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Ocena czynników wpływających na skuteczność terapii integracji sensorycznej u dzieci w wieku przedszkolnym i wczesnoszkolnym

Assessment of factors influencing the effectiveness of sensory integration therapy in preschool and early school-aged children

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- ZABURZENIA CZYNNOŚCIOWE UKŁADU RUCHOWEGO NARZĄDU ŻUCIA;
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Sports massage has the potential to reduce ischemic muscle pain and increase range of motion after exercise

Masaż sportowy a jego potencjał w redukcji bólu mięśni niedokrwionych oraz zwiększeniu zakresu ruchu po ćwiczeniach

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Abstract

The aim of this study was to analyze the potential of exercise massage on ischemic muscle pain and ROM after exercise. This experimental research uses a pre and post control group design. Research subjects were selected using purposive sampling technique. Next, the subjects were divided into 2 groups, namely group (K1) which was not given special treatment and group (K2) which was given sports massage. A total of 18 healthy men participated in this study. Our first procedure is preparing research administration and permission to borrow facilities and infrastructure. Next, we screened respondents who were used as research subjects based on inclusion and exclusion criteria and filled out Informed Consent. On the day of the research, all subjects collected data on the characteristics of the research subjects, then warmed up, and then the subjects did exercises in the form of treadmill training with an intensity of 50-60% of their maximum ability. The intensity of the exercise was monitored using a polarizer. Exercise is carried out for 15 minutes. 30 minutes after exercise, all subjects had pre-test data taken to measure ischemic muscle pain and Range of Motion. After collecting pre-test data, subjects carried out interventions based on their respective groups. After being given the intervention, the subject carried out post-test data collection. The intensity of ischemic muscle pain was measured using VAS and ROM was measured at the knee joint using a goniometer. The results of our study reported that the group given exercise massage was able to reduce the intensity of systemic muscle pain and increase ROM significantly ($P < 0.05$). Providing sports massage after exercise can reduce ischemic muscle pain and increase ROM. Considering that pain intensity and ROM are necessary to support body function, our research findings can be used as an alternative to support physical performance.

Keywords

sports massage, physical exercise, ischemic muscle pain

Streszczenie

Celem niniejszego badania było zanalizowanie potencjału masażu sportowego w redukcji bólu mięśni niedokrwionych oraz zakresu ruchu (ROM) po ćwiczeniach. W ramach eksperymentalnych badań zastosowano projekt badawczy przed i po z grupą kontrolną. Uczestnicy badania zostali wybrani za pomocą techniki doboru celowego. Następnie podzielono ich na 2 grupy: grupę (K1), której nie udzielono specjalnej interwencji oraz grupę (K2), której wykonano masaż sportowy. W badaniu wzięło udział 18 zdrowych mężczyzn. Naszym pierwszym krokiem było przygotowanie administracji badawczej oraz uzyskanie pozwolenia na korzystanie z obiektów i infrastruktury. Następnie przesiewano uczestników, którzy mieli być osobami badanymi, na podstawie kryteriów włączenia i wyłączenia oraz wypełniano formularze świadomej zgody. W dniu badania wszyscy uczestnicy zebrali dane na temat charakterystyki osób badanych, następnie przeprowadzono rozgrzewkę, a potem uczestnicy wykonywały ćwiczenia na bieżni z intensywnością 50-60% ich maksymalnych możliwości. Intensywność ćwiczeń monitorowano za pomocą polaryzatora. Ćwiczenia przeprowadzano przez 15 minut. 30 minut po ćwiczeniach u wszystkich uczestników pobrano dane przedtestowe w celu zmierzenia bólu mięśni niedokrwionych i zakresu ruchu. Po zebraniu danych przedtestowych uczestnicy przystąpili do interwencji zgodnie z przynależnością do grupy. Po interwencji przeprowadzono zbieranie danych potestowych. Intensywność bólu mięśni niedokrwionych mierzono przy użyciu skali VAS, a ROM mierzono w stawie kolanowym przy użyciu goniometru. Wyniki naszego badania wykazały, że grupa otrzymująca masaż sportowy była w stanie znacząco ($P < 0,05$) zmniejszyć intensywność bólu mięśniowego i zwiększyć ROM. Stosowanie masażu sportowego po ćwiczeniach może zmniejszyć ból mięśni niedokrwionych i zwiększyć zakres ruchu. Biorąc pod uwagę, że intensywność bólu i zakres ruchu są niezbędne do wsparcia funkcji ciała, nasze wyniki badawcze mogą być wykorzystane jako alternatywa wspierająca wydajność fizyczną.

