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Massage methods and duration of intervention in reducing muscle pain in minor KNEE injuries during the COVID-19 pandemic

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Abstract--During the Covid-19 pandemic, there was a change in physical activity behavior, both sports and work activities. There is a fear that exercise can increase immunity if you are infected with Covid 19. However, the risk of exercising is a mild knee injury which results in spasms of the muscles around the knee at the time of the injury. There is also a fear of coming to medical rehabilitation at the hospital because there is a concern that you are infected with Covid. An appropriate method is needed to help the injury recovery process. Testing the correct massage method in providing therapeutic interventions requires experimental testing. The independent variable in the form of the massage method used is effleurage and friction. The control group used is the Swedish method, and the dependent variable is pain reduction, so the research method used is quasi-experimental. To see a decrease in pain and not make the injury worse. The research sample used was 24 people with the purposive sampling method. They were divided into two groups: the treatment group and the control group. The place of research is a treatment at the MCO (Sports Injury Massage) handling center in Ngijo Semarang.

Keywords--sports, COVID 19, physical activity, massage.

Introduction

The increase mostly influences human civilization development in this world in science and technology or changes in modern technology's sophistication in all scientific fields. So that causes those that humans usually move actively as human movements turn into minimally mobile humans. The equipment is designed so that it is so easy to function. Even it is shaped like a remote control. Many activities do not require energy and body movement but are very time-consuming, wasting valuable time playing online games and Gadgets. Changes in these changes are not balanced with exercise-conscious behavior that can stimulate the whole body to synergize in providing strength or resources metabolically due to the functioning of the entire system of tools and support for optimal body movements. From another point of view, the development of science and technology has a positive side, of course. Technological advances that are well utilized will impact the efficiency and effectiveness of creating technology-based sports.

The substance of physical activity or exercise that needs to be discussed at any time to improve the quality of human life because, at present, with modernization in all areas of life, human beings as a whole are in a critical condition or suffer from sedentary disease resulting in obesity levels and susceptibility to chronic disease. The impact of the development of modernization is that it is assumed that sports are a waste of time without any intrinsic benefit value about sports, which can build achievement and change human behavior in a positive direction. However, during the Covid 19 pandemic, the existence of various chain effects on work activities and sports activities is now inversely proportional; that is, with a lot of time due to doing office work from home, people are confused about physical activity so that now, with fear of the immune system decreasing, people flock to sports activities.

Sports activities that are carried out are not optimal. They are less than optimal in sports activities because of shifting the current pattern of human life. The pattern that occurs is physical activity at work, then replaced and facilitated by technological designs. People do not move and are demanded to move after a long time, not too much—movement activity. With changes in movement patterns in people whose level is only a hobby in sports activities, the increase in the community's level of injury is due to irregular sports and fear of Covid 19. So that at present, there has been a change in behavior from an increase in technology science and a change in behavior due to the pandemic. Everyone needs adaptation and knowledge in adaptation. However, the unavoidable risk is the occurrence of sports injuries, from minor to severe injuries.

Injuries that occur due to sports require continuous handling and require assistance from professionals. During the Covid pandemic, 19 people suffered minor injuries that needed professional help, one of which was therapy. Still, people who experienced injuries experienced their fear if they had to come to the hospital. For this reason, people who like sports in the sports category look for solutions to their perceptions, so that one of the goals in handling injuries is massage therapy at the sports injury massage center in Ngijo, and the booming enthusiasts for therapy require procedures so that all are well served and

recovery occurs. Optimally. It takes time to be effective and efficient, and hoped that it does not need to come repeatedly for control. Because in providing massage during a pandemic, there are additional requirements that must apply health protocols.

The injuries experienced are very varied. Therefore, management is needed for each category of injury, one of which is the knee injury, resulting in muscle pain around the knee in both the thigh and the calf muscles. To be able to answer the problem that has become a polemic on understanding what massage therapy is applied to the MCO (Sports Injury Massage) Ngijo, it is, of course, necessary to discuss in a synergy that a suitable method is needed and has an impact on recovery for one location of the injury, one of which is the pain effect of For this reason, with the background described, the scope of this study is the massage method and duration of intervention in reducing muscle pain surrounding minor knee injuries.

