Differences in the interaction effect between telerehabilitation self-stretching and telerehabilitation self-massage on delayed onset muscle soreness

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Abstract

The aim of this research is to determine the differences in the interaction effect between telerehabilitation self-stretching and telerehabilitation self-massage on Delayed Onset Muscle Soreness

Material and methods

The research method used in this study is a quasi-experimental design with a two-group pre-test and post-test method. This study aims to find the relationship between dependent and independent variables. The location used in this study was the FitHub Prof gym and fitness center. Dr. Soepomo Street Number 30 Tebet Jakarta Selatan. We relied on a sufficient population and sample size to conduct a telerehabilitation self-stretching study for weightlifters. During this study, 18 treatments were performed over 6 weeks, 3 times per week.

Results

Comparing of groups A1B1 > A1B2. In the numeric rating scale <5 group who were given Telerehabilitation self-stretching (A1) treatment, there was a difference in the test results for NRS <5 (B1) and those with numeric rating scale >5 (B2). This is proven by the Sig value. = 0.000 < 0.05. Compare groups A1B1 << A2B1. In the Telerehabilitation self-stretching group which had a numeric rating scale >5 (B1), there was no difference in the test results between the Telerehabilitation self-stretching (A1) and the Telerehabilitation self-massage (A2) test results. This is proven by the Sig value. = 0.886 > 0.05. Compare groups A1B2 << A2B2. In the Telerehabilitation self Massage group which had a numeric rating scale <5 (B2), there was no difference in the test results between the Telerehabilitation self-stretching (A1) and the Telerehabilitation self-massage (A2) test results. This is proven by the Sig value. = 0.983 > 0.05. Comparing groups A2B1 > A2B2. In the numeric rating scale > 5 group who were given Telerehabilitation self Massage (A2) treatment, there was a difference in test results between numeric rating scale < 5 (B1) and those with numeric rating scale > 5 (B2). This is proven by the Sig value. = 0.000 > 0.05.

Conclusions

There is a difference in the effect between telerehabilitation self stretching and telerehabilitation self massage on reducing pain using the NRS scale. There is no influence between the numeric rating scale above 5 and the numeric rating scale below 5 on the results of the combination of telerehabilitation. There is a more significant effect of telerehabilitation self massage on reducing pain in DOMS cases.

Keywords

Telerehabilitation Self-Stretching, Telerehabilitation Self-Massage, Delayed Onset Muscle Soreness
Анотація

Мухаммад Пердана Азхар, Агус Крістіянто, Сламет Ріяді. Відмінності в ефекті взаємодії між телереабілітаційним саморозтягуванням і телереабілітаційним самосамасажем на відстрочену хворобливість м'язів

Мета цього дослідження полягає в тому, щоб визначити відмінності в ефекті взаємодії між телереабілітаційним саморозтягуванням і телереабілітаційним самосамасажем на відстрочену хворобливість м'язів.

Метод дослідження, використаний у цьому дослідженні, є квазіекспериментальним методом із двогруповим методом до та після тестування. Це дослідження має на меті знайти зв'язок між залежною та незалежною змінними. Місцем, використаним у цьому дослідженні, був тренажерний зал і фітнес-центр FitHub Prof. Dr. Soepomo Street Number 30 Tebet Jakarta Selatan. Ми базувалися на достатній сукупності та розмірі вибірки для проведення дослідження телереабілітаційного саморозтягування для любителів важкої атлетики. Під час цього дослідження було проведено 18 процедур протягом 6 тижнів із частотою 3 рази на тиждень.

Результати

Порівняння груп A1B1 <> A1B2. У групі з числовою шкалою оцінки <5, яка отримувала лікування телереабілітаційним саморозтягуванням (A1), була різниця в результатах тесту для NRS <5 (B1) і тих, хто отримав шкалу оцінки >5 (B2). Це підтверджується значенням Sig. = 0,000 < 0,05. Порівняйте групи A1B1 <> A2B1. У групі телереабілітаційного саморозтягування, яка мала числову шкалу оцінок >5 (B1), не було різниці в результатах тесту між телереабілітаційним саморозтягуванням (A1) і телереабілітаційним самосамасажем (A2). Це підтверджується значенням Sig. = 0,886 > 0,05. Порівняйте групи A1B2 <> A2B2. У групі телереабілітаційного самосамасажу, яка мала числову шкалу оцінок <5 (B2), не було різниці в результатах тесту між телереабілітаційним саморозтягуванням (A1) і телереабілітаційним самосамасажем (A2). Це підтверджується значенням Sig. = 0,983 > 0,05. Порівняння груп A2B1<= A2B2. У групі з числовою шкалою оцінок > 5, які отримували лікування телереабілітаційним самосамасажем (A2), була різниця в результатах тестування між числовою шкалою оцінок < 5 (B1) і тими, хто отримав числову шкалу оцінок > 5 (B2). Це підтверджується значенням Sig. = 0,000 > 0,05.

