Hatayama et al., 2017). Exercise (VO2 max 70%) reduces the degradation of adenine nucleotides and the production of lactic acid which can induce noradrenaline release which results in decreased plasma concentrations and excretion of occipurine in the blood (hypoxanthine, xanthine) and the concentration of uric acid in plasma and urine (Green & Fraser, 1988). The purpose of this study was to determine the effect of progressive muscle relaxation training based on Arduino Uno on blood sugar, cholesterol, and uric acid levels in the elderly.

Methods

Study Design

The design of this study was a pre-experimental study with pre-post-test design in the elderly who did progressive muscle relaxation exercises.

Research Subject

The population in this study were all elderly in two Sub-District of Medan Sunggal District, North Sumatra. The sampling technique used was purposive sampling. The criteria established by the researcher for determining the respondents in this study were elderly who are active in integrated elderly services. Respondents in the study were 39 elderly in environment II and III of Medan Sunggal District.

Setting

This research was conducted from May to June 2020 in two sub-districts of Medan Sunggal, North Sumatra. These two sub-

districts have a number of elderly people which makes it easier for researchers to collect them and are also one of the districts that have access to integrated elderly services.

Instruments

This study uses a demographic data questionnaire and a muscle strength sensor observation sheet based on Arduino Uno with an Android application (Karimpour, Parsaei, Rojhani, Sharifian, & Yazdani, 2019). This study uses a demographic data questionnaire and an Arduino Uno based power sensor observation sheet with an Android application. The validation of this instrument has been tested involving more than 100 different curves with practice several times. This validation analysis is performed by comparing the isometric sEMG output signal of commercial and low cost devices (del Toro et al., 2019). Demographic data are in the form of name, age, gender, occupation, while the observation sheet contains a graph of the fluctuation of the Arduino Uno-based electromyogram sensor which functions to detect muscle strength in the elderly during progressive muscle relaxation training.

Intervention

This instrument was made to make it easier for researchers to conduct research. How to use this instrument by connecting arduino uno to the Bluetooth HC-05 application which is already connected to the Android application (Tyle Yan H.H Lukar, 2018).
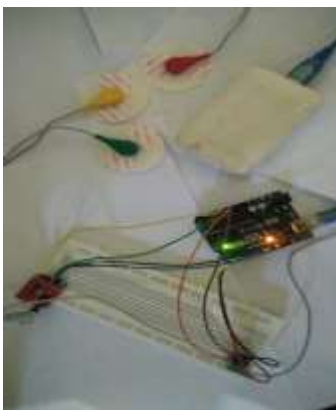

Figure 1 The Arduino Uno based electromyogram.

The tools needed to assemble this instrument are: Arduino Uno, project board, muscle V3 sensor, USB, power bank, EMG dot, Bluetooth HC-05, jumper cables and electromyogram sensor. When connecting these devices, it is necessary to know the exact location of the pairing. After the instrument is connected and the power on is turned on. Researchers placed EMG (Electromyogram sensor) dots in the muscle area.

Figure 2 The area of the muscle where the EMG dot is attached.

Data Analysis

This study was analyzed using SPSS version 26 using the Wilcoxon test. The intervention section in this study was carried out in the upper limb area on the hands and arms. After the progressive muscle relaxation exercise is given, it is analyzed again with an Arduino Uno-based Electromyography where the device detects the motor muscle signal whether it is working properly.

Ethical Consideration

First of all, this research obtained a research permit from the Dean of the Faculty of Nursing addressed to the Mayor of Medan and the Head of Medan Sunggal. After the permit was issued from the Mayor's office, the researchers conducted research by obtaining data from the heads of environment II and III Medan Sunggal Subdistrict with the ethics commission number: 01.622/KEPK/Health Polytechnic of the Ministry of Health, Medan/2020. This research was funded by the

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RESULTS
Characteristics of Respondents by Age, Gender, and Occupational

Demographic data from 39 respondents consisting of age, gender, and occupation will be described as follows in table 1.

Table 1 Distribution of Respondents by Age, Gender, and Occupational in Two Sub-District of Medan Sunggal District from May until June 2020 (n = 39).

Characteristics	Number (n)	Percentage (%)
Age		
45 – 49 year	11	28.21
50 – 54 year	7	17.95
55 – 59 year	6	15.38
60 – 64 year	7	17.95
≥ 65 year	8	20.51
Gender		
Male	21	53.85
Female	18	46.15
Work Activity		
Productive	21	53.85
Non - Productive	18	46.15

Sources: Primary data of Questionnaire, 2020.

This age grouping is based on WHO, where the age of the most dominant respondents is at the age of 45 - 49 years as many as 11 people (28.21%). Respondents with male gender were 21 people (53.85%) more dominating than women. The work activities of the respondents still have jobs/ productive as many as 21 people (53.85%) with entrepreneurship, or as freelancers. Meanwhile, 18 respondents who were not productive (46.15%) only did activities at home because some were retirees and housewives.