The type of research method used is quantitative research because the data to be obtained is in the form of numbers analyzed using statistical calculations (Sugiyono, 2010). This research design is an experimental quash experiment with two groups selected with predetermined criteria: one-month injury and injury to knee injury. What is meant by a knee injury with an injury for one month that has lost inflammation but is still uncomfortable in movement, does not need medical action, and can be immediately given therapeutic action? The variables in this study used the independent variable in the form of a one-month injury with massage effleurage and friction treatment, and the dependent variable was a reduction in pain. To measure pain using a numeric pain scale instrument. After doing the pre-test, the patient's pain level was then given massage treatment with effleurage and friction massage therapy techniques. The duration of therapy was given for 15 minutes of session, both for the injured one month after that. Finally, a post-test was carried out by measuring the pain experienced after being given therapy. This research was conducted on a sample of 24 people.

The sampling technique was purposive sampling. The study sample selection was based on several inclusion criteria, namely being male, aged between 21-24 years. The injury experienced had passed the acute period and had a standard body mass index (BMI). And based on the exclusion criteria, namely not taking drugs at least one week before the study and having no history of illness other than injuries sustained. Because sportspeople with sports injuries come on their own and of their own volition to carry out therapeutic procedures to be carried out are:

- Apply for ethical clearance to the institute of ethics code of Semarang state universities
- Questionnaire about injuries suffered from the following format
- Make groups based on the duration of injury; the injured sportsmen are divided into the duration of the injury; the group consists of 1 month
- Examination of specific types of injuries in knee injuries and muscle pain due to overuse which results in the knee joint is not optimal in the ring of motion
- Make a statement letter that is willing to be a research sample if it meets the criteria desired by the researcher

- The implementation of therapy, with the effleurage and friction developed at the MCO ngijo therapy place in the implementation of the therapy, has the following procedures:

Supine position

Manipulate the effleurage and friction with the thumb and press it with all palms in the following order:

In the quadriceps muscle

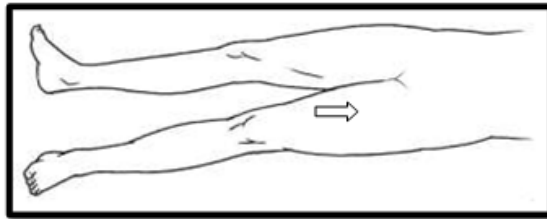


Figure 1. Quadriceps Muscle (Graha et. al., 2012: 87)

In the joints



Figure 2. Inner and Outer Side Knee Ligaments (Graha et al., 2012: 87)

In the lower leg



Figure 3. Flexor Muscle/digitorum longus/gastrocnemius (Graha et al., 2012: 87)

In the lower leg, inside and out

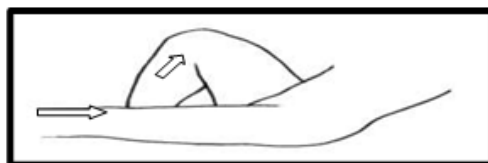


Figure 4. In the lower leg inside and out (Graha dkk, 2012: 87)

Facedown

Manipulate the effleurage and friction with thumb rubbing and pressing with all palms in the following order:

In the hamstring muscles

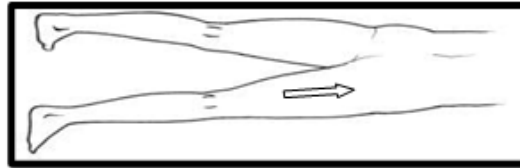


Figure 5. Hamstring Muscles (Graha dan Priyonoadi, 2012: 87)