Słowa kluczowe

masaż sportowy, ćwiczenia fizyczne, ból mięśni niedokrwionych

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Introduction

Intense physical exercise can trigger fatigue, resulting in a decrease in muscle work efficiency [1]. The efficiency of muscle work during exercise is influenced by its intensity and duration [2]. The mechanism of muscle fatigue is considered a complex interaction phenomenon between central and peripheral factors [3]. A study reports that central nervous system (CNS) processes that reduce nerve impulses to muscles cause a decrease in muscle strength known as central fatigue [2]. On the other hand, peripheral fatigue is mainly triggered by increased levels of lactic acid in the blood [4, 5]. A study reports that lactic acid contributes to ischemic muscle pain in sensory neurons that innervate muscles [6]. In addition, the occurrence of pain can trigger a decrease in Range of Motion (ROM).

In the current case, non-steroidal anti-inflammatory drug (NSAID) modalities are the most popular in treating post-exercise pain [7–9]. This is evidenced by approximately 30 million people worldwide using NSAIDs, including athletes and others engaged in high physical activity [10]. On the other hand, using NSAIDs is the wrong action because it interferes with the muscle growth response so that it will have an impact on muscle hypertrophy [11]. In addition, the use of NSAIDs will cause dependence (Bindu, Mazumder and Bandyopadhyay, 2020. In this regard, fatigue and pain caused during training sessions and matches will interfere with athlete performance [12].

Alternative solutions need to be sought to overcome these problems. One of them is sports massage. Massage has been widely used when an athlete suffers an injury in a match [13, 14]. In addition, several studies have reported that massage can increase muscle strength again [1, 15, 16]. On the other hand, the lack of reports regarding this matter gives us the opportunity to discuss in depth and evaluate the effect of exercise massage on pain intensity and post-exercise ROM.
This study aims to analyze the potential of exercise massage on ischemic muscle pain and ROM after exercise.

Materials and methods

Study design

This experimental research uses a pre and post control group design. Research subjects were selected using purposive sampling technique. Next, the subjects were divided into 2 groups, namely group (K1) which was not given special treatment and group (K2) which was given sports massage.

Subjects

A total of 18 healthy men participated in this study (subject characteristics are shown in table 1). The inclusion criteria in this study were men aged 18 to 30 years, with a normal BMI. The exclusion criteria in this study were subjects under 18 years of age. The drop out criteria in this study were taking non-steroidal anti-inflammatory drugs (NSAIDs), and failing for certain reasons. Research subjects received instructions regarding research procedures and signed a letter of agreement agreeing to become research subjects.