Висновки

Існує різниця в ефекті між телереабілітаційним саморозтягуванням і телереабілітаційним самосамасажем на зменшення болю за шкалою NRS. Немає жодного впливу між числовою шкалою оцінок вище 5 і числовою шкалою оцінок нижче 5 на результати комбінації телереабілітації. Існує більш значний вплив телереабілітаційного самосамасажу на зменшення болю у випадках DOMS.

Ключові слова

tелереабілітаційне саморозтягування, телереабілітаційний самосамасаж, відстрочена хворобливість м’язів
Introduction

As we know, exercise has positive effects that are beneficial to the body because exercise is an activity that involves physical activity, thereby improving the quality of health and fitness [1]. The benefits of exercise are to improve bodily and psychosocial development, improve sleep quality and reduce alcohol dependence and can reduce the effects of dementia (senility) [2]. However, the effects of exercise can also have negative effects if done excessively, such as fatigue, injury, or injuries due to incidents during exercise. If exercise is done correctly, it will give positive results. In the current pandemic conditions, people must choose good sports because otherwise it will increase the incidence of covid-19 transmission.

Weight training is an exercise that involves eccentric contractions of the muscles so that it often causes pain after exercise, known as delayed onset muscle soreness. In the research carried out [3] stated that all respondents had experienced delayed onset muscle soreness after doing exercise. Delayed onset muscle soreness is the body's adaptation to new training and usually appears at the beginning of a new exercise or training program that uses eccentric contractions. The prevalence shows that half of all respondents (50%) felt mild pain and 47% experienced moderate pain after exercising and the parts that often experienced delayed onset muscle soreness were the calf (gastrocnemius) at 36% and the hamstring muscles at 28% [3].

Delayed onset muscle soreness is very dangerous for athletes, even mild pain from delayed onset muscle soreness can negatively impact performance and increase the chance of injury which then stops them from taking part in ongoing competitions [4]. The author tries to create an effective treatment strategy to overcome delayed onset muscle soreness and the associated potential harmful factors so that physical therapists help athletes to recover as soon as possible, speed up the regeneration process and prevent further damage [5].

Stretching has long been used to avoid injury, reduce discomfort, improve athletic performance, and decrease delayed onset muscle soreness before and after training or competition. The most popular method for rehabilitation of clinical athletes is static stretching. Maintaining a stretched muscle at its limit point for a long period of time is called static stretching [6].

The stretching techniques used are static and ballistic [7]. Ballistic stretching is generally not used because many people think that it causes more injury, but this fact is not documented in the literature. In fact, both ballistic and static stretching increase range of motion and reduce delayed onset muscle soreness. Static stretching is the safest and is done by holding the stretching position for at least 30 seconds. With this type of stretching, the client relaxes during the stretch, allowing the stiff soft tissue to slowly lengthen [8]. Massage is an ancient art and modern clinical research has provided increasing scientific evidence for its therapeutic use. Since time immemorial the 'laying on of hands' has been known to have beneficial effects, not only on the body but also on the mind [9].

Telemedicine, telerehabilitation, and telehealth are part of the health IT trend. Her research concerns the use of ICT to bridge geographic gaps between patients and providers and between providers and each other. Using technology to provide health services remotely has several advantages. Overall, the main contribution of the telemedicine and telehealth movement is the ability to perform relatively stable medical procedures remotely. The movement finds that, despite some usability issues, this technology offers much-needed benefits for individuals who live in remote areas or who want access to medical information and treatment but may have difficulty reaching a hospital, clinic, or doctor [10]. Telerehabilitation is seen as an ideal alternative approach to accessing rehabilitation care during this period [11].

As rehabilitation providers, we can no longer do anything. This is because of covid-19. In addition to responding to covid-19 cases in the short term, healthcare practitioners as a whole need to start planning for the long-term impact immediately [12]. Many people experiencing difficulties related to covid-19 require face-to-face rehabilitation therapy, which is available due to community quarantine [13].

People have widely used telerehabilitation during the covid-19 epidemic; However, its use may decrease after the pandemic ends. New ways are needed for dedicated individuals to create long-term telerehabilitation plans. In addition to clinical resources for telerehabilitation, this strategy should incorporate commercial and marketing concepts to drive and profit from post-pandemic demand for telerehabilitation [14].

Based on the explanation above, the author is interested in conducting research that discusses the effect of telerehabilitation self-stretching on reducing
pain with an numeric rating scale review of delayed onset muscle soreness among weight training enthusiasts. Because in previous research there was no research on the effect of telerehabilitation self-stretching on reducing pain with an numeric rating scale review of delayed onset muscle soreness. With the hope that the research I carry out can run easily, smoothly and without significant obstacles.