At the back of the knee joint

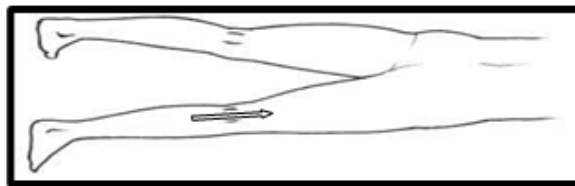


Figure 6. At the back of the knee joint (Graha dkk, 2012: 87)

In the lower leg muscles

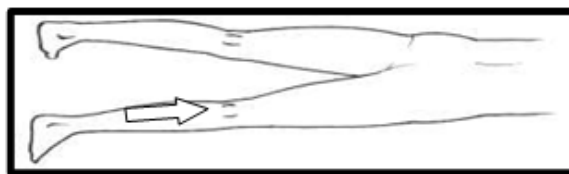


Figure 7. Gastrocnemius (Graha dkk, 2012: 87)

Traction and repositioning

They were performed in a supine and prone position using the legs being pulled (traction) using the masseur's body weight, then repositioned by turning them laterally and medial 90°.

Supine position



Figure 8. Supine position (Ali Satia Graha dan Bambang Priyonoadi, 2012: 88)

Facedown



Figure 9. Facedown (Graha dkk, 2012: 88)

Treatment protocol

- Group K1 (Injury Group 1 month) Effleurage and friction on the muscles with manipulation of the quadriceps, front and rear knees, front-rear calves, heels, and instep with a duration of 15 minutes
- Group K2 (Injury Group 1 month) Swedish massage on the muscles with manipulation of the quadriceps, front and back knees, front and back calves, heels, and instep with a duration of 15 minutes

Pain Measurement Protocol

The pain felt by the athlete with a knee injury was pre-tested and the injured sportsman answered by stating the range number 0-10 and stated that it was translated into the meaning of pain measurement. Furthermore, the pain measurement was repeated for the post-test after the effleurage, and friction massage treatment was carried out for 15 minutes. Pain examination in this study used the Numeric Rating Scale (scale 0–10).

Table 1
Functional Numerical Pain Scale

Score	Meaning
0	No. pain
1-3	Pain that does not require a change in activity
4-6	Pain that does require a change in activity
7-9	Pain that fully prohibits one more activity
10	Pain that is unbearable

The pain check mechanism is carried out before the massage friction treatment. Before the pain examination, all patients were subjected to the same rules because the therapy was not administered simultaneously. They were instructed to perform an extended flexion motion, then held for 15 seconds. After doing the flexion and extension movements at a certain point, the subject will stop the movement and hold for 15 seconds. The subject is asked to say one of the numbers 0 to 10 according to how he felt when doing the extended flexion movement. The number 0 indicates that the subject does not feel pain at all. Numbers 1-3 mean that the subject feels mild pain. If the subject mentions the numbers 4-6, it means that the subject feels moderate pain. Numbers 7-9 mean that the subject feels quite severe pain, and number 10 means excruciating.

Description of Research Data

The research data results from observations based on pain in athletes with knee injuries. The data was observed in two measurements, namely the pre-test and post-test. The application of the massage effleurage and friction treatment was analyzed descriptively to provide an overview of the research data and facilitate the presentation of the research data. The results of a descriptive analysis of each research data are as follows:

Description of Mass Treatment Data

Data description of the effect of massage was observed using pain. Massage treatment data amounted to 24 samples, which are sample friction massage therapy. The picture of pain reduction is as follows.

Table 2
Research Sample Group

Between-Subjects Factors		Value Label	N
J_T	1,00	Effleurage and friction Swedish massage	24
	1,00	1 Month	12
	1,00	1 Month	12

From the table above, it can be seen that the number of samples treated with effleurage and friction massage was ten people divided into two groups based on the duration of the injury, namely the one-month injury group.