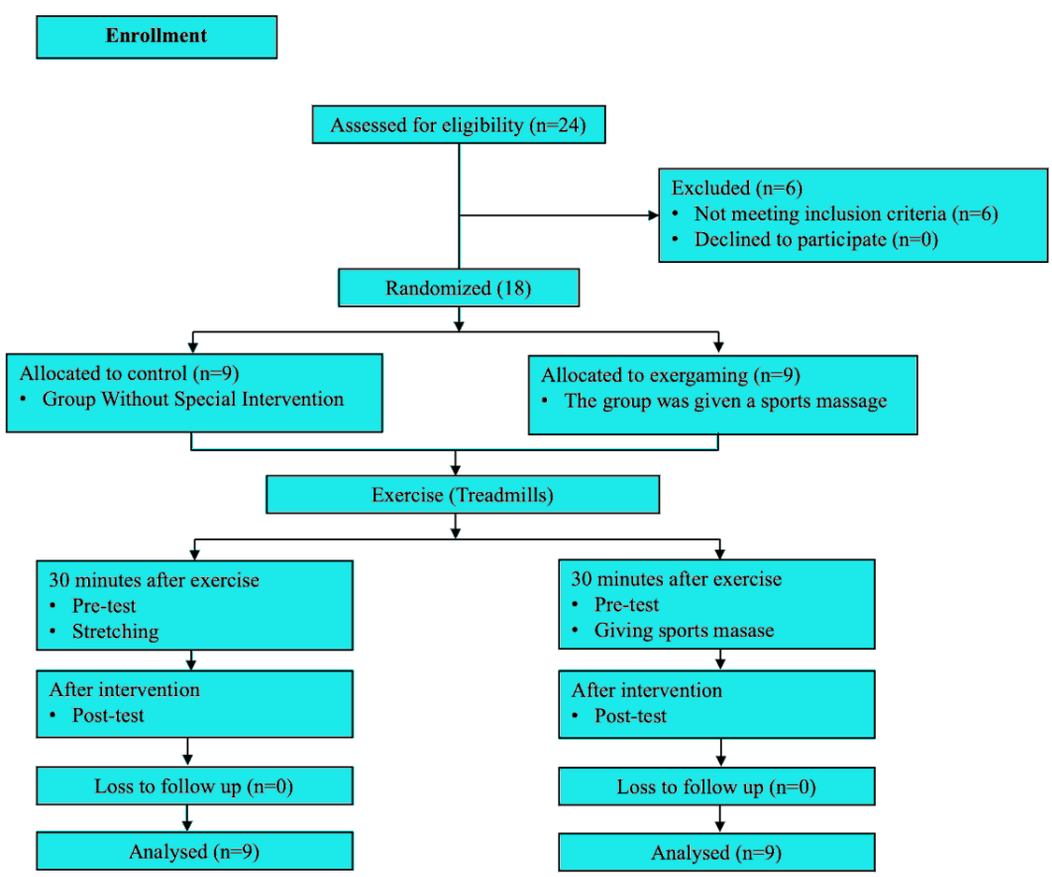

Figure 1. The CONSORT flowchart

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Procedure

1. First, we prepare administrative aspects, including obtaining ethical clearance and permits to use facilities and infrastructure.
2. We screened respondents for inclusion and exclusion criteria, and they filled out informed consent forms agreeing to participate in the research.
3. Subjects were divided into two groups: one that received no special treatment and another that was given sports massage.
4. On the day of the research, all subjects collected data on the characteristics of the research subjects, then warmed up, then the subjects did exercises in the form of treadmill training with an intensity of 50-60% of their maximum ability, the intensity of the exercise was monitored using a polarizer. The subjects exercised for 15 minutes. Thirty minutes after exercising, pre-test data were collected from all subjects to measure ischemic muscle pain and range of motion. After the pre-test data collection, the subjects received interventions according to their assigned groups. After being given intervention, the subject carried out post test data collection.
5. The intensity of ischemic muscle pain was measured using the Visual Analog Scale (VAS), and ROM was measured at the knee joint using a goniometer.

Statistical analysis

Statistical analysis in this study was performed using the IBM SPSS version 27 application. A descriptive test was conducted to obtain the mean, standard deviation, and standard error. Furthermore, the normality test was carried out using the Shapiro-Wilk method, if the data were normally distributed the different test was carried out using the paired t-test, but if the data was not normally distributed, the difference was carried out using the Wilcoxon signed rank test.

Ethics

Declaration of ethics was approved by the Health Research Ethics Committee of the Faculty of Medicine, Universitas Negeri Semarang with registration number (No. 068/KEPK/FK/KLE/2024).

Results

Data on the characteristics of the research subjects are shown in Table 1.

Table 1. Characteristics of research subjects

Data	Group	N	Mean ± SD	Shapiro-Wilk	p-value
Age [years]	K1	9	19.55 ± 0.72	0.008	0.157
	K2	9	20.00 ± 0.50	0.001	
Height [cm]	K1	9	166.88 ± 4.91	0.562	0.205
	K2	9	164.55 ± 2.55	0.031	
Weight [kg]	K1	9	57.55 ± 5.34	0.252	0.363
	K2	9	60.22 ± 5.58	0.875	
BMI [kg/m^2]	K1	9	20.63 ± 1.01	0.206	0.104
	K2	9	22.18 ± 2.00	0.270	

The data in the table above show no significant differences between the groups.

Sports massage reduces the intensity of ischemic muscle pain

Table 1. Study design

Data	Group	n	Shapiro-Wilk p-value
Pain Intensity (Pre-test)	K1	9	0.156
	K2	9	0.031
Pain Intensity (Post-test)	K1	9	0.317
	K2	9	0.002

Information:
P > 0.05 = Data is normally distributed
P < 0.05 = Data is not normally distributed

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The results of the analysis of pain intensity levels between pre-test and post-test in each group are presented in Figure 2.