Material and methods

The research method used in this research is a quasi-experimental method with a two group pre and post test method. This research aims to find the relationship between the dependent and independent variables. The place used in this research was the GYM and Fitness Center FitHub Prof. Dr. Soepomo street Number 30 Tebet Jakarta Selatan. based on a sufficient population and sample size to conduct research on Telerehabilitation Self Stretching for Weight Lifting Sports Enthusiasts. During this research, the author directed the sample to carry out research with a total of 18 treatments for 6 weeks with a frequency of 3 times a week.

Results

. Normality Test

Based on the SPSS output table above, it is known that the significance value of Asymp. Sig. (2-tailed) of 0.052 is greater than 0.05. So it can be concluded that the data is normally distributed. Thus, the normality assumptions or requirements in the regression model have been met.

Table 1

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Unstandardized Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Parametersa,b</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0E-7</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>58335892</td>
</tr>
<tr>
<td>Most Extreme Differences</td>
<td></td>
</tr>
<tr>
<td>Absolute</td>
<td>0.138</td>
</tr>
<tr>
<td>Positive</td>
<td>0.138</td>
</tr>
<tr>
<td>Negative</td>
<td>-0.100</td>
</tr>
<tr>
<td>Kolmogorov-Smirnov Z</td>
<td>0.138</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>0.052</td>
</tr>
</tbody>
</table>

Notes: a. Test distribution is Normal.
b. Calculated from data.

. Homogeneity Test

Based on the output above0. the Sig value is known. Levene's Test for Equality of Variances 0.2260. because Fcount is 1.518 with a probability value of Sig. 0.226 is greater than 0.050. so it can be concluded that all these variables have the same variance.

Table 2

<table>
<thead>
<tr>
<th>F</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,518</td>
<td>3</td>
<td>36</td>
<td>0.226</td>
</tr>
</tbody>
</table>

Notes: Tests the null hypothesis that the error variance of the dependent variable is equal across groups; a. Design: Intercept + factorA + factorB + factorA * factorB

. Uji Hipotesis
### Table 3

Tests of Between-Subjects Effects

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>240.275*</td>
<td>3</td>
<td>80.092</td>
<td>210.263</td>
<td>0.000</td>
</tr>
<tr>
<td>Intercept</td>
<td>870.025</td>
<td>1</td>
<td>870.025</td>
<td>2280.679</td>
<td>0.000</td>
</tr>
<tr>
<td>factorA</td>
<td>0.225</td>
<td>1</td>
<td>0.225</td>
<td>0.591</td>
<td>0.227</td>
</tr>
<tr>
<td>factorB</td>
<td>240.025</td>
<td>1</td>
<td>240.025</td>
<td>630.131</td>
<td>0.000</td>
</tr>
<tr>
<td>factorA * factorB</td>
<td>0.025</td>
<td>1</td>
<td>0.025</td>
<td>0.066</td>
<td>0.799</td>
</tr>
<tr>
<td>Error</td>
<td>130.700</td>
<td>36</td>
<td>0.381</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1250.000</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>370.975</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: a. R Squared = 0.639 (Adjusted R Squared = 0.609)

### Notes:
- Corrected Model: The influence of all independent variables together on the dependent variable (Choreographic Creativity Results). If Significance (Sig.) < 0.05 (Alpha) = Significant. Data is above 0.0000. so the corrected model is significant.
- Intercept: The value of the dependent variable changes without being influenced by the existence of the independent variable(s). meaning that without the influence of the independent variable(s), the dependent variable can change its value. If Significance (Sig.) < 0.05 (Alpha) = Significant. For example, above 0.000 means the intercept is significant.
- Class: Influence of Class on Y. If Significance (Sig.) < 0.05 (Alpha) = Significant. Data above 0.447 means class has no effect on Y.
- NRS: Effect of NRS on Y. If Significance (Sig.) < 0.05 (Alpha) = Significant. Data above 0.000 means that NRS has an effect on Y.
- Class * NRS: Effect of Class * NRS on Y. If Significance (Sig.) < 0.05 (Alpha) = Significant. Data above 0.799 means Class * NRS has no significant effect.
- Error: The model error value. The smaller it is, the better the model.
- R Squared: Multiple determination value of all independent and dependent variables. Data above 0.639 means the correlation is strong.