Table 3
Results of the Descriptive Analysis of Data for the Pretest and Posttest of Mass Treatment

	<i>Pre-test</i>				<i>Posttest</i>			
	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Std. Dev</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Std. Dev</i>
Pain	6,0	9,0	7,2	0,41	1,00	3,00	1,33	0,35

In table 3, it can be seen from the mean or average of all data that it can be seen that there is a decrease in pain perception after massage therapy. It can occur because massage treatment has an increased physiological effect by relaxing muscles, increasing blood flow, and reducing pain (Novita Intan Arovah, 2008: 2). However, this is not optimal because the perception of pain is still in the 1.33 category, which means that there is a pain when viewed on a numeric pain scale, but it can be ignored. But close to ordinary degrees. Comparing the mean value of the pre-test and post-test in massage treatment can be seen in the following table.

Table 4
Comparison of the Mean Value of Pretest and Posttest Mass Treatment

No			<i>Pre-test</i>	<i>Posttest</i>	Increase/ decrease	Percentage (%)
1	Effleurage and friction	Pain	7,4	1,35	5,89	76,49%
2	Swedia Massage	Pain	7,7	2,38	5,32	69,09%

Massage is used to treat or rehabilitate knee injuries by using a massage technique in the form of friction, which is a combination of doing massage simultaneously from the rubbing technique (effleurage), friction, using the thumb and the entire palm, and pressing deeper and scouring is not optimal in doing the technique. Scour. And withdrawal (traction) and return of the joint to its position (repositioning). There is an opposite opinion of effleurage and friction, namely from Ali Satia Graha (2009: 14) states that forage massage is carried out by combining friction techniques with effleurage techniques which use the thumb to relax or relieve muscle tension, making it easier to pull (traction) and the return (repositioning) of the joint in place. The advantage of the effleurage and friction in the skin surface is more comprehensive, and the pressure is deeper because there is a scouring technique that is not optimal. The technique was developed at the MCO Ngijo therapy place, Semarang.

Methodology research

Test Data Analysis Requirements

The analysis requirements that must be met in testing the hypothesis using the t-test include the normality test and the homogeneity test. The results of the research data analysis requirements test are as follows.

Normality test

The normality test is carried out to test whether the analyzed research data has a normal distribution or not. The data normality test was carried out using the Kai Square test (Chi-Square) with the following results.

Massage Treatment Data Homogeneity Test

The homogeneity test was used to test the variance of the repeated observations at the pre-test and post-test. The statistical test used to test the variance's homogeneity is the F-test, which compares an enormous variance with the smallest variance. The results of the homogeneity test are shown in the following table 5.

Message Treatment Data

Table 5
Data Homogeneity Test Results for Massage Therapy Treatment

Test of Homogeneity of Variances			
PN			
Levene Statistic	df1	df2	Sig.
,207	1	18	,657

Based on the summary of the homogeneity test above, it is known that all the results of the data testing have a calculated F value less than the F table and a significance value greater than 0.05 ($p > 0.05$); it is concluded that there is no difference between the variance of all data. Namely: flexion, extension, abduction, adduction, and pain, both pre-test and post-test, were all stated to be homogeneous. Thus, the prerequisite for variance homogeneity has been met. This means that the scores on the pre-test and post-test variables measured in the massage therapy treatment spread homogeneously.

Message Treatment ANOVA Test Results

ANOVA test is carried out to compare the two treatment methods whether there is a significant difference or not. The results of the ANOVA test of this research data can be seen in the following table.

Table 6
Message Treatment Pain Data Test Results

Independent Samples Test										
	Levene's Test for Equality of Variances		t-test for Equality of Means							
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
								Lower	Upper	
pain	Equal variances assumed	5.790	.037	2.318	10	.033	2.833	1.222	.109	5.557
	Equal variances not assumed			2.318	6.509	.046	2.833	1.222	-.102	5.769

From the table above, it can be concluded that effleurage and friction massage therapy has a significance of 0.033 compared to the Swedish method, the significance of which is 0.46, which means that massage effleurage and friction therapy can significantly reduce the pain suffered by sportsmen with a duration of 15 minutes for knee injuries with the action that has been done. It is allowed to be given therapy even without medical if the acute period has passed, so it can be interpreted that massage therapy has better success in treating minor knee injuries.