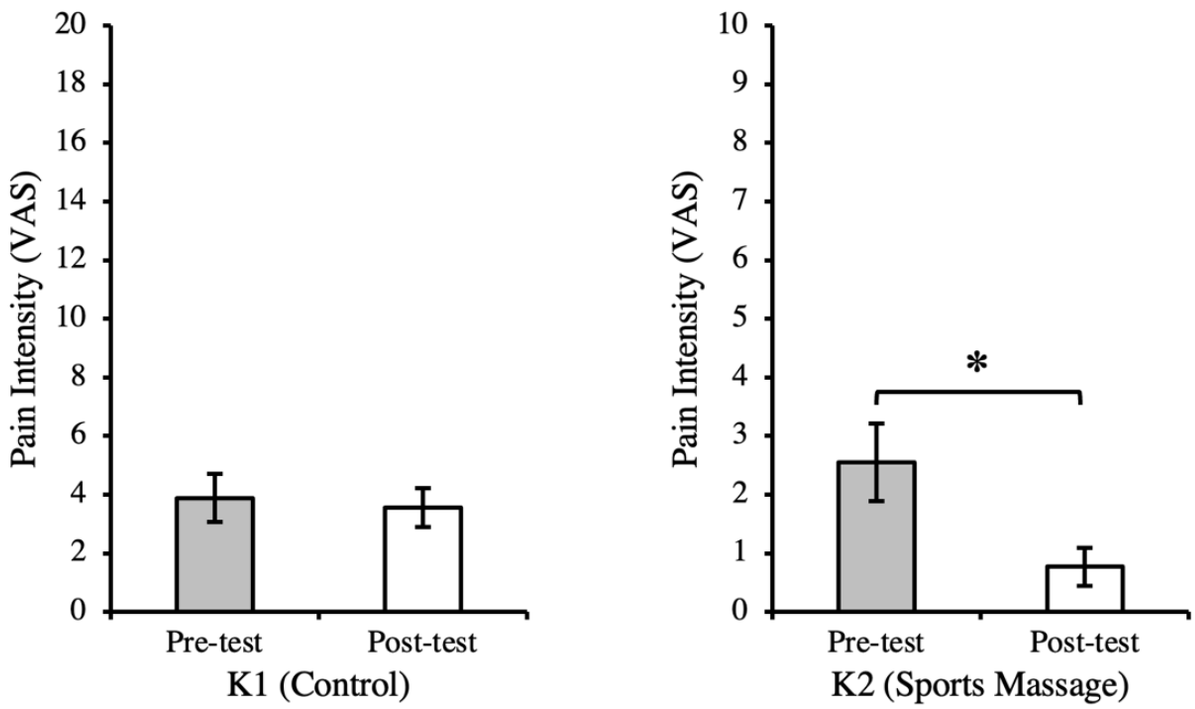

Figure 2. The group (K1) without special intervention post-exercise experienced no significant reduction in pain intensity ($p > 0.05$), while the group (K2) receiving exercise massage showed a significant reduction in pain intensity ($p < 0.05$). Data are presented as Mean ± Std Error. P-value was obtained using the Paired t-test and Wilcoxon signed rank test to compare the pre-test and post-test of each group

Table 3. Results of pain intensity difference tests

Difference Test Method	Group	P
Paired t-test	K1 (pre-test and post-test)	0.471
Wilcoxon signed rank test	K2 (pre-test and post-test)	0.027*

Table 4. ROM normality test results

Data	Group	n	Shapiro-Wilk p-value
ROM (Pre-test)	K1	9	0.250
	K2	9	0.000
ROM (Post-test)	K1	9	0.586
	K2	9	0.132

Information:
P > 0.05 = Data is normally distributed
P < 0.05 = Data is not normally distributed

The results of the analysis of ROM between pre-test and post-test in each group are presented in Figure 3.