Characteristics of Respondents by Results of Measurement of Blood Sugar, Cholesterol, and Uric Acid Before and After Before and After Getting Treatment in the form of Progressive Muscle Relaxation Exercises

Table 2 Distribution of Respondents by Results of Measurement of Blood Sugar, Cholesterol, and Uric Acid Before and After Before and After Getting Treatment in the form of Progressive Muscle Relaxation Exercises in Two Sub-District of Medan Sunggal District from May until June 2020 (n = 39).

Measurement	Pre – test		Post – test	
	n	%	n	%
Blood Sugar Levels				
Normal	38	97.44	38	97.44
To increase	1	2.56	1	2.56

Cholesterol				
Normal	36	92.31	38	97.44
To increase	3	7.69	1	2.56
Uric Acid				
Normal	22	56.41	26	66.67
To increase	17	43.59	13	33.33

Sources: Primary data of Questionnaire, 2020.

From the data this table shows that the blood sugar levels before and after progressive muscle relaxation exercises have the same value. This suggests that progressive muscle relaxation exercises have no effect at all. Meanwhile, cholesterol levels before and after progressive muscle relaxation exercises decreased, this is indicated by post-intervention data as much as 2.56 percent from 7.69 percent. In contrast to the data on uric acid levels where the data before the intervention showed that it was 43.59 percent down to 33.33 percent. These results are shown from the results of examinations using a blood sugar, cholesterol and uric acid check tool, the brand of nesco multicheck-1.

Analysis of the Effect of Progressive Muscle Relaxation Training Based on Arduino Uno on Blood Sugar, Cholesterol, and Uric Acid Levels in The Elderly using Wilcoxon Test

Table 3 Results of the Analysis Effect of Progressive Muscle Relaxation Training Based on Arduino Uno on Blood Sugar, Cholesterol, and Uric Acid Levels in The Elderly using Wilcoxon Test.

	Pre – Test (Mean)	**Post – Test (Mean)**	***p*-value**
Blood sugar (mg/dl)	1.03	1.03	1.000
Cholesterol (mg/dl)	1.08	1.03	.157
Uric acid (mg/dl)	1.44	1.3	.046

Sources: Primary data of Questionnaire, 2020.

The results of statistical tests using SPSS 26 show that the value of blood sugar levels between before and after has a value of p (1,000), where p value> 0.05 means that progressive muscle relaxation exercises have no effect at all on blood sugar levels. The average value of cholesterol before and after has a decrease where the p value is (0.157), where the p value> 0.05 means that cholesterol levels have no effect on progressive muscle relaxation exercises while uric acid levels before and after have a p value (0.046), where the value <0.05, which means that uric acid levels have an effect on progressive muscle relaxation exercises in the elderly.

DISCUSSION

The results of this study indicate that blood sugar levels have the same value between the pre-test and post-test. The average pre and posttest cholesterol levels were almost the same as blood sugar levels, only 2 people showed no decrease in the value between the pre and posttest. This is very different from research (Meilani et al., 2020) that progressive muscle training was able to reduce blood sugar levels of type 2 diabetes mellitus sufferers with 12 intervention groups and 12 control groups in 24 respondents in Kota Baru sub-district, South Pontianak district. Research conducted (Kelley & Kelley, 2009) shows that progressive muscle training in twenty-nine studies representing 1,329 men and women who were given exercise as many as 676 respondents with a control group of 653 respondents resulted in changes in cholesterol levels with a statistically significant improvement value found for TC (-5.5 mg / dl, -9.4 to -1.6), TC / HDL-C (-0.5, -0.9 to -0.2),

non-HDL-C (-8.7 mg / dl , - 14.1 to -3.3), LDL-C (-6.1 mg / dl, -11.2 to -1.0) and TG (-8.1 mg / dl, -14.5 to -1.8) but not HDL-C (0.7 mg / dl, -1.2 becomes 2.6). Changes are equivalent to -2.7%, 1.4%, -11.6%, -5.6%, -4.6%, and -6.4%, respectively, for TC, HDL-C, TC / HDL-C, non-HDL-C, LDL -C, and TG.

This study was predominantly male as many as 21 respondents (53.8%) this is different in the study (Correa, Teixeira, Bittencourt, & Oliveira, 2014) that postmenopausal women experience changes in metabolism and lipoprotein concentrations during muscle strength training and this is similar in research (Meilani et al., 2020), where women are more dominant than men. The value that shows an increase is uric acid levels, which means that progressive muscle relaxation training can reduce uric acid levels with the Asymp value. Sig (2-tailed) is $0.046 < 0.05$, it can be concluded that Ha is accepted. This means that there are differences in the results of pre and post training progressive muscle relaxation in elderly gout.

CONCLUSION

Based on the description above, it can be concluded that Arduino Uno-based progressive muscle relaxation training affects changes in blood sugar, cholesterol and uric acid levels.

SUGGESTION

The implications of this study are expected to be able to provide benefits for others in the problem of changes in blood sugar, cholesterol and uric acid levels in the body.

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DECLARATION OF CONFLICTING INTEREST

The interesting conflict in this study was carried out during the Covid-19 pandemic so that researchers had a little difficulty in collecting measurement data.

AUTHOR CONTRIBUTION

Eqlima Elfira: Compile the article dan analyze data.

Bina Melvia Girsang: Assist in data collection and complete articles.

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