Result and Discussion

The statistical analysis results proved that massage therapy had a significant effect on healing chronic minor knee injuries in sportsmen ($p < 0.05$). This result can be explained because there are measures that function to treat knee injuries in massage therapy. Management of knee injury massage therapy using friction massage is carried out in various positions to heal knee injuries effectively. Handling of massage friction is carried out in the supine and prone positions. Handling in each of these positions maximizes message manipulation on the entire leg apart from the injured knee.

In the treatment of massage friction, there are rubbing and scrubbing techniques that will relax, reduce muscle tension, and improve blood circulation. Treatment of injuries using friction massage is also provided with joint retracting and return manipulations which will return the joint to its original position so that chronic minor knee injuries can be appropriately treated. As supported by Graha and Priyonoadi's (2009: 79) opinion, the techniques used in rehabilitating minor knee joint injuries are using scouring and rubbing techniques to relax and relieve muscle tension as well as withdrawal and return of mild knee joints. This is why massage therapy can work effectively to treat chronic knee injuries. The treatment of massage therapy can be seen from the reduction in the level of pain as much as the result of giving massage a decrease of 76.49%. These results can be explained that the treatment of knee injuries using massage therapy can relax to reduce the degree of pain, reduce muscle tension, improve blood circulation and return the joints to their position.

Based on the ANOVA difference test in this study, there is a significant difference. This indicates that the decrease in pain intensity is influenced by the manipulation of effleurage and friction therapy, where 15 minutes has a better effect on decreasing the decrease's intensity. In general, giving manipulation friction massage therapy is an effort to reduce pain after exercise that occurs immediately or after physical work on muscles experiencing tension (Hemmings et al., 2000). In addition, research has shown that the use of massage therapy after the acute period has passed recovery time and can significantly prevent DOMS (delayed onset of muscle soreness) pain after matches (Hilbert et al., 2003).

Effleurage and friction massage therapy effectively reduced the level of pain reported by subjects after each treatment, with pain levels reported after 15 minutes of therapy. A clinical correlation was noted between the significant reduction in reported pain levels during the 15-minute implementation of the effleurage and friction Massage Therapy intervention in reducing the rate of

hamstring flexion contractions during each session and the equalized heel-height differences during the session. In addition, lymphatic drainage techniques show a clinically significant reduction in inflammation, reducing knee pain.

Dysfunction is the result of muscle imbalance and not due to arthritic changes in the patella's articular surface. Subjects reported that the onset of patellar dysfunction symptoms, including pain, occurred 1-2 months after the initial mild knee injury. The subjects had no history of knee pain before this initial injury, which further suggests that the patellofemoral dysfunction resulted from a muscle imbalance that was not resolved during physical therapy. Subjects have reported the successful use of the massage friction technique to reduce pain, thereby strengthening and facilitating the quadriceps neurologically. These unmonitored techniques may have influenced the results of this study. The effects reported by the injured were due to the physiological effects of massage therapy affecting the hormonal and nervous systems (Giam and Teh, 1993). It can be interpreted that massage techniques, especially combined techniques, namely effleurage, and friction, can provide optimal physiological effects.

Ganong (1995) states that nerve receptors under the skin consist of Ruffini nerve endings, Merkel discs, Meissner bodies, Pacini bodies, Krause nerve endings, and nerve endings between cells in the network. These receptors are sensitive to stimuli in the form of pressure touch (pressure is a touch that is pressed for a long time), cold, warmth, and pain. Illustration of Gate Control Theory (Monsdragon, 2004) that pain fibers carry pain stimulation to the brain is smaller, and the sensation travels more slowly than broad touch fibers. When touch and pain are stimulated together, touch travels to the brain closing the gates in the brain. Massage therapy which has a distraction effect, can also increase the formation of endorphins in the descending control system and create muscle relaxation. One can also use the basis of Opiate Endogenous Theory, where the opiate receptors located in the brain and spinal cord determine where the central nervous system rests morphine substances called endorphins and enkephalin when pain is received. The stimulation of the skin can stimulate this endogenous opiate through massage. These opiate receptors are located on peripheral sensory nerve endings.