### Table 4

Tukey Multiple Comparisons Test

<table>
<thead>
<tr>
<th>(I) PH</th>
<th>(J) PH</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Upper Bound</td>
</tr>
<tr>
<td>A1B2</td>
<td>A1B1</td>
<td>-10.6000</td>
<td>0.27588</td>
<td>0.000</td>
<td>-20.3430</td>
</tr>
<tr>
<td></td>
<td>A2B1</td>
<td>-0.2000</td>
<td>0.27588</td>
<td>0.866</td>
<td>-0.9439</td>
</tr>
<tr>
<td></td>
<td>A2B2</td>
<td>-10.7000</td>
<td>0.27588</td>
<td>0.000</td>
<td>-20.4430</td>
</tr>
<tr>
<td>A1B1</td>
<td>A1B2</td>
<td>10.6000</td>
<td>0.27588</td>
<td>0.000</td>
<td>-0.8570</td>
</tr>
<tr>
<td></td>
<td>A2B1</td>
<td>10.4000</td>
<td>0.27588</td>
<td>0.000</td>
<td>-0.6570</td>
</tr>
<tr>
<td></td>
<td>A2B2</td>
<td>-0.1000</td>
<td>0.27588</td>
<td>0.983</td>
<td>-0.8430</td>
</tr>
</tbody>
</table>
This further test serves to determine the comparison between the four existing groups. The details are as follows:

Compare groups A1B1 < A1B2. In the numeric rating scale <5 group who were given Telerehabilitation self-stretching (A1) treatment0. there was a difference in the test results for numeric rating scale <5 (B1) and those with numeric rating scale >5 (B2). This is proven by the Sig value. = 0.000 < 0.05.

Compare groups A1B1 > A2B1. In the Telerehabilitation self-stretching group which had a numeric rating scale >5 (B1). there was no difference in the test results between the Telerehabilitation self-stretching (A1) and the Telerehabilitation self-massage (A2) test results. This is proven by the Sig value. = 0.886 > 0.05.

Compare groups A1B2 > A2B2. In the Telerehabilitation self-Massage group which had a numeric rating scale <5 (B2). there was no difference in the test results between the Telerehabilitation self-stretching (A1) and the Telerehabilitation self-massage (A2) test results. This is proven by the Sig value. = 0.983 > 0.05.

Comparing groups A2B1 < A2B2. In the numeric rating scale > 5 group who were given Telerehabilitation self Massage (A2) treatment0. there was a difference in test results between numeric rating scale < 5 (B1) and those with numeric rating scale > 5 (B2). This is proven by the Sig value. = 0.000 > 0.05

### Discussion

In this study there are two independent variables and one dependent variable to be studied. Independent variables consist of manipulative variables or treatment variables. This variable consists of two treatments0. namely telerehabilitation self-stretching and telerehabilitation self-massage0. the other independent or attributive variable is the group without any data collection for each treatment.

Delayed onset muscle soreness is pain that is found in the distal area of the muscle and can be detected by stretching and is included in type 1 muscle injury [15]. There are various reasons why delayed onset muscle soreness occurs0. such as someone repeating heavy activity later in the day where they have been away from that heavy activity for a long time [16]. Meanwhile0. the second reason is when someone undertakes physical activity with excessive intensity and frequency. Muscle work due to eccentric movements and excessive performance in unusual circumstances is the main cause of delayed onset muscle soreness [17]. This can cause local pain0. decreased joint range of motion (LGS)0. and disruption of daily activities.

To provide rehabilitation services to individuals remotely0. either at home or at another location0. information and communications technology0. or ICT0. is used in telerehabilitation. With the use of ICT0. healthcare providers can contact patients who cannot access traditional medical services0. thereby improving continuity of care for individuals with disabilities. Additionally0. clients can have easier access to rehabilitation programs. Patients are empowered and given the ability to take responsibility for their medical needs and interventions when telerehabilitation is used to provide care in their home or other living environment [18]. This is because it allows for individual care0. control and choice.

Stretching is a deliberate attempt to lengthen or stretch the muscles in the body in order to improve a person’s physical or mental well-being. Stretching in any form can be considered beneficial. The individual’s purpose in doing or assisting with the stretch makes a difference in this situation [19]. Here0. we promote stretching as a way to achieve
certain therapeutic effects in addition to using it as a pre- or post-workout habit.

Massage is defined as the systematic manual manipulation of the body's soft tissues with movements such as rubbing0, squeezing0, pressing0, rolling0, slapping0, and tapping for therapeutic purposes such as improving blood and lymph circulation0, muscle relaxation0, alleviating pain0, restoring metabolic balance0, and other benefits both physically and mentally [20].

Conclusion

There is a difference in the effect between telerehabilitation self stretching and telerehabilitation self massage on reducing pain using the numeric rating scale.

There is no influence between the numeric rating scale above 5 and the numeric rating scale below 5 on the results of the combination of telerehabilitation.

There is a more significant effect of telerehabilitation self massage on reducing pain in delayed onset muscle soreness cases.

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