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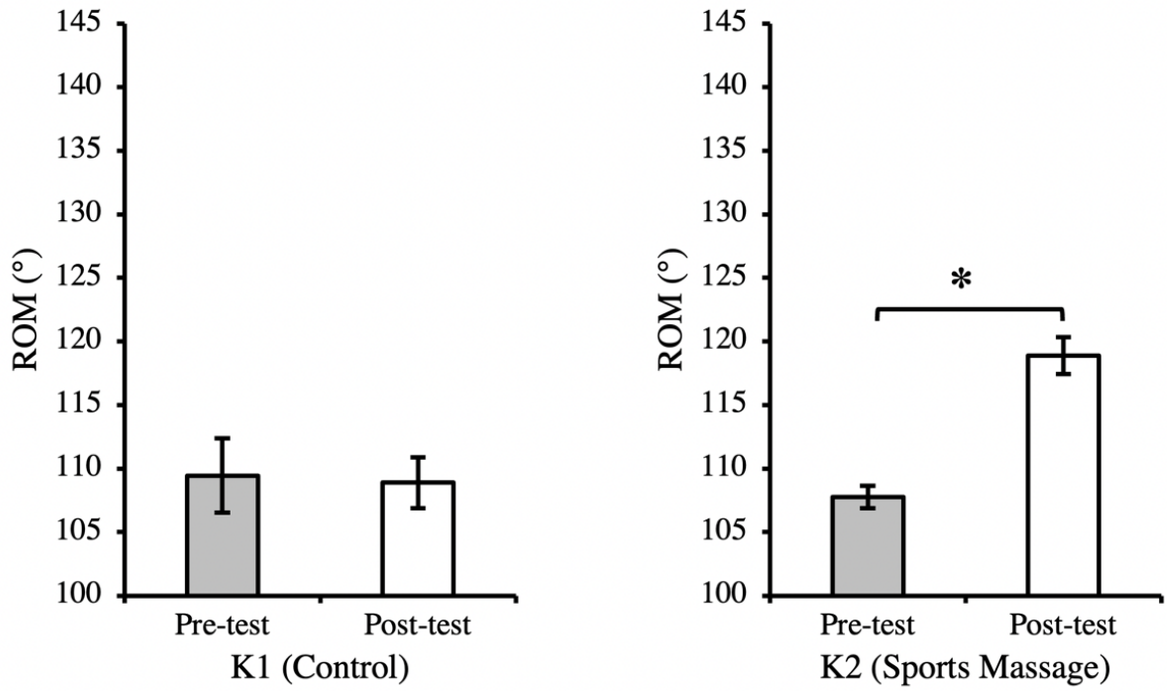

Figure 3. The group (K1) that was not given special intervention after exercise did not experience a significant increase in ROM ($p > 0.05$) and there was a significant increase in ROM in the group (K2) that was given exercise massage ($p < 0.05$). Data are presented as Mean ± Std Error. P-value was obtained using the Paired t-test and Wilcoxon signed rank test to compare the pre-test and post-test for each group

Table 5. Results of ROM difference tests

Difference Test Method	Group	P
Paired t-test	K1 (pre-test and post-test)	0.834
Wilcoxon signed rank test	K2 (pre-test and post-test)	0.007*

Discussion

The main aim of this study was to analyze the potential of exercise massage on ischemic muscle pain and ROM after exercise. We observed that the K1 group, which did not receive special intervention, showed no reduction in the intensity of ischemic muscle pain or increase in ROM. In contrast, the group that received exercise massage experienced a significant reduction in muscle pain intensity and an increase in ROM ($P < 0.05$). In this context, our research supports and validates findings from previous literature, indicating that massage can accelerate recovery and alleviate muscle soreness following physical exercise [17].

Ischemic muscle pain, which occurs when skeletal muscles do not receive enough metabolic oxygen, includes physiological pain caused by exercise [18]. The efficiency of muscle work during exercise is influenced by its intensity and duration [2]. Peripheral fatigue after exercise is triggered by increased lactic acid levels in the blood [4, 5]. Accordingly, an increase in lactic acid contributes to ischemic muscle pain in the sensory neurons innervating the muscles [6]. This research indicates that exercise massage can be an effective alternative for quickly reducing the intensity of ischemic pain. Our findings are corroborated by a study that reports massage can facilitate adaptive changes in the somatosensory cortex, aiding in injury recovery and peripheral nerve repair [19]. In this regard, basically exercise massage facilitates information integration by reversing the activity of the somatosensory cortex to restore sensory function. Additionally, a study has shown that massage effectively reduces blood lactic acid levels [20]. As previously explained, we subscribe to the theory, as reported by Sonkodi (2022), that lactate contributes to ischemic pain in sensory neurons innervating muscles. We think that reducing ischemic muscle pain and increasing ROM can support body function. ROM correlates with muscle pain intensity [21]. A decrease in ischemic muscle pain is likely to be associated with an increase in ROM.

However, a limitation of our research is the lack of analysis of lactic acid levels and other aspects of physical performance, such as muscle strength and explosive power. Therefore, we strongly recommend that future research focuses on these areas.

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Conclusion

Sports massage post-exercise has been shown to effectively reduce ischemic muscle pain and enhance ROM. Given the importance of pain intensity and ROM in supporting bodily functions, our research findings offer a viable alternative for enhancing physical performance.

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