The study results proved that massage therapy had a significant effect on the recovery process of chronic knee injuries in sportspeople. The healing can be seen from the level of pain that has decreased after being given massage therapy and exercise therapy. These results can be seen from the ANOVA results, which produce a significant difference between before and after treatment. It is reinforced by Cava (1995), who states that injury is damage to soft or hard tissues, technical errors, and physical activity that exceeds the limit of load training. Mild knee injuries experienced by sportsmen can be an obstacle to doing sports activities and daily activities. It requires treatment using the right method to handle the injury quickly. The recovery process is faster, returns to peak performance, and the injury suffered is not prolonged.

Conclusion

The research presented demonstrating the benefits and effleurage and friction of

massage therapy for soft knees with a therapy duration of 15 minutes should be another therapeutic tool used by strength and conditioning specialists. Choosing the right combination of techniques and the right time to apply the techniques as described is useful for post-training recovery, limiting injuries, and preparing athletes for performance. Future research should focus on the standardization of massage therapy, including treatment duration/time and a combination of different massage techniques, to provide a clear understanding of massage's effects on muscle performance and recovery from exercise and injury.

References

- Ali Satia Graha dan Bambang Priyonoadi. (2009). Terapi Masase Frirage Penatalaksanaan Cedera pada Anggota Tubuh Bagian Atas. Yogyakarta: FIK UNY.
- Ali Satia Graha. (2009). Fisiologi Olahraga dan Kesehatan Olahraga. Jurnal. Bandung: UNPAD.
- Arif Setiawan. (2011). Faktor Timbulnya Cedera Olahraga. Jurnal Media Ilmu Keolahragaan Indonesia., Volume 1., Edisi 1. Semarang: UNNES.
- Arovah, Intan Novita. 2011. Masase dan Prestasi Olahragawan. (Online), <http://staff.uny.ac.id/sites/default/files/132300162/4.%20Masase%20dan%20Prestasi%20Olahragawan>.
- Bambang Priyonoadi. (1995). Modalitas Terapi Fisik untuk Pananggulangan Nyeri. Yogyakarta: FPOK IKIP Yogyakarta.
- BM. Wara Kushartanti. (2007). Patofisiologi Cedera Olahraga. Makalah. Yogyakarta: Klinik Terapi Fisik FIK UNY.
- Brown, A. 2014. Strategies To Reduce Or Eliminate Wound Pain. Nursing Times.110(15),12-15.[Online]. <http://www.nursingtimes.net/Journals/2014/04/04/h/k/k/Strategies-to-reduce-eliminate-a-t-e-wound-p-a-in-090414>
- Burnley DE, Angela NO, Sharp RL, Bailer SW, Alekel DL, 2010. Impact of Protein Supplements on Muscle Recovery After Exercise-Induced Muscle Soreness. Journal Exercise Science Fitness. 8: 89-96.
- Byrne C, Twist C, Eston R, 2004. Neuromuscular Function After Exercise Induced Muscle Damage: Theoretical and Applied Implications. Journal Sport Medicine. 34: 49-69.
- C.K.Giam and K.C.Teh. (1992). Ilmu Kedokteran Olahraga (Hartono Satmoko, Terjemah) Jakarta: FIK UNY.
- Callaghan, M. J. (1993). The role of massage in the management of the athlete: a review. British Medical Journal 27(1): 28.
- Case Studies in Construction Materials, Volume 16,2022, e01136.
- Cava, G.La. (1995). Pengobatan dan Olahraga Bungan Rampai. Semarang: Dahara Prize
- Clarkson PM, Hubal MJ. Exercise-induced muscle damage in humans. Am J Phys Med Rehabil 2002; 81: S52-69
- Clarson PM, Hubal MJ, 2008. Exercise Induced Muscle Damage in Humans. Journal Physiology Medical Rehabilitation. 81: 52-69.
- Dikdik Zafar Sidik dan H.Y.S Santosa Giriwijoyo. (2012) Ilmu Faal Olahraga. Bandung: Remaja Rosdakarya.

- Dr. Ritika Malik, Dr. Aarushi Kataria and Dr. Naveen Nandal, Analysis of Digital Wallets for Sustainability: A Comparative Analysis between Retailers and Customers, *International Journal of Management*, 11(7), 2020, pp. 358-370.
- Dunkin, M.A. (2004). Sports Injuries. Diakses tanggal 12 Juli 2013 dari <http://www.niams.nih.gov/hi/topics/sportinjuries/SportsInjuries.htm>
- Ganong, William F. (1990). Buku Ajar Fisiologi Kedokteran. Jakarta: Penerbit Buku Kedokteran EGC
- Giam C.K, dan Teh, K.C. (1993). Ilmu Kedokteran Olahraga (Hartono Satmoko. Terjemahan). Jakarta: Binarupa Aksara Buku asli diterbitkan tahun 1992.
- Goldberg, DS & McGee, SJ. 2011. Pain as a Global Public Health Priority. *BMJ Public Health*. 11 (7 7 0).[Online]. <http://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-11-770>.
- Guyton AC, Hall JE, 2006. Textbook of Medical Physiology. Philadelphia: WB Saunders Company.
- Hamdi, Asep Saeful. 2014. Metode Penelitian Kuantitatif Aplikasi dalam Pendidikan. Yogyakarta: Deepublish
- Hersh F. Mahmood, Hooshang Dabbagh, Azad A. Mohammed, Comparative study on using chemical and natural admixtures (grape and mulberry extracts) for concrete, *Case Studies in Construction Materials*, Volume 15, 2021.
- Kneale, JD & Davis, PS. 2011. *Kep erawa tan Ortopedik dan Trauma*. Edisi 2. Jakarta: Penerbit buku kedokteran EGC.
- Margono. (2006). Upaya Pencegahan Pulled Muscle Pada Sprinter. Medikora. Yogyakarta : FIK UNY.
- Masood Abu-Bakr, Hersh F. Mahmood, Azad A. Mohammed, Investigation of metakaolin and steel fiber addition on some mechanical and durability properties of roller compacted concrete,
- Narbuko, Cholid dan H. Abu Achmadi. (2010). *Metodologi Penelitian*. Jakarta: Bumi Aksara.
- Novita Intan Arovah. (2008). *Masase dan Prestasi Olahragawan*. Yogyakarta: FIK UNY
- Poerwadarminto, Wjs. (1989). *Kamus Umum Bahasa Indonesia*. Yogyakarta: Departemen Pendidikan dan Kebudayaan.
- Potter & Perry. (2005). *Buku Ajar Fundamental Keperawatan: Konsep, Proses, dan Praktik*, Jakarta: EGC
- Rachma Laksmi Ambardini. (2006). *Peran Latihan Fisik dalam Manajemen Terpadu Osteoarthritis*. Medikora. Yogyakarta: FIK UNY.
- Rahim. A. (1988). *Swedish massage*. Jakarta.
- Sudjana, Nana. 2011. *Penilaian Hasil Proses Belajar Mengajar*. Bandung: Remaja Rosdakarya.
- Sugiyono. 2017. *METODE PENELITIAN BISNIS Pendekatan Kuantitatif, Kualitatif, dan R&D*. Bandung : Alfabeta.
- Veeranki S. R, Varshney M. (2022). Intelligent Techniques and Comparative Performance Analysis of Liver Disease Prediction, *International Journal of Mechanical Engineering*, 7(1), 489-503. <https://kalaharijournals.com/ijme-vol7-issue-jan2022part2.php>,